Hydrobiology

MARINE ECOLOGY BASELINE AND IMPACT ASSESSMENT

BRISBANE | PERTH | SINGAPORE | PAPUA NEW GUINEA

CAPE FLATTERY SILICA PROJECT

B21055

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EXECUTIVE SUMMARY

BACKGROUND

This report provides the results of the desktop assessment and marine ecology sampling undertaken in November 2021 as part of the environmental assessment for the proposed development of the Cape Flattery Silica Project (the project). The project is in the Cape Bedford/Cape Flattery dunefield complex, north of Cooktown. The assessment specifically relates to the marine infrastructure developments off the coast of Cape Flattery. The field survey involved several methods to be employed throughout the marine environment to assess and identify existing marine ecosystem values and their condition such as: local habitats, the presence of conservation significant species, marine and intertidal fauna of the area, and water quality (in-situ physicochemical priorities).

Based on the concept design of the project, construction and operational impacts are discussed, with appropriate management and mitigation measures detailed to protect marine ecosystem values.

MARINE ECOSYSTEM VALUES

The present marine habitats detected within the study area are as follows:

- The Study area contains a single continuous roughly 1.5km fringing reef which ranges from approximately 10-80m off the shoreline. The reef is generally rocky, dominated by microalgal mats and algal forests characterised by *Sargassum.* Coverage analysis revealed approximately 64.2% macroalgal coverage while maintaining a cumulative 12.9% of hard coral coverage and 3% soft coral coverage. This hard coral community composition was dominated by branching Acroporid corals and to a lesser degree corymbose (4%) and foliose corals (2.3%). No solitary sponges were observed with the exception of symbiotic like macroalgae and sponge forms being observed (3.3%) bare seafloor within the reef constituted approximately 16.5%.

- Seagrass meadows that were generally restricted to the lower intertidal to subtidal zones of the Study area. These meadows were located approximately 3-10 m behind the reef with 3 known species detected: *Halodule uninervis*, *Halophila spinulosa*, and *Halophila ovalis*. Coverage generally ranged between approximately 10-30% seagrass coverage within meadows generally maintained lower species diversity and coverage due to seagrass being present within deeper waters.
- The coastline of the Study area is characterised by a rocky shore extending in line with the fringing reef. The rocky shore extends continuously with the exception of some sand coverage at the mouth of an unnamed creek to the immediate north-east of the loading facility. The general fauna incidentally observed in these rocky environments during field surveys included snails and hermit crabs on sandy beaches and hardier fauna on the boulder beaches such as barnacles, oysters, chitons, limpets, and snails.
- A mixed community of intertidal mangroves were present along the rocky shores of the Study area. Community density was fairly low and is likely derived by the limited presence of muddy substrates for mangroves to colonise. The community was comprised of four species previously known to the area and was dominated by *Rhizophora stylosa* and to a lesser degree *Avicennia marina* alongside several individuals of *Aegialitis annulata* in addition to three individuals of *Sonneratia alba* also being recorded.

Water quality within the area was considered to be generally consistent across depths and among sites with the exception of minor differences in sites on top of reef habitat. Fauna assessments were undertaken for macroinvertebrates with analysis revealing that macroinvertebrate taxonomic richness and general abundance were higher within tidal samples taken from the shoreline in contrast to lower diversity and abundance in samples taken further offshore in addition to community composition contrasted between offshore and tidal sites with a generally diverse range of families present within offshore sites, with no taxa appearing to dominate in abundance.

Within marine reptiles a single species marine turtle was detected, the Green sea turtle (*Chelonia mydas*), no additional incidental sightings or tracks were noted. No signs of marine turtle nesting or shoreline presence were observed in Study area. This is likely due to a lack of habitat and the natural barriers of the Study area which was largely comprised of fringing rocky reefs and rocky shorelines

No marine mammals were detected within the Study area during the surveys, however dugongs were sighted in the southern region of the cape, approximately 5 km south of the Marine Offloading Facility (MOF) alongside the unnamed beach adjacent to the Ports North Wharf. Based upon past literature, Dugongs are also confirmed to be present within Cape Flattery waters with sightings and feeding trails being previously noted in past studies.

A total of 10 species of fish were detected within the marine environment, the majority through the use of Baited Remote Underwater Videos (BRUVs). eDNA sampling detected a single species of fish, this being the milkfish (*Chanos chanos*). Analysis of ROV (Remotely Operated Vehicle) imagery recorded 6 fish families typical of the GBR (Great Barrier Reef). No conservation significant fish species were detected.

PROJECT IMPACTS

The construction and operation stages of the project are expected to have negligible to minor residual impact on the marine ecosystem values of the Study area. With the development and implementation of rigorous monitoring and re-establishment programmes within each habitat zone, the impacts of the project can be mitigated. The application of these programmes is important to offset the impacts that the project will incur.

1. INTRODUCTION

1.1 PROJECT CONTEXT

Cape Flattery Silica Pty Ltd (CFS) is a company 100% owned by Metallica Minerals Limited (MM) and intend to mine high quality silica sands from an area at Cape Flattery. The Project will involve a dry-mining and processing facility with associated accommodation, access, and support infrastructure. Relevant to marine ecosystem values the project includes the construction of a loading facility for resource export.

Operations on the proposed Mining Lease (#100284) (ML) are expected to start in late 2023 when construction of the processing plant required to treat the silica sands will be completed, pre-stripping and stockpiling of sand will also commence in 2023 with production and shipping planned to start in Q4 of 2023. The ML will be operated in isolation, all infrastructure planned for the operation will be constructed within the ML boundary with the exception of the planned loading facility which will require a Development Application submitted to the Assessment Manager. At this stage only one ML is required which will encompass the resource and all relevant infrastructure required for the operation.

The report for this Project will involve an area of assessment for the marine works relating to the loading facility hereafter referred to as the "*Study area*". The Study area encapsulates the marine waters and coastal features of the loading facility. The immediate surrounds within a 2 km radius (Figure 1-1) are hereafter referred to as the "*local region*" for comparative purposes. Beyond this 2km radius there are two port facilities associated with the adjacent silica mining operation. We also refer to the "*wider region*" which includes the habitats within the Cape Flattery port limits as mapped by

Ayling et al. (1998), extending from Lookout Point (17km to the north-west) around the Cape to the eastern beach (4km south).

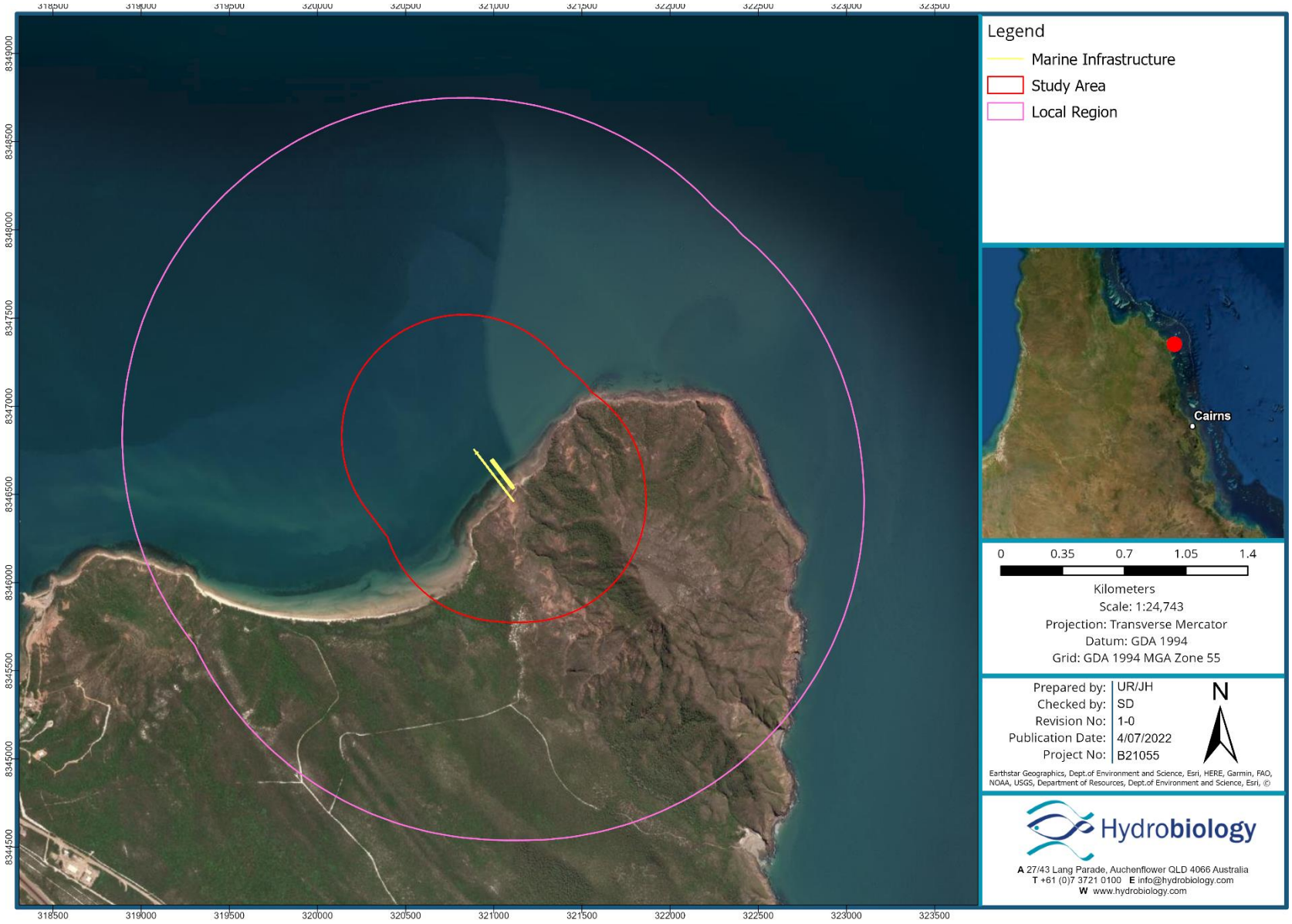

Figure 1-1 Proposed marine infrastructure displaying study area and local region.

1.2 PROJECT DESCRIPTION

1.2.1 OVERVIEW

The Cape Flattery Silica Sand Project (the Project) is a silica sand mining and processing operation located within the Mining Lease Application (MLA) 100284, covering an area of approximately 616 ha. Cape Flattery Silica Pty Ltd (CFS) is wholly owned by Metallica Minerals Limited (Metallica) and CFS is the proponent for the Project.

The Project is located on a greenfield site within the Cape Bedford/Cape Flattery dunefield complex and is characterised by large northwest trending transgressive elongated and parabolic sand dunes. The Project is located on Lot 35 SP232620 within the Hope Vale Shire Local Government Area (LGA), adjacent to the existing silica sand mining and shipping operation owned by Mitsubishi, approximately 42 km northeast of Hope Vale and 200 km north of Cairns, Queensland.

Outside of MLA100284 on the western side of the site (but still connected to the site), a jetty / marine offloading facility is proposed to be constructed on land within the Hope Vale Aboriginal Shire Council local government area, and inside the tidal areas of Cook Shire Council and the Cape Flattery Port which is owned and operated by Ports North.

The Project involves mining and processing approximately 1.8 million tonnes per annum (Mtpa) of high-quality silica sand onsite over a 20 to 25-year life of mine (LOM), with approximately 1.35 Mtpa of saleable product to be shipped offsite. Shipping frequency will be one ship every two weeks, accessing the Port via established shipping routes under REEFVTS pilotage. Estimated shipping size is Supramax (55,000 DWT) with a loading time per ship of around 3-4 days.

1.2.2 INFRASTRUCTURE

On-lease Project infrastructure will include a Mine Infrastructure Area (MIA) for general mine service facilities, mining panels, stockpile areas, laydown areas, processing plant, worker's accommodation for up to 80 persons, sediment basin, water storages, sewage treatment plant, conveyors, access tracks and a jetty infrastructure facility (JIF) to service the off-lease project infrastructure. Off-lease Project infrastructure includes a 320 metre (m) jetty, a 200m Marine Offloading Facility (see below), conveyors from the JIF to the jetty hopper, transhipment from the jetty to a swing basin for with mooring / anchorage capability (Figure 1-2). The Jetty will be supported by ten single piles at over the total length and a further five smaller, single piles will support the barge loading and jetty hopper infrastructure which extends an additional 10 m.

The Marine Offloading Facility (MOF) is a purpose-built structure to facilitate the delivery of equipment and goods to the Project during both construction and operations. The MOF is designed to never make contact with the bottom substrate and will sit above any habitat on the seafloor. From the JIF, an access road will lead down to the shoreline and a steel ramp which will be constructed and extended to the edge of the rocky shore area where it will meet a series of floating jack up barges (5). These barges are self-supporting on the seafloor via piles (assume 4 per barge) and will allow the barges to move up and down as needed, allowing tide and flow underneath. Seafloor disturbance is therefore constrained to the immediate location at each barge support. The last barge will be at a sufficient depth to allow for the loading and unloading of materials from appropriately sized barges and ships. During inclement weather, the barges can be relocated to deeper water if required to prevent damage.

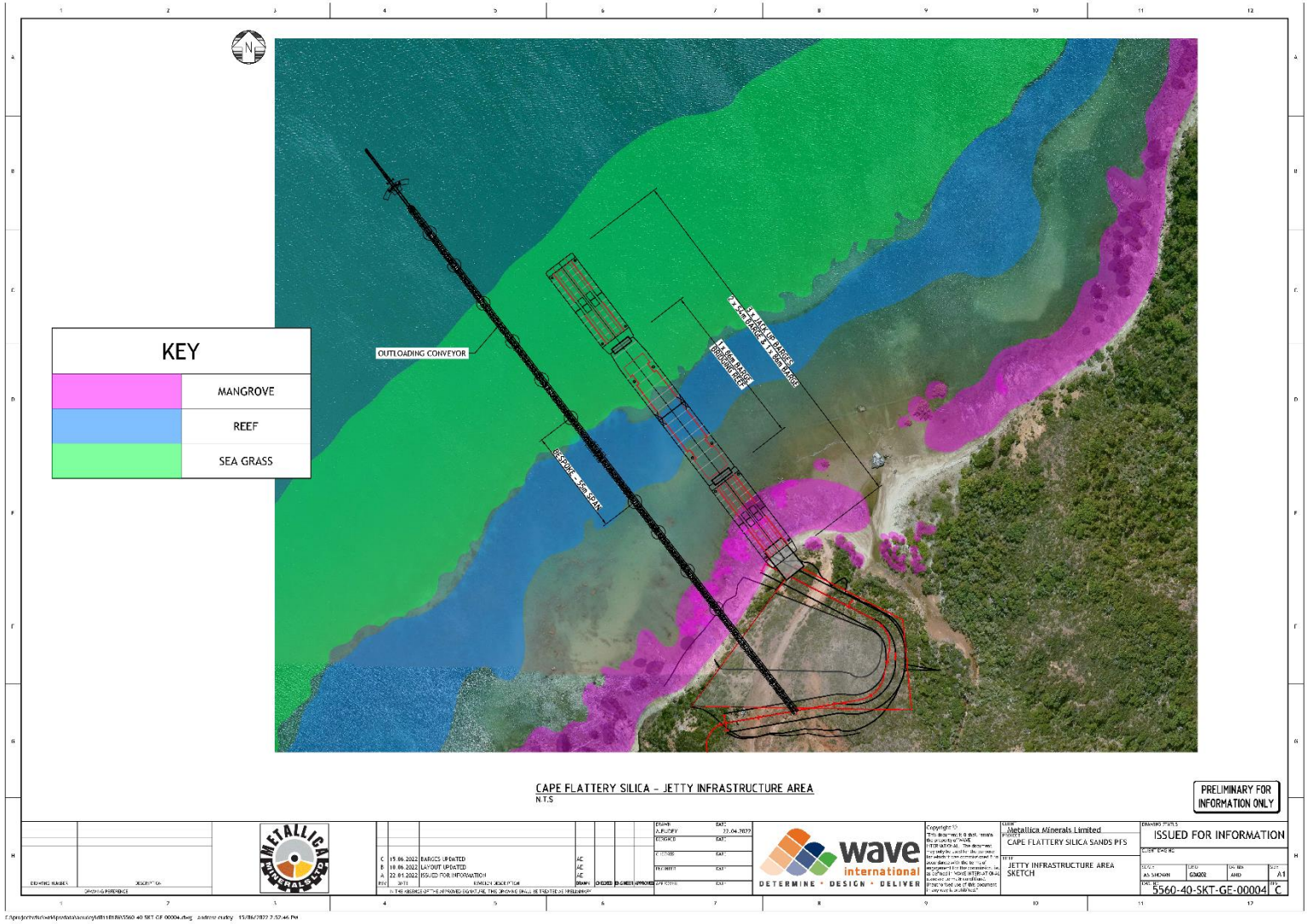

Figure 1-2 Proposed infrastructure.

1.2.3 CONSTRUCTION

Construction is expected to commence in 2023 and will run for approximately 6 months. A construction workforce of around 35 persons per swing will be required and will work on a roster basis with transport to the Project from Cooktown by fast passenger boat.

1.2.4 OPERATIONS

The mining method would involve sequential excavation using a front-end loader feeding a mobile tracked hopper-feeder which connects to the processing plant via a covered conveyor system. Water is added to the hopper-feeder to slurry the material from the pit to the plant.

Development of the active mine area would be staged with progressive rehabilitation occurring behind the advancing mine face. Clearing and grubbing activities will occur during daylight hours. Mining and processing will operate as a continuous process for 24 hours per day and 360 days per year.

Processing of silica will occur within the MIA which will consist of separation processes, and recovery/reuse of water used in the processing plant. Non product materials generated through processing such as organics, would be directed to storage for use in rehabilitation activities. Silica sand will be directly loaded from the product stockpile onto a conveyor, then transported to the jetty and loaded onto barges via a hopper. From there, silica sand will be transported offshore and transhipped onto bulk carrier ships within the Cape Flattery Port area and exported. An operational workforce of approximately 65 staff per roster will be required and will work on a roster basis with transport to the Project from Cooktown by fast passenger boat.

1.3 SCOPE AND OBJECTIVES

As part of the proposed works, it is required that marine ecological assessments be undertaken for a range of ecological components to form the appropriate knowledge and approvals to commence construction activities. This included assessments through both a baseline characterisation to understand the habitat and marine flora and fauna communities of the local environment and an impact and mitigation assessment of the project works. To address this requirement, Hydrobiology was commissioned to assist Epic Environmental to undertake a three-stage assessment process which included the following:

- Stage 1 – Desktop assessment (literature review and gap analysis) of the marine ecosystem values within the region;
- Stage 2 – A single field survey to confirm the desktop findings and extend on the knowledge regarding the existing marine ecosystem values and their condition; and
- Stage 3 – An Impact and mitigation assessment.

This report presents the impact and mitigation assessment alongside the findings of the initial desktop assessment and associated field survey on items of marine ecological importance.

It is important to reiterate that this report presents only marine ecosystem values for the loading facility. Freshwater ecosystem values will be investigated by Hydrobiology in a separate report.

1.4 PROJECT SETTING

1.4.1 REGIONAL CONTEXT

The study area is located adjacent to the Great Barrier Reef Marine Park (GBRMP), with Lizard Island situated ~31km to the north-east of the project (Figure 1-3). Existing marine infrastructure includes a service wharf located ~2km to the east and the Ports North wharf situated ~4km to the south-west.

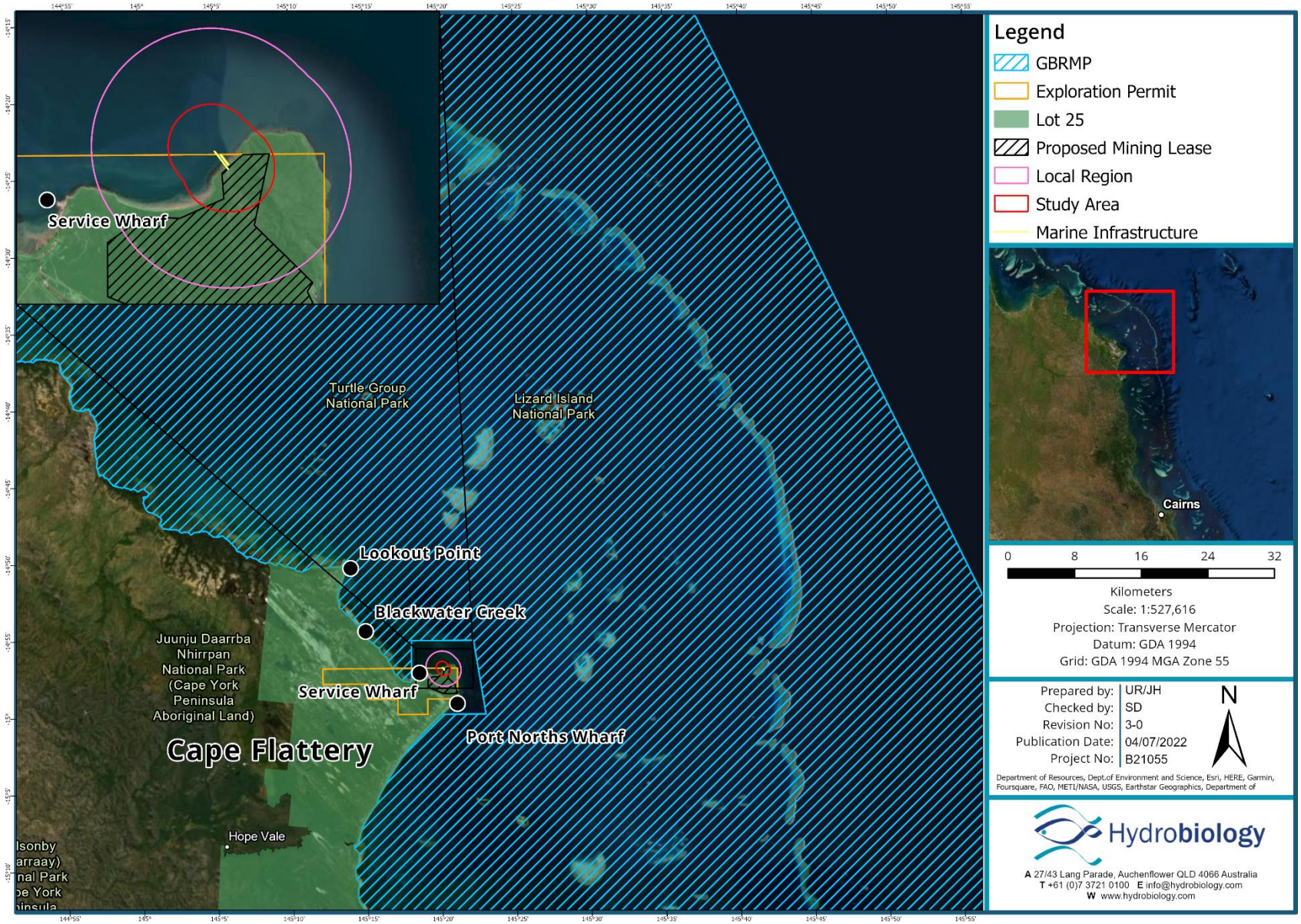

Figure 1-3 Regional setting of the project.

1.4.2 BASIN AND CATCHMENTS

The coastal waters of the Study area are within the Jeannie River Basin within the management areas of the Port of Cape Flattery Marine Waters and adjacent to the Cape Flattery Dune Lakes and Port of Cape Flattery land side. No major rivers discharge into the Study area, instead a series of small, unnamed, non-perennial first order stream inputs discharge into the marine study area (Figure 1-4).

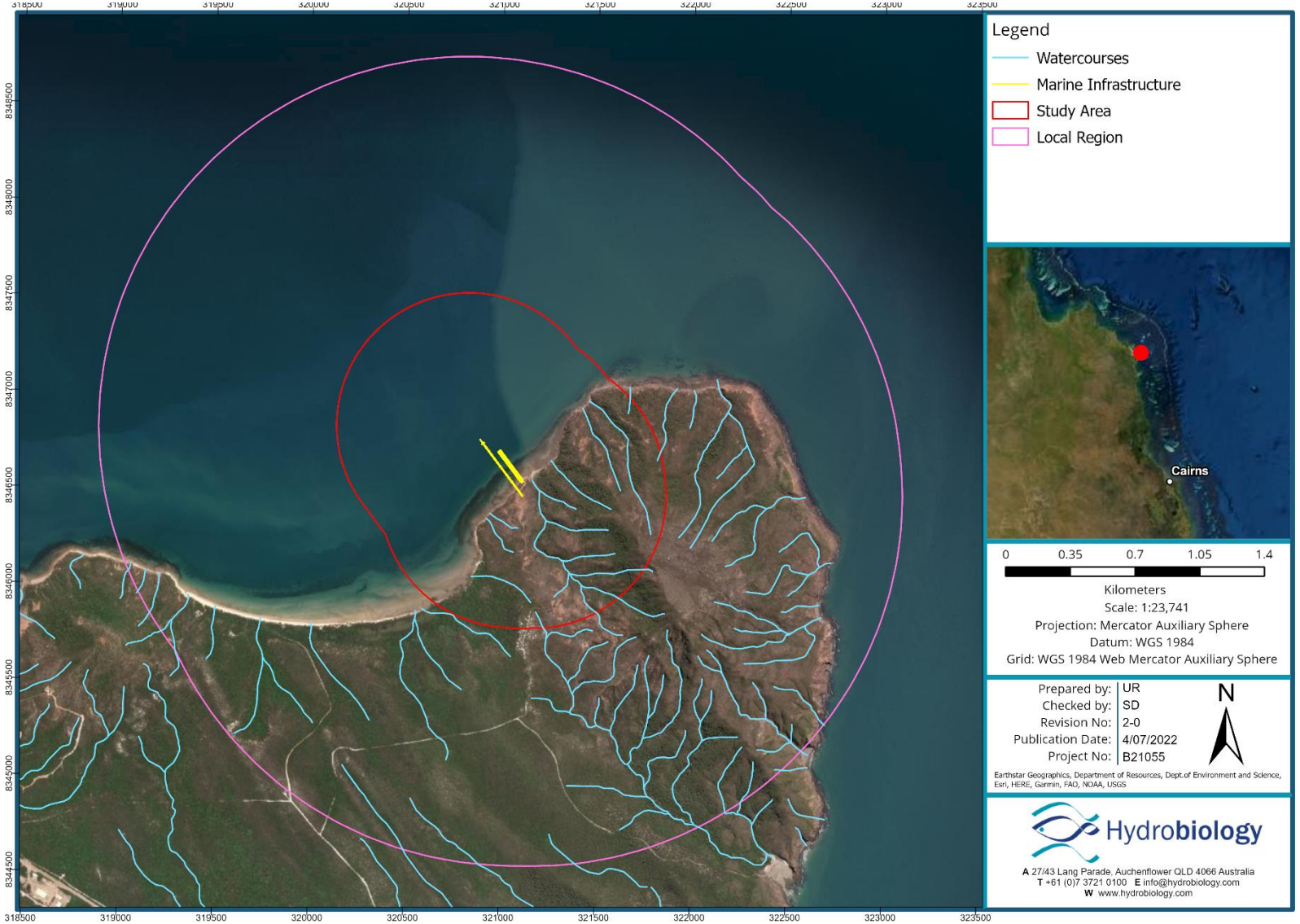

Figure 1-4 Watercourses of the Study area.

1.4.3 CLIMATE

The Study area lies within the Australia Monsoon Zone, specifically within the Wet Tropics which exhibits a humid tropical maritime climate with distinctive wet and dry seasons. Cyclones regularly affect the Cape Flattery area during the wet season between December and April.

During the wet Season, Cape Flattery typically experiences hot and humid summers with sea breezes and heavy rainfall. The dry season from May to November is generally cooler with less humidity, though unlike most of the tropical Australia, onshore winds still produce some light showers. The dry season is often characterised by continual 12-25 knots south easterly winds with an average wind speed of 5 knots for the remainder of the year.

Rainfall is highest during the wet season in the summer months, these months often account for the majority of the annual rainfall (80%) with peak rainfall often coinciding with cyclonic events. During typical summary periods, average maximum monthly temperatures can reach over 33°C while average monthly minimum temperatures can reach 19°C in winter (Figure 1-5).

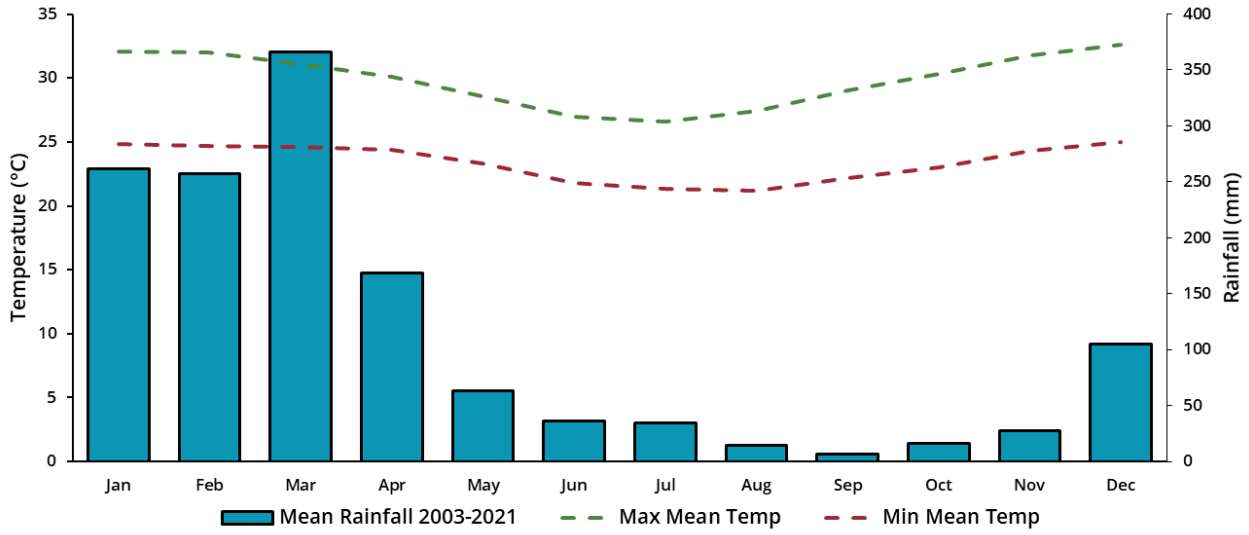

Figure 1-5 Average monthly climate statistics, sourced from Cape Flattery Station (#31213). Historical data inclusive from 2003 to present.

1.4.4 LANDUSE

Cape Flattery and its surrounds are located in mostly undeveloped landscapes, with access tracks forming the primary infrastructure in the ML. Currently there are no developed marine infrastructure within the area proposed for the Jetty of MOF. Initial developments at Cape Flattery occurred in 1968 when the first silica sand mine was established. This silica mine (Cape Flattery Silica Mines – owned by Mitsubishi Corporation) occurs along the southwestern border of the proposed ML. The existing mine operates a 500m wharf consisting of 5 breasting dolphins and 3 mooring dolphins.

1.4.5 GREAT BARRIER REEF MARINE PARK

The Study area is located adjacent to but outside the Great Barrier Reef Marine Park (GBRMP), with the boundary being approximately 3.5–4.0 km in either direction. This boundary surrounds the loading facility and is excluded from the marine park (Figure 1-6). The area outside of this boundary is defined as the Great Barrier Reef Marine Park, Cairns/Cooktown Management Area. The Study area is effectively surrounded by the GBRMP with it principally being zoned as General Use (Light blue). The

adjacent borders of this location include a Habitat Protection Zone (Dark blue) to the immediate west that stretches along the majority of the coastline between Lookout Point and Cape Flattery. A Marine National Park Zone (Dark green) approximately 5 km to the east and another towards the north that is defined around Decapolis Reef. The remainder of its surrounds is referred to as a General Use Zone (Light blue). A GBRMP zoning activities guideline for uses permitted in the respective areas is available in Figure 1-7.

The Study area is located outside the GBRMP, commercial vessels that utilise the loading facility and associated infrastructure will cross the GBRMP to access and depart the facility.

Additionally, the Queensland Government has created the Great Barrier Reef Coast Marine Park (GBRCMP), this is a State marine park that encompasses the full length of the Commonwealth GBRMP but it also provides protection to Queensland tidal waters and tidal lands. The GBRCMP effectively extends the GBRMP zoning from low waters to high waters, or the seaward edge of mangrove forests however, this generally excludes estuaries, creeks, rivers, and channels. The zoning of the GBRCMP mirrors the zoning of the GBRMP bordering to it and is thus approximately 3.5–4.0 km outside of the Study area.

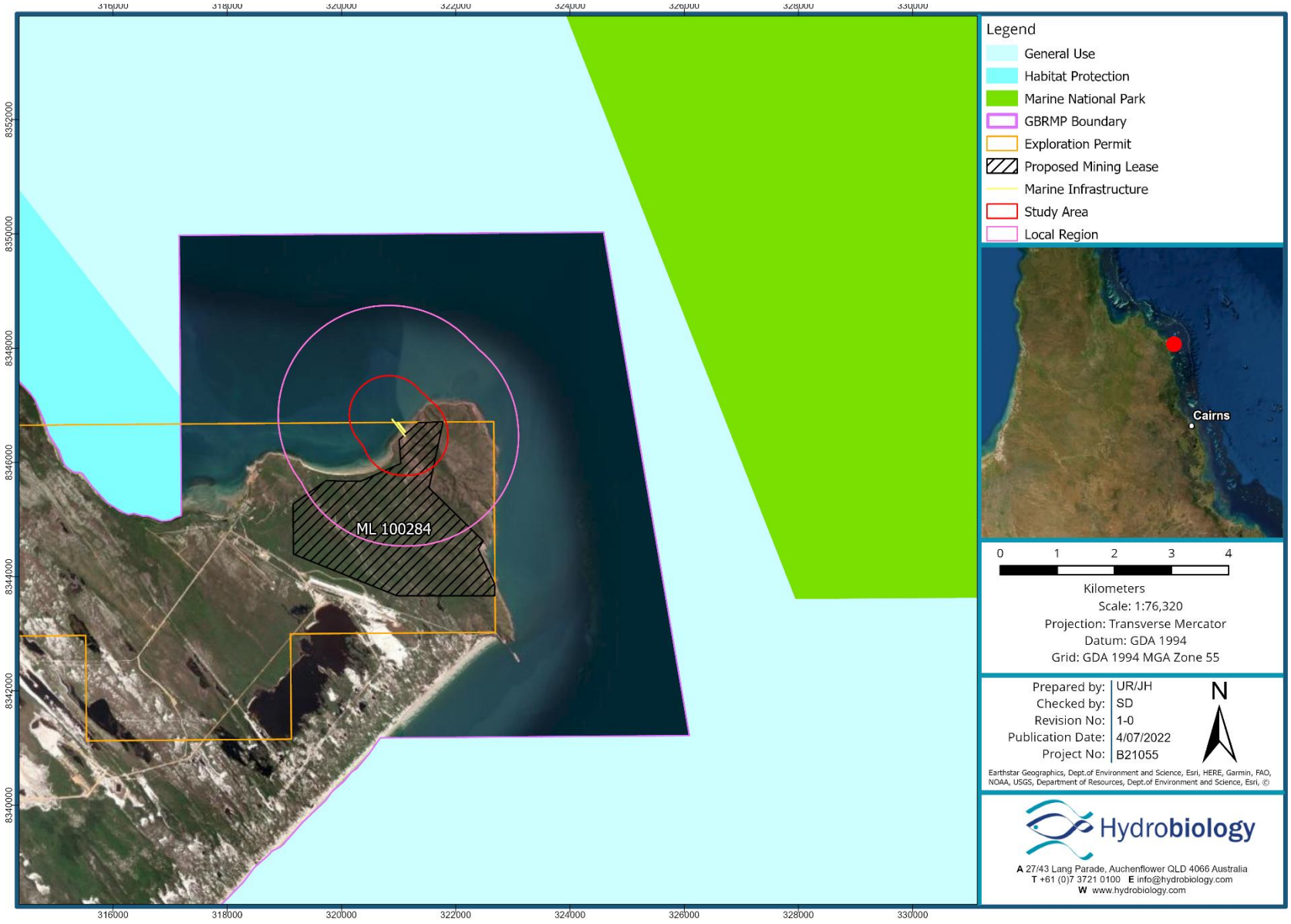

Figure 1-6 Great Barrier Reef Marine Park Boundary and Zoning.

ACTIVITIES GUIDE

(see relevant *Zoning Plans* and *Regulations* for details)

	General Use Zone	Habitat Protection Zone	Conservation Park Zone	Buffer Zone	Scientific Research Zone [3]	Marine National Park Zone	Preservation Zone	State Zoning Only	Estuarine Conservation Zone
Aquaculture	Permit	Permit	Permit [1]	×	×	×	×		Permit
Bait netting	✓	✓	✓ [2]	×	×	×	×		✓
Boating, diving, photography	✓	✓	✓	✓	✓ [3]	✓	×		✓
Crabbing (trapping)	✓	✓	✓ [4]	×	×	×	×		✓
Harvest fishing for aquarium fish, coral and beachworm	Permit	Permit	Permit [1]	×	×	×	×		×
Harvest fishing for sea cucumber, trochus, tropical rock lobster	Permit	Permit	×	×	×	×	×		×
Limited collecting	✓ [5]	✓ [5]	✓ [5]	×	×	×	×		✓
Limited spearfishing (snorkel only)	✓	✓	✓ [1]	×	×	×	×		✓
Line fishing	✓ [6]	✓ [6]	✓ [7]	×	×	×	×		✓
Netting (other than bait netting)	✓	✓	×	×	×	×	×		✓
Research (other than limited impact research)	Permit	Permit	Permit	Permit	Permit	Permit	Permit		Permit
Shipping (other than in a designated shipping area)	✓	Permit	Permit	Permit	Permit	Permit	×		Permit
Tourism programme	Permit	Permit	Permit	Permit	Permit	Permit	×		Permit
Traditional use of marine resources	✓ [8]	✓ [8]	✓ [8]	✓ [8]	✓ [8]	✓ [8]	×		✓ [8]
Trawling	✓	×	×	×	×	×	×		×
Trolling	✓ [6]	✓ [6]	✓ [6]	✓ [6,9]	×	×	×		✓

State Zoning Only

Figure 1-7 Summary of activities allowed in zones according to the Great Barrier Reef Marine Park Zoning Plan 2003.

2. METHODOLOGY

2.1 LITERATURE REVIEW

The following tasks were undertaken as part of the literature review:

- Identify Matters of State and National Environmental significance (MSES / MNES) and undertake Endangered, Vulnerable and Near Threatened (EVNT) searches;
- Identify and discuss relevant environmental baseline reports prepared and previous ecological surveys to assist in defining marine ecological values;
- Identify the presence of any protected areas or environmentally sensitive areas that exist within the Study area;
- Describe the regulatory framework relevant to marine ecological values;
- Undertake relevant database searches of any priority marine species or populations present within and surrounding the Study area;
- Assess the pre-existing disturbance levels and the value of marine ecological processes in the Study area;
- Identify information and data that will be required to undertake the baseline marine ecological survey; and
- Describe the marine ecology of the Study area, including habitat, marine flora, marine mammals and megafauna, benthic invertebrates, fish communities, and marine reptiles.

2.2 GAP ANALYSIS AND FIELD PLAN

Based on the literature review, a field program was developed to confirm findings and address identified knowledge gaps relevant to the marine ecosystem values.

2.3 SURVEY DESIGN AND MONITORING ASPECTS

Table 2-1 defines the identified knowledge gaps based on the literature review and outlines the investigations undertaken to address these gaps.

To address the identified gaps and items of importance a field survey for marine transect surveys and shoreline works was undertaken by Hydrobiology from the 22-29th of November 2021. The key goal of this field survey was to assess the biodiversity and condition of benthic primary producing habitats and marine flora and fauna at subtidal, intertidal and the coastal shorelines. The Study area and selected sites for each method can be viewed in Table 2-2 and Figure 2-1 & Figure 2-2. Sites were determined with relevance to information from the literature review and known infrastructure designs at the time.

Table 2-1 Identified gaps and items of importance and associated forward plan.

Items	Comment	Action	Method and/or Reference
Knowledge Gaps			
Habitat	• No information on seagrass community composition or extent in the project area with little information on the surrounding area. • Little information regarding reef structure, extent, and coral composition in the project area and its surrounds. • No information on other benthic and primary producing habitats in the project area.	• Undertake habitat surveys to identify and define the extents of present habitat and benthic primary producing habitats.	• Undertake survey transects via side scan sonar and Remotely Operated underwater Vehicle (ROV) video assessments along the gantry, barges and surrounds. • Multispectral/photogrammetry aerial imagery via Unmanned Aerial Vehicle (UAV) surveys of exposed intertidal flats.
Water quality	• No information on water quality of the project area and its surrounds.	• In situ physiochemical data of water quality profiles to be collected at each grab site	• DES (2018) • ANZG (2018)

Items	Comment	Action	Method and/or Reference
Benthic Invertebrates	• No information on benthic invertebrates in intertidal and subtidal systems within the study area. Some information is available on community structure for the region, but this is limited.	• Survey present benthic invertebrates in intertidal and subtidal systems.	• DES (2018) • Undertake sampling via grab samples (triplicates).
Marine flora	• No information on marine plants (mangroves, seagrass, saltmarsh, etc.) within the study reach and its surrounds.	• Undertake marine plant surveys	• Extent, cover, health, and species community identification surveys via ground truthing and UAV survey • DES (2018)
Marine fauna	• No information on marine fauna within the study reach. • No defined species list of marine species within the area.	• Undertake marine fauna survey • Undertake likelihood of occurrences assessment	• Undertake active marine fauna surveys through opportunistic surveys and via the use of Baited Remote Underwater Videos (BRUVs) at identified habitats.
Sea turtle nesting	• No information relating to sea turtle shoreline nesting of the coastal shoreline in the study area.	• Undertake sea turtle nesting surveys along beach front • Undertake shoreline surveys to locate and identify turtle tracks	• UAV and on-foot survey of nests and tracks • QLD Marine Turtle Field Guide

2.4 MONITORING ASPECTS

Marine surveys were undertaken from the 22 to 27 November 2021. At each site, a range of parameters were assessed to provide an understanding of the marine environmental values of the Study area (Table 2-2). Method implementation is detailed in Appendix C.

Table 2-2 Survey sites across each monitoring aspect.

Site	Longitude	Latitude
Water Quality grab sample		
WQ1	145.3337	-14.949
WQ2	145.3336	-14.9478
WQ3	145.335	-14.9481
WQ4	145.3363	-14.9491

Site	Longitude	Latitude
WQ5	145.3345	-14.9507
WQ6	145.3367	-14.9427
WQ7	145.3379	-14.9419
WQ8	145.3389	-14.9412
BRUV placement		
B1	145.3353	-14.9502
B2	145.3339	-14.9487
B3	145.3335	-14.9477
B4	145.3362	-14.9492
B5	145.3348	-14.9477
B6	145.3371	-14.9488
B7	145.3379	-14.9482
B8	145.3382	-14.942
Grab location		
G1	145.3343	-14.9503
G2	145.3333	-14.9489
G3	145.3341	-14.9518
G4	145.3355	-14.9505
G5	145.3365	-14.9495
ROV transect start and end points		
R1 A	145.333	-14.949
R1 B	145.3329	-14.9476
R2 A	145.3331	-14.9491
R2 B	145.3339	-14.9507
R3 A	145.3361	-14.9505
R3 B	145.3355	-14.9491
R4 A	145.3364	-14.95
R4 B	145.3361	-14.9488

Site	Longitude	Latitude
R5 A	145.3368	-14.9497
R5 B	145.3366	-14.9484
R6 A	145.3332	-14.9474
R6 B	145.3344	-14.9488
R7 A	145.3345	-14.9476
R7 B	145.3354	-14.9488
R8 A	145.3395	-14.941
R8 B	145.3379	-14.942

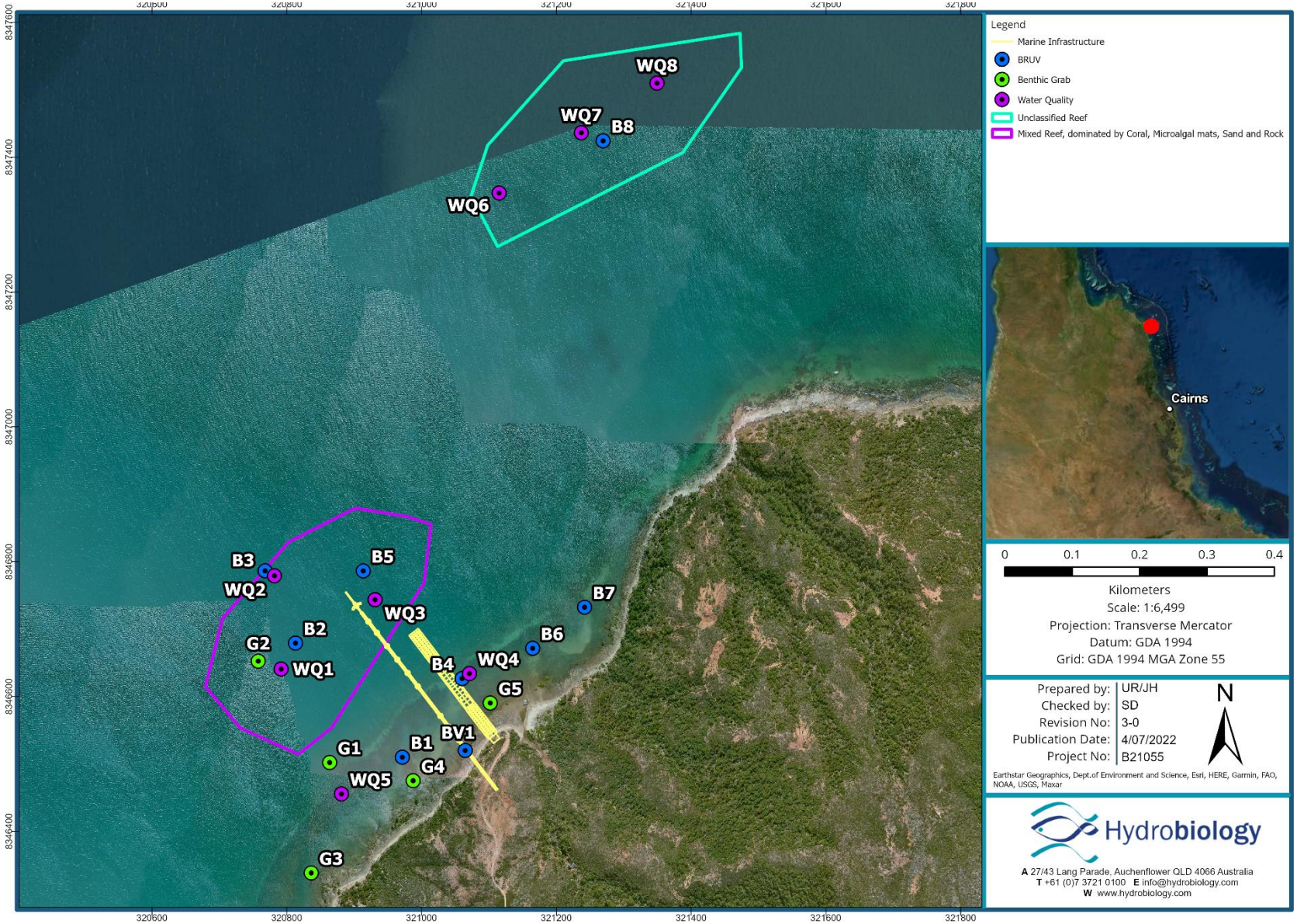

Figure 2-1 Project Study area and water quality, benthic grab, and BRUV deployment sites.

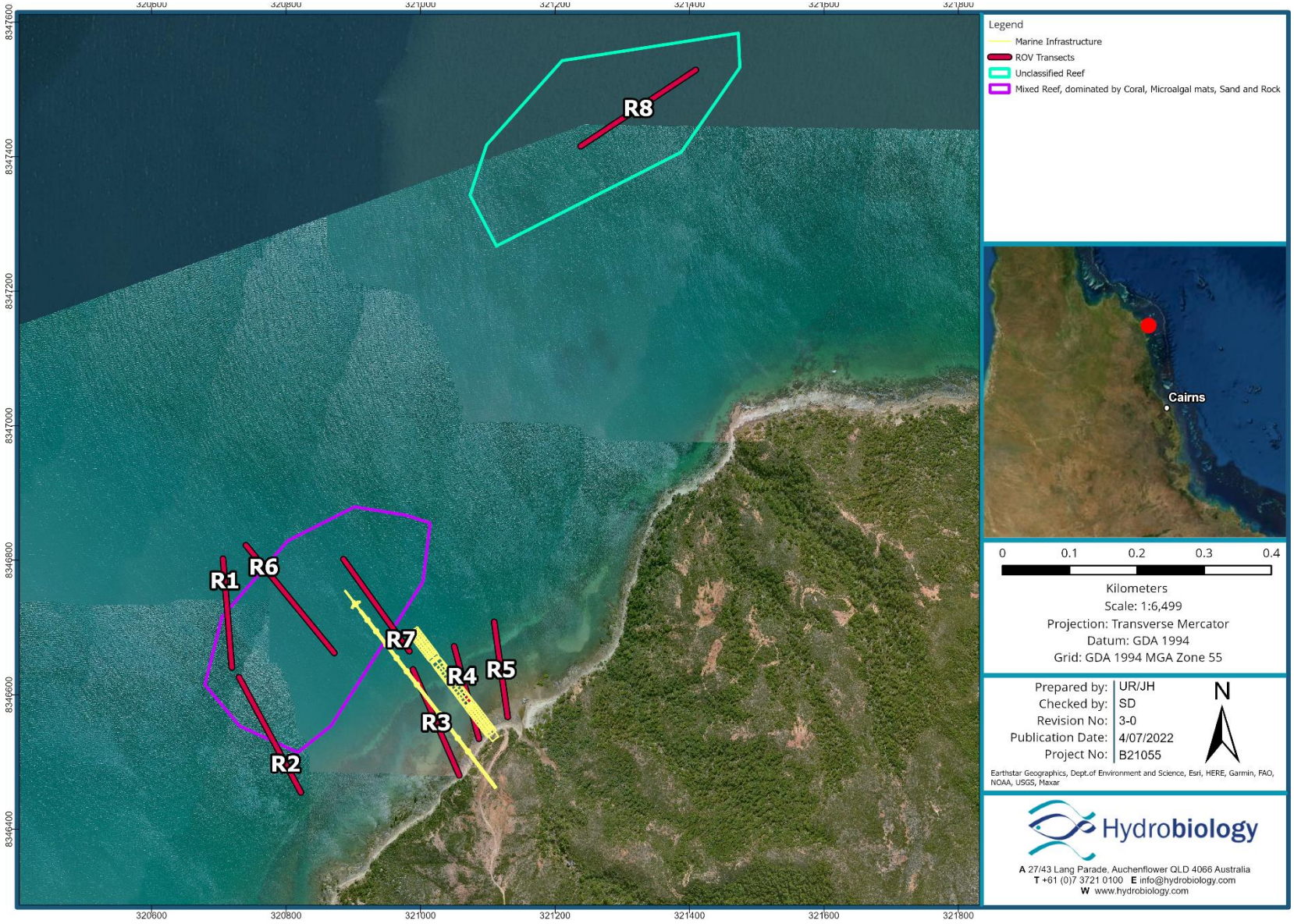

Figure 2-2 Project Study area and ROV transects.

2.5 IMPACT AND MITIGATION ASSESSMENT

The aim of this assessment is to define the residual impacts associated with the Project. That is, the impacts that will occur after the successful adoption of identified mitigation measures. This is achieved via the following sequential impact assessment framework:

1. Identification of the environmental value/s
2. Identification of the potential impact, including a description of the action that will cause an impact, the effect which is predicted to occur as a result of the action, and identification of the environmental value on which the impact will occur. This will also identify the following impact aspects:
    - Whether the impact is *direct* or *indirect*, examples of the former are clearance of habitat, the latter could be ambient water quality changes as a result of clearance of habitat
    - The phase of the project; *construction*, *operation*, or *ongoing* throughout the life of the project
    - Location of impact relevant to the action, typically relates to project infrastructure as defined in the Project Description (Section 1.2)
    - The direction of the impact, that is whether it is a *positive* (beneficial) or *negative* impact.
3. Categorising the impact using the criteria specified in Table 2-3 for the following aspects:
    - the *magnitude* of the impact, incorporating consideration of the geographic footprint of the impact,
    - the *duration/reversibility* to account for degree of permanence
    - the *likelihood/frequency* temporal aspects and degree of permanence as defined in Table 2-3
4. Deriving an *impact rating* using the matrix in Table 2-4
5. Identifying the intrinsic *sensitivity/importance* of the environmental value, using the criteria defined in Table 2-5 which can include legal protections, endemism, individual or community perception, rarity or uniqueness.
6. Deriving the *significance* of the impact through a matrix of *sensitivity* : *impact rating* as per Table 2-6.
7. Identifying avoidance, mitigation and management measures that could reduce the effects of potential impacts.
8. Assessing the residual impact, assuming that the mitigation measures adopted are successful.
9. Recommendations for a monitoring plan to confirm the significance of the impact, efficacy of the mitigation measures, and identify any areas for improvement associated with the Project within the context of the environmental values described in this Study.

Table 2-3 Impact categorisation

	Magnitude	Duration/Reversibility	Likelihood/frequency
Environment-biological	• Negligible- Little noticeable impact to the environment, impacts consistent with existing activities taking place in the area • Minor- Limited impacts, may affect some common species within a local context but unlikely to change ecological dynamics • Moderate- Impacts to multiple species or communities requiring complex mitigation or management, widespread impacts • Major- Impacts to multiple species or communities or intact areas with no or negligible anthropogenic stressors, possibly including significant impacts to threatened species or critical biological systems, affects may be felt outside of the region	• Short term- effects will be occur over a period of weeks or months; are easily reversible • Long Term – effects will occur for years • Permanent- values will never return to pre-existing state	• Rare- may occur in exceptional circumstances • Possible- may occur on this project, has occurred occasionally or intermittently on similar projects or actions in the past • Likely – could be expected to occur, has occurred on similar projects or actions in the past. Intermittent affects have occurred frequently in the past. • Almost certain- Is expected to occur, has occurred recently on similar projects or actions and is very likely to occur again
Environment-physical	• Negligible- Little measurable impact to physical environmental features, no additional surface disturbance above that normally created by existing activities • Minor- Limited physical disturbance or minimal changes which are within the normal range of variability, impacts limited to an immediate area of disturbance • Moderate- Measurable changes to physical environment which are outside of the range of normal variability, impacts which extend beyond the immediate disturbance area • Major- Serious physical disturbance or changes which pose a significant risk to physical environment, extensive physical changes well beyond the project area	• Short term- effects will be occur over a period of weeks or months. • Long Term – effects will occur for years • Permanent- values will never return to pre-existing state	• Rare- may occur in exceptional circumstances • Possible- may occur on this project, has occurred occasionally or intermittently on similar projects or actions in the past • Likely – could be expected to occur, has occurred on similar projects or actions in the past. Intermittent affects have occurred frequently in the past. • Almost certain- Is expected to occur, has occurred recently on similar projects or actions and is very likely to occur again

Table 2-4 Impact rating matrix

Magnitude	Duration	Likelihood	Impact Rating
Negligible	Short Term	Rare	Insignificant
		Possible	Insignificant
		Likely	Insignificant
		Almost Certain	Insignificant
	Long Term	Rare	Insignificant
		Possible	Insignificant
		Likely	Insignificant
		Almost Certain	Insignificant
	Permanent	Rare	Insignificant
		Possible	Insignificant
		Likely	Insignificant
		Almost Certain	Insignificant
Minor	Short Term	Rare	Insignificant
		Possible	Insignificant
		Likely	Low
		Almost Certain	Low
	Long Term	Rare	Low
		Possible	Low
		Likely	Medium
		Almost Certain	Medium
	Permanent	Rare	Low
		Possible	Medium
		Likely	Medium
		Almost Certain	Medium
Moderate	Short Term	Rare	Low
		Possible	Low
		Likely	Medium
		Almost Certain	Medium
	Long Term	Rare	Low
		Possible	Low
		Likely	Medium
		Almost Certain	High
	Permanent	Rare	Low
		Possible	Medium
		Likely	High
		Almost Certain	High
Major	Short Term	Rare	Low
		Possible	Medium
		Likely	Medium
		Almost Certain	High
	Long Term	Rare	Low
		Possible	Medium
		Likely	High
		Almost Certain	High
	Permanent	Rare	Medium
		Possible	High
		Likely	High
		Almost Certain	High

Table 2-5 Sensitivity criteria

Rating	Rationale
Low	The environmental value is not listed on any statutory register or recognised locally. No detectible response to change will occur.
Moderate	The environmental value is not listed on any statutory protection register and is in a poor to moderate condition due to disturbances. The value is abundant and widely distributed and could be replaced if unavoidable losses were to occur.
High	The environmental value is important at a regional level and is in moderate to good condition retaining most of its intrinsic elements. Replacement of unavoidable losses is possible due to its abundance and distribution.
Extreme	The environmental value is listed to have conservation significance at the state, national or international level and is completely intact and retains its intrinsic value. The value has not been exposed to threatening processes and Project activities will have an adverse impact on the value.

Table 2-6 Significance criteria

		Sensitivity/Importance			
		Low sensitivity	**Moderately sensitive**	**Highly sensitive**	**Extremely sensitive**
Impact rating	**Insignificant**	Negligible	Negligible	Minor	Minor
	Low	Negligible	Minor	Moderate	Moderate
	Medium	Minor	Moderate	Moderate	Major
	High	Moderate	Moderate	Major	Major

Table 2-7 Impact significance definition.

Significance	Definition
Negligible	An impact of negligible significance (or an insignificant impact) occurs where a resource or receptor will not be affected in any way by a particular activity, or the predicted effect is deemed to be 'negligible' or 'imperceptible' or is indistinguishable from natural background variations.
Minor	An impact of minor significance occurs where an effect will be experienced, but the impact magnitude is sufficiently small (with and without mitigation) and well within accepted standards, and/or the receptor is of low sensitivity/value. Monitoring may be required to assess whether impacts remain acceptable.

Significance	Definition
Moderate	An impact of moderate significance is one within accepted limits and standards. The emphasis for moderate impacts is on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP). This does not necessarily mean that 'moderate' impacts have to be reduced to 'minor' impacts, but that moderate impacts are being managed effectively and efficiently. Impact is likely to require monitoring if there are opportunities to further reduce impact level.
Major	An impact of major significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. These impacts are a priority for mitigation in order to avoid or reduce the significance of the impact.
Positive	A positive impact based on the outcome of the development. For example, an improvement in water quality or an improvement in ecological habitats as a result of the development.

3. LITERATURE REVIEW

3.1 PREVIOUS STUDIES

There have been limited previous ecological investigations for the region, this is likely due to the isolated location of Cape Flattery and still largely undeveloped landscape. In terms of marine ecology, an initial seagrass survey was undertaken at a broadscale level in 1984 (Coles et al., 1992) and a detailed benthic monitoring baseline survey (including seagrass) within the Port limits of Cape Flattery was conducted in 1996 (Ayling et al., 1997).

3.2 AQUATIC PROTECTED AREAS

The Study area and surrounds are protected under both Commonwealth and State legislation as detailed in Table 3-1. Commonwealth and State database searches are provided in Appendix B.

3.3 ENVIRONMENTAL VALUES

There are a range of environmental values (EVs) applicable to waterways and coastal marine waters in Queensland. These include the value of the coastal marine waters to aquatic ecosystems, primary industries, recreation and aesthetics, drinking water, industrial uses as well as cultural and spiritual values. The Study area is located within the water management area deemed to be the Port of Cape Flattery Marine Waters (DES, 2020). Table 3-2 defines coastal water EVs for the noted water management area.

Table 3-1 Aquatic protected areas within the Study area and surrounds

Legislation/Directory	Protection areas	Notes
Matters of National Environmental Significance		
Environmental Protection and Biodiversity Conservation Act 1999	National heritage places	The Study Area is located within the Great Barrier Reef.
	World heritage properties	The Study Area is located within the Great Barrier Reef.
	Wetlands of international significance (Ramsar wetlands)	There are no mapped wetlands of international significance within the Study area and surrounds.
	Great Barrier Reef Marine Park	The GBRMP does not directly overlap with the Study area, however the GBRMP is located within 3.5-4 km in either direction. Immediate zones include GU-11-6002 and HP-14-5112 (IUCN VI)
	Commonwealth marine waters	The Study area and surrounds are not located within Commonwealth marine waters
	Listed Threatened Species	Threatened species or species habitat likely occurs within the Study area and its surrounds (Table 3-6).
	Listed Migratory Species	Migratory marine species or species habitat possible occurs within the Study area and its surrounds (Appendix A).
Wet Tropics World Heritage Protection and Management Act 1993	Wet tropics world heritage area	The Study area and surrounds are not located within the Wet Tropics World Heritage catchments.
Directory of Important Wetlands in Australia	Wetland of national importance	There are two mapped wetlands of national importance within the Study area and surrounds. These wetlands include: The Cape Flattery Dune Lakes and the Great Barrier Reef Marine Park. The Dune Lakes are freshwater environments and are no relevance to the loading facility or the marine assessment.
Matters of State Environmental Significance		
Marine Parks Act 2004	State Marine Parks – highly protected zone	There are no mapped marine parks within the Study area, however the Great Barrier Reef Coast Marine Park surrounds the immediate Study area within 3.5-4 km in either direction.
Fisheries Act 1994	Marine Plants	There are tracts of marine plants thought to be located in within the Study area. These are discussed in Section 3.6
Fisheries Regulation 2008	Fish habitat areas (A and B areas)	There are no protected fish habitat areas within the Study area and surrounds.
Environmental Protection Act 1994	Referable wetlands	There are no mapped referrable wetlands within the Study area and surrounds.
	High ecological values (HEV)	There are no mapped HEV wetlands or waterways within the Study area, however the Study area is surrounded by HEV waters (approx. 3 km). These HEV waters are in relation to the GBRMP and are of no relevance to the loading facility
	High ecological significance (HES) and Wetland Protection Area (WPA)	There are no mapped HES or WPA areas within the Study area and surrounds
Nature Conservation Act 1992	Protected marine fauna and flora	Protected species or species habitat likely occurs within the Study area and its surrounds (Table 3-6).

Table 3-2 EVs of the Study area

Label	Environmental Value	Port of Cape Flattery Marine Waters
	Aquatic ecosystem	✓
	Irrigation	-
	Farm supply	-
	Stock watering	-
	Aquaculture	-
	Human consumption	-
	Primary recreation	-
	Secondary recreation	-
	Visual appreciation	✓
	Drinking water (raw water supply)	-
	Industrial	✓
	Cultural and spiritual values	✓

3.4 WATER QUALITY

While there is no published water quality data within the Study area, the wider Jeannie Catchment basin exhibits varying degrees of anthropogenic influences on water quality. Water quality of the catchment is generally influenced by diffuse run-off and point source inputs (DES, 2021).

The major consideration for the catchment and the particular Study area is the proximity of sensitive receiving environments. Coral reefs, seagrass beds, and mussel beds are all areas of high conservation significance and occur in the marine waters adjacent to the catchment. These waters adjacent to Cape Flattery and offshore of its dunes support diverse marine plant communities, which support the ecosystem in roles such as fish nursery areas for local and offshore fisheries (DES, 2021).

Due to the remoteness of Cape Flattery, the scarcity of industry in the area, and the low impact of sand mining on marine water quality. There is little contaminant load on the marine waters

adjacent to Cape Flattery (Ports North, 2014). As a result, there has been hardly any need in the past for comprehensive water quality monitoring programs at the study site or in its immediate waters (Ports North, 2014; Ayling et al., 1997).

The limited data available indicates that the water clarity near the Study area is generally high with low levels of suspended solids. This is consequently due to the lack of major rivers in the area or sources of fine sediment that could be resuspended, with the exception of severe weather events (cyclones) (Ayling et al., 1997). Within the GBR region, fringing reefs are generally subjected to periodically high natural levels of turbidity caused by coastal sediments being resuspended from south easterly (SE) winds and storm events (Ayling et al., 1997).

Generally, the water quality of the marine environment in Cape Flattery should be relatively undisturbed due to the geographical isolation of the area and the minimal risk correlated with existing activities of the area.

3.5 SEDIMENT QUALITY

Marine sediments of the Study area consist of primarily white silica sands (quartz) with minimal heavy mineral content. Available data for contaminant levels within the sediment is scarce but is unlikely to contain any significant levels of contaminants due to the region's isolation and distance from major catchments (Ports North, 2014; Ayling et al., 1997).

3.6 MARINE AND COASTAL HABITAT

3.6.1 ROCKY REEF AND SAND COMPLEXES

Cape Flattery supports a range of intertidal habitats with those closest to the study area being fringing reef, followed by sandy beaches, and low-lying rocky platforms (Figure 3-1). The general fauna inhabiting these zones includes snails and hermit crabs on sandy beaches and hardier fauna on the boulder beaches such as barnacles, oysters, chitons, limpets, and snails. Rocky platforms are characterised by barnacles, oysters, mussels and cnidarians (including anemones). The sandy beaches of Cape Flattery provide potential nesting areas for turtles.

The communities of the rocky beaches within Cape Flattery appear to be similar to those within other rocky beach environments in the wider GBRMP. The rocky shores within Cape Flattery support the common rock oyster, gastropods and chitons, alongside several species of barnacles. The common rock oyster *Saccostrea cucullata* is generally quite abundant, along the entire intertidal rocky shoreline (Ayling et al.,1997).

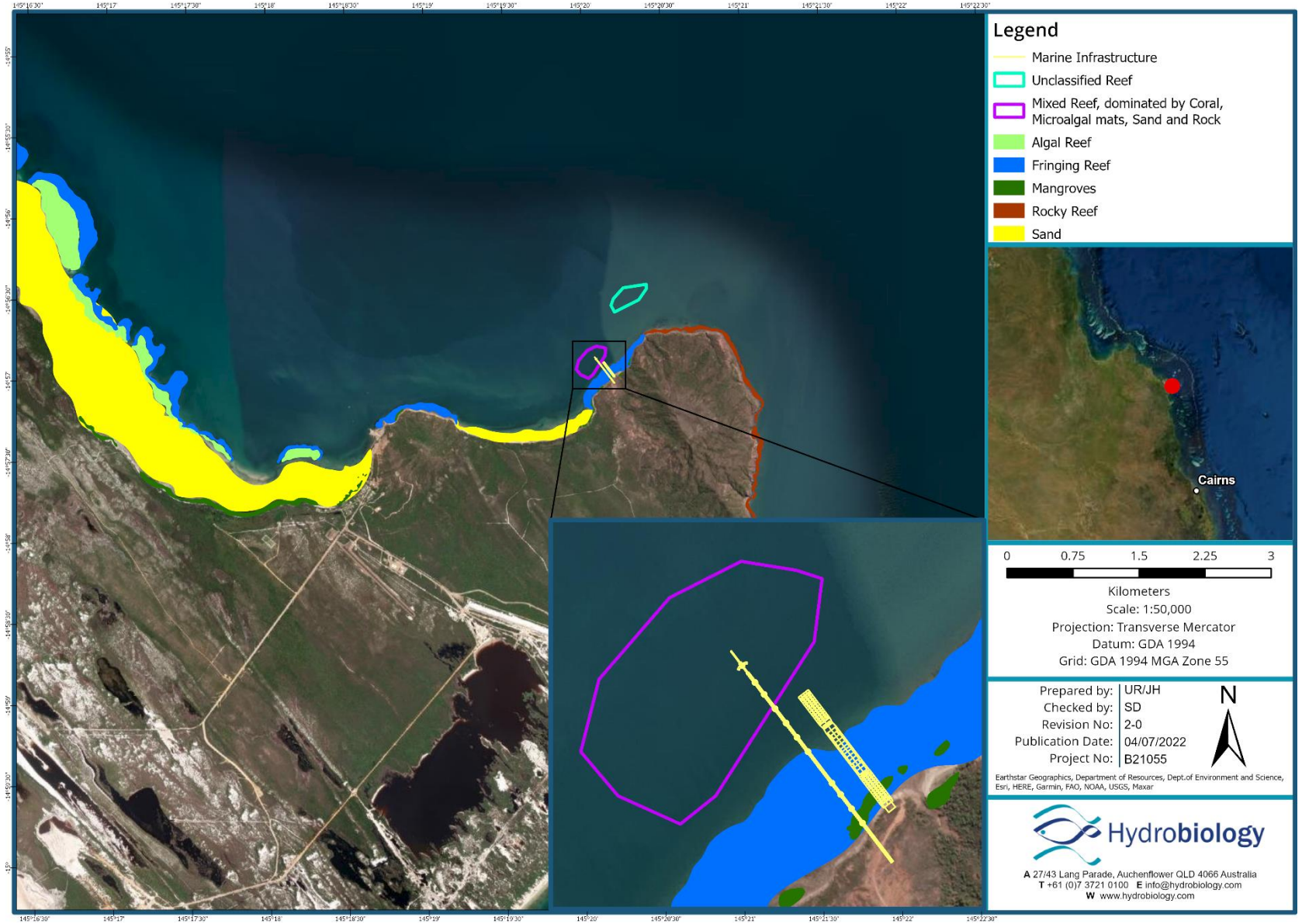

Figure 3-1 Mapped coastal and marine habitats of the Study area (source: GBRPMA 2021)

3.6.2 REEFS

Coral reefs are highly dynamic ecosystems, known to support the highest biodiversity of marine life while also being the most threatened ecosystems on the planet. Coral reefs offer several ecosystem services of substantial importance to cultural, economic, and social processes (Göltenboth et al., 2006). Coral reefs are recognised as very stable ecosystems in which reefs are susceptible to rapid changes in abiotic factors such as turbidity, dissolved oxygen, temperature, and salinity, as such coral reefs known as "low input systems" in which emissions of chemicals such as nutrients and poisons can easily impact these ecosystems (D'Elia and Wiebe, 1990).

A baseline reef survey of the Study area and its surrounds was conducted in 1996 by Ayling et al., (1997). Coral reefs in the Cape Flattery region include both inshore reefs and fringing coastal reefs. The inshore reefs are Decapolis Reef (Approx. 7 km north-west from the Study area) and an unnamed reef (Approx. 6 km south from the Study area).

Narrow coastal fringing reefs line the north facing portion of Cape Flattery, directly within the Study area. The remaining recorded fringing reefs line the east facing section of Cape Flattery Beach, which extends continuously to Lookout Point. The outer depth of these fringing reefs reaches a depth of 3-5 m below Australian Height Datum (AHD) (Ayling et al., 1997). Contrastingly, GBRMP mapping displays two distinct reefs within the survey location, one being directly within the bounds of the proposed loading facility roughly 200 m offshore and a second approximately 300 m north of the first (Figure 3-1). The first reef, directly adjacent to the proposed loading facility is mapped on allencoralatlas.org as being comprised of microalgal mats, rock, coral, and sand, with the majority being microalgal mats, there is no evidence of a second reef on this resource. Little information is known regarding the reefs and their locations with available mapping suggesting contrasting reef locations.

Further information from the baseline survey by Ayling et al., (1997) indicates that the fringing reefs of the Cape Flattery region maintained nearly 50% hard coral cover in a high abundance, while being lower on rocky reefs with just 5% cover. Hard coral community composition was generally dominated by Acroporid corals. Soft corals were roughly of 12% cover and less abundant on rocky and inshore reefs. The rocky reefs of the area were dominated by turfing algae and *Saragassum* algal forests, this is a common characteristic for rocky reefs of the region. Sponges were considered to moderately common fringing reefs with just 3% cover and were fairly rare on rocky and inshore reefs (Ayling et al., 1997).

3.6.3 MANGROVES

Mangroves persist in environments where conditions are often considered as restrictive, harsh, and dynamic due to the short-term rhythms of seasons and tides, in addition to long-term changes of sea levels and climate (Duke, 1992). The ecological significance of mangroves habitats is great with primary production in these systems being significantly high (Comely & McGuiness, 2005). Mangroves assist in the protection of coastal environments from seawater intrusion, while also helping in floodwater mitigation and nutrient recycling and filtration (Balakrishna, 1995; Clarke, 1994). Similarly, to seagrass, mangroves also support fish populations by providing nursery habitats for juvenile fish and breeding grounds, many commercially important fishery species utilise these habitats (McClusky & Elliot, 2004; Connolly & Lee, 2007). These ecosystem services illustrate the high economic importance of mangroves (Ronnback, 1999).

Mangrove wetlands were mapped in 1996 using aerial photos by Ayling et al., (1997), mangroves are present throughout the Cape Flattery area and are the dominant vegetation type along the sheltered muddy/sandy foreshore areas between Cape Flattery and Blackwater Creek. A slender strip of mangroves borders roughly 5.4 km of the Flattery Port beach alongside approximately 1.2 km of chiefly *Rhizophora* spp. (red mangroves) along the southern edge of the beach. The remainder of the

beach is characterised by Red Mangroves in the surrounds of the two local creek mouths. Satellite imagery has additionally revealed small patches of unidentified mangroves along the coastline of the loading facility, these have been mapped in Figure 3-1.

A WildNet species list search has identified 7 previously recorded mangrove species within the approximate Study area, these are listed below in Table 3-3.

Table 3-3 Previously recorded mangrove species within the Study area.

Species	Common Name	Conservation Status
Acanthaceae		
Avicennia marina	Grey Mangrove	Protected – (Fisheries Act 1994)
Combretaceae		
Lumnitzera racemosa	White-flowered black mangrove	Protected – (Fisheries Act 1994)
Lythraceae		
Sonneratia alba	None	Protected – (Fisheries Act 1994)
Myrtaceae		
Osbornia octodonta	Myrtle mangrove	Protected – (Fisheries Act 1994)
Rhizophoraceae		
Rhizophora stylosa	Spotted mangrove	Protected – (Fisheries Act 1994)
Rhizophora apiculata	None	Protected – (Fisheries Act 1994)
Bruguiera gymnorhiza	large-fruited orange mangrove	Protected – (Fisheries Act 1994)

3.6.4 SEAGRASS

Seagrass meadows are present in coastal waters of most of the world's continents and are one of the most diverse, efficient, and productive habitats in the world (Alevizon & Brooks, 1975; Heck et al.,1989). Seagrass meadows provide a plethora of important features and ecological benefits, alongside several geomorphological roles and have been referred to as "ecosystem engineers" due to roles such as seagrass leaves slowing the speed of currents, rhizomes and roots securing the substrate which traps sediment (Coleman & Williams, 2002; Merlin, 2011). They also provide ecological benefits such as the sequestering of carbon, nutrient cycling, absorbing coastal run off, and acting as a critical source of food to many projected species including dugongs and turtles which are listed within the EPBC Act 1999 (Duarte et al. 2005; Merlin, 2011). Another key ecological feature of seagrasses is the ability for a meadow to support nursery grounds for juvenile fish, crabs, and prawns, offering resources and refuge from predation (Nakamura & Sano, 2004).

Seagrasses have ecological, morphological, and physiological adaptations that allow them to live submerged. Due to this, seagrasses can be easily affected by changes to water quality and sedimentation (Merlin, 2011). Threats that obstruct the ability of light to reach seagrass meadows are by far one of the key threatening processes, as without light seagrasses will perish (Short & Wyllie-Echeverria, 1996). Recent studies however have clearly indicated that seagrass population and distributions are heavily deteriorating globally (Orth et al., 2006).

There are no current seagrass monitoring programs in the Study area. The area to north of Cape Flattery has been mapped at a broadscale level by Coles et al., (1992), more detailed mapping has since been undertaken by Ayling et al., (1997). Seagrass meadows have been recorded to the direct north-west of the Study area along the coastline towards Lookout Point. Seagrass communities have historically been comprised of *Halodule/Thalassia* meadows extending along the coast to the

immediate south (Figure 3-2.). A species list of seagrass observed from Ayling et al. (1997) is available in Table 3-4.

The biomass of above ground seagrass was recorded by Ayling et al. (1997) in 1996, *Halodule universis* and *Thalassia hemprichii* had the largest and highest ranges in biomass. Overall, four species maintained the highest average biomass detected in the surveys, those being the following: *Thalassia hemprichii, Cymodocea rontundata, Cymodocea serrulata,* and *Halodule universis* (Figure 3-3).

It is important to note that no surveying was undertaken within the Study area itself with the closest survey sites being approximately 3km from the Study area. To date, there has been no seagrass surveying within the specific Study area however, adjacent communities (if present) can infer that the species composition will likely be similar to that of the region.

Table 3-4 Previously recorded seagrass species within the Study area.

Species	Common Name	Conservation Status
Halophila ovalis	Paddle weed	Protected – (Fisheries Act 1994)
Halophila spinulosa	Fern seagrass	Protected – (Fisheries Act 1994)
Thalassia hemprichii	Pacific turtlegrass	Protected – (Fisheries Act 1994)
Cymodocea rotundata	Smooth ribbon seagrass	Protected – (Fisheries Act 1994)
Cymodocea serrulata	Serrated ribbon seagrass	Protected – (Fisheries Act 1994)
Halodule pinifolia	Needle seagrass	Protected – (Fisheries Act 1994)
Halodule uninervis	Narrowleaf seagrass	Protected – (Fisheries Act 1994)
Syringodium isoetifolium	Noodle seagrass	Protected – (Fisheries Act 1994)

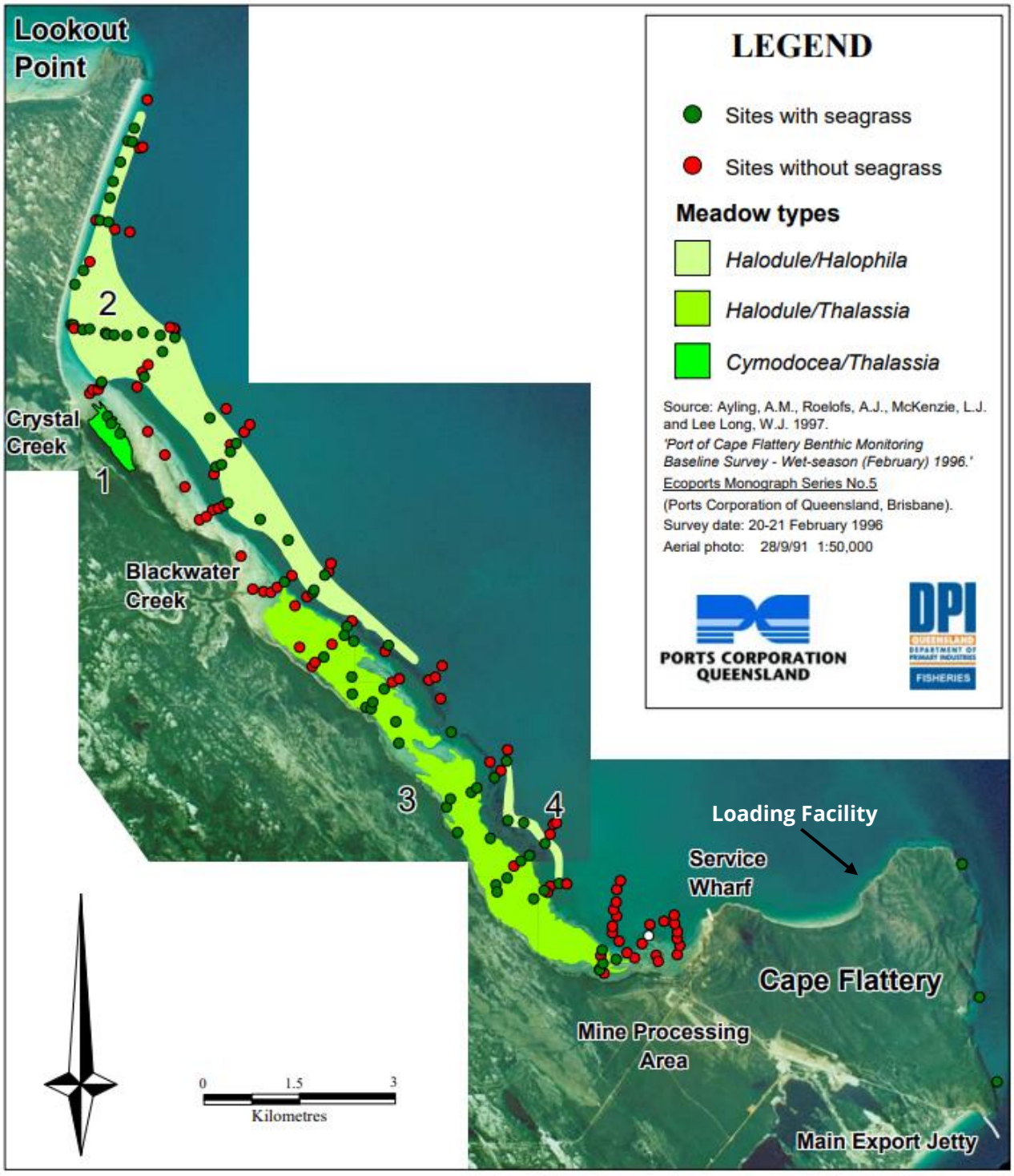

Figure 3-2 Location of survey sites and seagrass meadows between Cape Flattery and Lookout Point – February 1996 (Ayling et al.,1997).

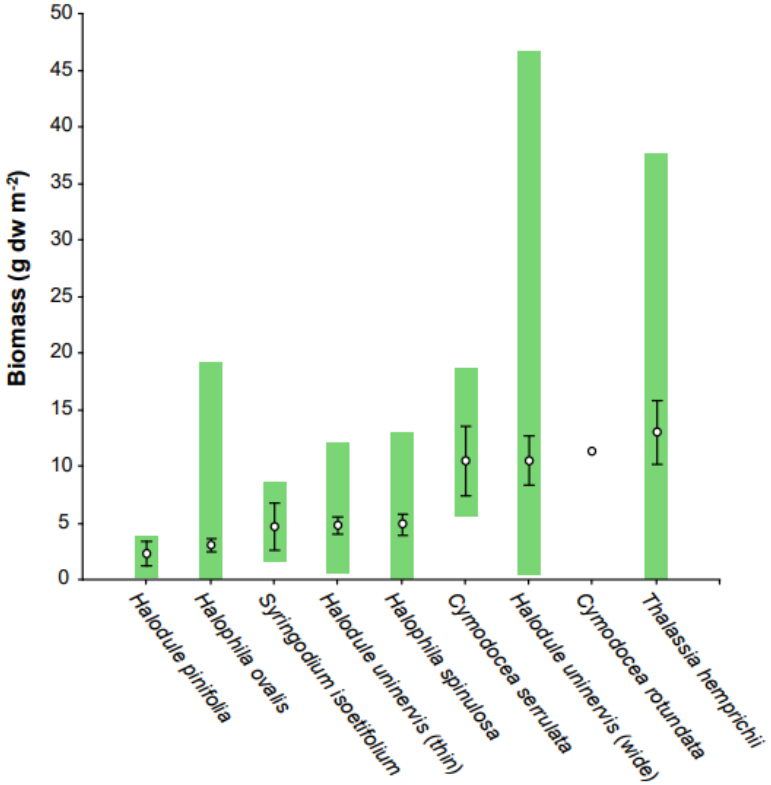

Figure 3-3 Means, standard errors and ranges of above ground biomass of seagrass species surveyed from Lookout Point to Cape Flattery in February 1996 (Ayling et al., 1997).

3.7 MARINE FAUNA

Resources such as the EPBC Act Protected Matters Search Tool, the Queensland Matters of State Environmental Significance Search Tool, and the Marine Turtle Breeding and Migration Atlas Project were used to identify conservation significant species that occur or could occur in the Study area. The habitat and distribution of threatened and migratory marine fauna known or likely to occur in the Study area and surrounds were identified below in Table 3-6. In summary, the following were identified:

- Threatened marine mammals: 7 species
- Threatened marine reptiles: 7 species
- Threatened sharks and rays: 7 species
- Threatened ecological communities: 0 species

The protected matters search tool indicated a range of listed migratory or marine species that may be present in and around the Study area. A review of the likelihood of occurrence of the species identified by the search tool is provided in Appendix A.

The likelihood of species occurring was considered under four categories; (i) unlikely; (ii) possible; (iii) likely; and (iv) Known. The criterion used to define each category is provided in Table 3-5.

Table 3-5 Criteria used for assigning likelihood of occurrences relevant to EVNT and special least concern species.

Likelihood of occurrence category	Criteria
Unlikely	• No suitable habitat present.
Possible	• Suitable species habitat present.
Likely	• Suitable species habitat present and; • A record occurs nearby (5 km) in similar habitat.
Known	• Species recorded during field surveys (including past records).

Table 3-6 Threatened Species – Likelihood of Occurrence

Species	Status (EPBC / NC Act)	Distribution / Habitat	Likelihood of Occurence
Marine Mammals			
Balaenoptera musculus Blue Whale	EPBC: Endangered, Migratory, Cetacean NCA: Not listed	No previous records in the region. Blue whales are generally oceanic and migratory through Australian waters (DoE, 2021a).	Unlikely
Megaptera novaeangliae Humpback whale	EPBC: Vulnerable, Migratory, Cetacean NCA: Vulnerable	Humpback whale adults and calves have been recorded within the Cape Flattery region (Smith et al., 2010), potentially using the area for resting on their southern migration. The wider Cape York to Cairns GBRMP area is recognised as biologically important for breeding and calving (DoE, 2021b)	Likely – however occurrences would be limited to the deeper waters ~5km to the north-west of the study area. It is unlikely for a healthy Humpback whale to swim closer to shore.
Balaenoptera edeni Brydes Whale	EPBC: Migratory, Cetacean NCA: Not Listed	Coastal waters of much of Australia and southern Africa where it searches for baitfish (Van Dyke & Strahan, 2008) Insufficient information is available regarding how the Australian Bryde's Whales use their habitat. This is due to no specific breeding or feeding grounds being discovered off Australia (DoE, 2021h).	Unlikely
Orcinus orca Killer whale, Orca	EPBC: Migratory, Cetacean NCA: Not Listed	Killer Whales prefer habitat within oceanic, neritic, and pelagic waters in both warm and cold regions. Generally being common in cold, deep waters off the continental slope and shelf of Australia, particularly near seal colonies (Thiele & Gill, 1999). Killer Whales do not utilise or form any listed ecological community. Instead, use of habitats has been linked to behaviour requirements, and the movement of food (Similae et al., 2002).	Unlikely

Species	Status (EPBC / NC Act)	Distribution / Habitat	Likelihood of Occurence
Orcaella heinsohni Australian Snubfin Dolphin	EPBC: Migratory, Cetacean NCA: Near Threatened	Recorded throughout the GBRMP where it inhabits coastal, estuarine, and riverine waters (Parra, 2006).	Possible
Sousa chinensis Indo-Pacific Humpback Dolphin	EPBC: Migratory, Cetacean NCA: Near Threatened	Occurs in coastal and estuarine areas in association with rocky reef areas (DoE, 2021c; Van Dyke & Strahan, 2008).	Possible
Dugong Dugon Dugong	EPBC: Listed Marine, Migratory NCA: Vulnerable	Marine habitats with shallow nutrient rich water with silt allowing intact sea grass meadows to grow (Van Dyke & Strahan, 2008). The northern Great Barrier Reef region (which includes Cape Flattery) is one of the most important dugong habitats in Australia (Grech *et al.*, 2011)	Known – previous sightings recorded offshore within the Cape Flattery area (Ports North, 2014). Additional evidence of Dugong feeding trails on seagrass noted in surveys by Ayling et al., (1997).
Marine Reptiles			
Chelonia mydas Green Turtle	EPBC: Vulnerable, Migratory, Listed Marine NCA: Vulnerable	The marine waters of the region can be important foraging areas for the species where it can feed on seagrass and benthic invertebrates (Wilson & Swan, 2003). Nesting has been recorded 30km offshore from the project site on Lizard Island with 1-10 females nesting per year (Limpus, 1985).	Known – previous distribution records include the Cape Flattery area, though do not include nesting sites (Limpus, 2008).
Caretta caretta Loggerhead Turtle	EPBC: Endangered, Migratory, Listed Marine NCA: Endangered	Pelagic and benthic species. It is unknown if the project site represents a nesting site. Forages on marine invertebrates (Wilson & Swan, 2003). Nesting has been recorded 30km offshore from the project site on Lizard Island with 1-10 females nesting per year (Limpus, 1985).	Known - previous distribution records include the Cape Flattery area, though do not include nesting sites (Limpus, 2008).

Species	Status (EPBC / NC Act)	Distribution / Habitat	Likelihood of Occurence
Dermochelys coriacea Leatherback Turtle	EPBC: Vulnerable, Migratory, Listed Marine NCA: Endangered	Oceanic species which feeds on jellyfish and other soft bodied invertebrates (DEWHA, 2007; Wilson, 2005).	Possible – nesting record from 1996 on the other side of the headland around 4km south east of the Study area (DES, 2022)
Eretmochelys imbricata Hawksbill Turtle	EPBC: Vulnerable, Migratory, Listed Marine NCA: Vulnerable	Typically forages in tidal and sub-tidal coral and rocky reefs. Nesting is not known to occur in the Cape flattery area (DoE, 2021d).	Possible
Lepidochelys olivacea Olive Ridley Turtle	EPBC: Endangered, Migratory, Listed Marine NCA: Endangered	Typically our in shallow soft-bottomed habitats and coastal tropical waters, predominantly feeding on gastropods and bivalves. Nesting is not known to occur along the eastern coastline (DoE, 2021e), and no distribution records in the cape flattery area (Limpus, 2008)	Possible
Natator depressus Flatback Turtle	EPBC: Vulnerable, Migratory, Listed Marine NCA: Vulnerable	Flatback turtles generally inhabit soft bottomed habitats and tropical coastlines. Nesting is not known to occur in the area (DoE, 2021f), though distribution records include the Cape Flattery area.	Likely - previous distribution records include the Cape Flattery area, though do not include nesting sites (Limpus, 2008).
Crocodylus porosus Salt-water crocodile	EPBC: Migratory, Listed Marine NCA: Vulnerable	Inhabits swamps, coastal rivers, estuary mouths, inland rivers and open sea (Wilson & Swan, 2003) Species has been observed in the Study area (Ayling et al., 1997).	Known
Sharks and Rays			
Carcharodon carcharias Great White Shark	EPBC: Vulnerable, Migratory NCA: Not listed	Suitable habitat may be present within the region however, the nearest known aggregation area of the species is offshore of Rockhampton, roughly 1200 km south of Cape Flattery (DoE, 2021g).	Unlikely

Species	Status (EPBC / NC Act)	Distribution / Habitat	Likelihood of Occurence
Pristis zijsron Green Sawfish	EPBC: Vulnerable NCA: Not listed	Species is known to occur in shallow and coastal and estuarine areas. Occurrence in much of its range is unknown due to a lack of data, It most abundant in the tropics with the closest sighting to the project site being in Port Douglas, roughly 160 km south. (Simpfendorfer, 2019)	Possible
Manta birostris Giant manta ray	EPBC: Migratory NCA: Not listed	Giant manta rays are generally associated with offshore reefs and islands. The species has previously been recorded off the coast of Cape Flattery (Armstrong et al., 2019).	Likely
Pristis pristis Largetooth Sawfish	EPBC: Vulnerable, Migratory NCA: Not listed	The species are generally restricted to shallow estuarine fresh and coastal waters (Thorburn et al., 2007). Juvenile individuals inhabit estuarine and freshwater watercourses, while adults are generally marine (Whitty et al., 2008). There are no known observations of the large tooth Sawfish in or within the surrounds of the Study area.	Possible
Anoxypristis cuspidate Narrow Sawfish	EPBC: Migratory NCA: Not listed	The species is bentho-pelagic, inhabiting estuarine and coastal habitats (Last & Stevens, 2009). Adults generally inhabit offshore environments while juveniles and mothers require coastal and estuarine habitats (Peverell, 2005). The species is not known to occur in the Study area.	Unlikely
Carcharhinus longimanus Oceanic Whitetip Shark	EPBC: Migratory NCA: Not listed	These sharks generally inhabit pelagic waters in subtropical and tropical regions (Last & Stevens, 2009). The species is not known to occur in the Study area.	Unlikely

Species	Status (EPBC / NC Act)	Distribution / Habitat	Likelihood of Occurence
Manta alfredi Reef Manta Ray	EPBC: Migratory NCA: Not listed	This ray is often observed in coastal inshore locations around rocky and coral reefs (Marshall et al., 2009). Sighting records compiled by Armstrong et al., (2019) indicates small population in the Cape Flattery region.	Likely

Legislation: EPBC – (Environment Protection and Biodiversity Conservation Act 1999) NCA – (Nature Conservation Act 1992).

4. FIELD SURVEY RESULTS

4.1 WATER QUALITY

Water quality measurements were undertaken between sites within quick succession, due to this recordings were not susceptible to many influences (i.e. differences in time of day, weather conditions or shading). Measurements at each site were undertaken from the surface and then from every 1m of depth until reaching the seafloor. All recordings were generally consistent across depths and among sites.

Where applicable, water quality objectives (WQOs) were compared to moderately disturbed values for open coastal waters within the Jeannie River Basin. It is noted that the Study area and the sites are however, within close proximity to the lower estuary/enclosed coastal wars boundary of the area.

Recorded water temperatures were found to be consistent across all depths and sites ranging between 28.7 -28.9°C (Figure 4-1).

Electrical conductivity across the assessed sites were all uniform and considered to be marine ranging from 54280-54360 µS/cm (Figure 4-2).

Turbidity levels were generally low ranging between 0.7-2.4 NTU (Figure 4-3), values were highest in WQ4 and WQ5 as these sites were situated on top of the fringing reef. It was expected that areas within the bounds of the fringing reef to be higher with fringing reefs within the Great Barrier Reef region often maintaining very high natural levels of turbidity due to the suspension of coastal sediments by SE wind processes (Ayling et al., 1997).

Recorded pH levels were all below the defined WQO values for all sites (8.1-8.4). The recorded values were consistent between sites and all considered to be neutral with pH ranging slightly between 7.67-7.7 (Figure 4-4).

Dissolved oxygen levels were relatively uniform and remained within defined WQO ranges (95%-105%) for all sites with the exception of WQ4 and WQ5 which fell slightly below the defined ranges. Values for both DO (%sat) and DO (mg/L) were consistent across all sites ranging from 91%-100% and 5.6-6.3 mg/L (Figure 4-5 and Figure 4-6).

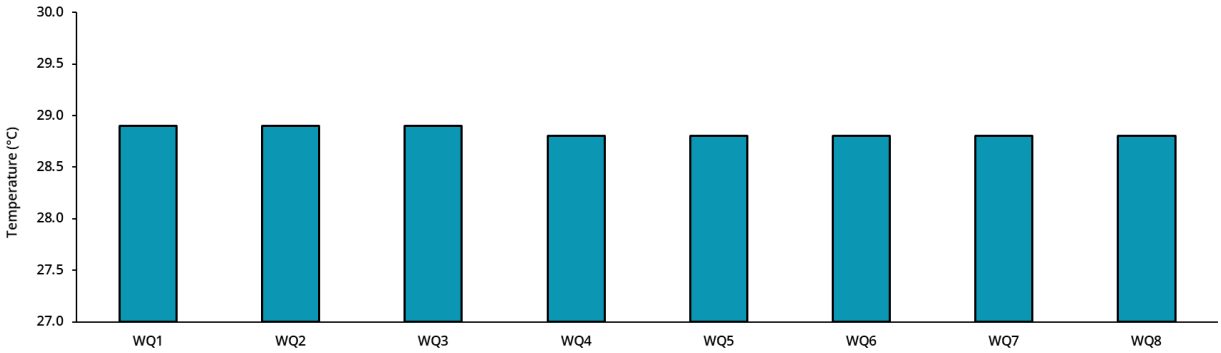

Figure 4-1 Temperature recorded at each site.

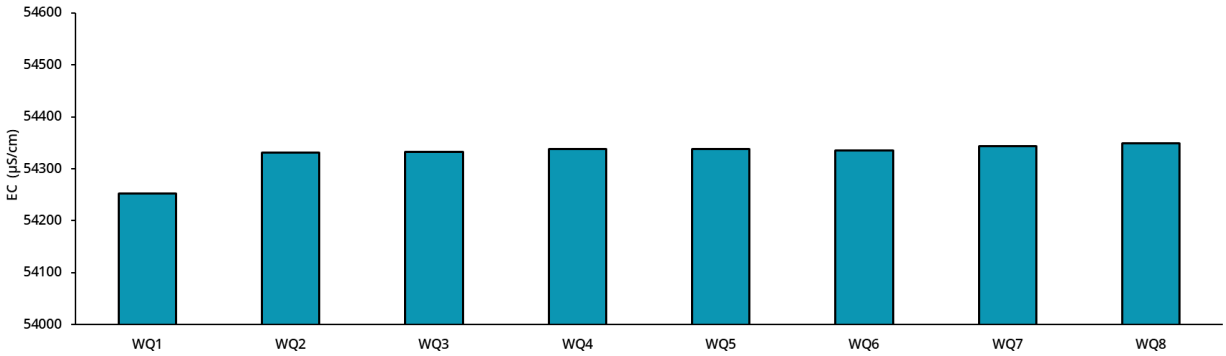

Figure 4-2 Electrical conductivity (EC) recorded at each site.

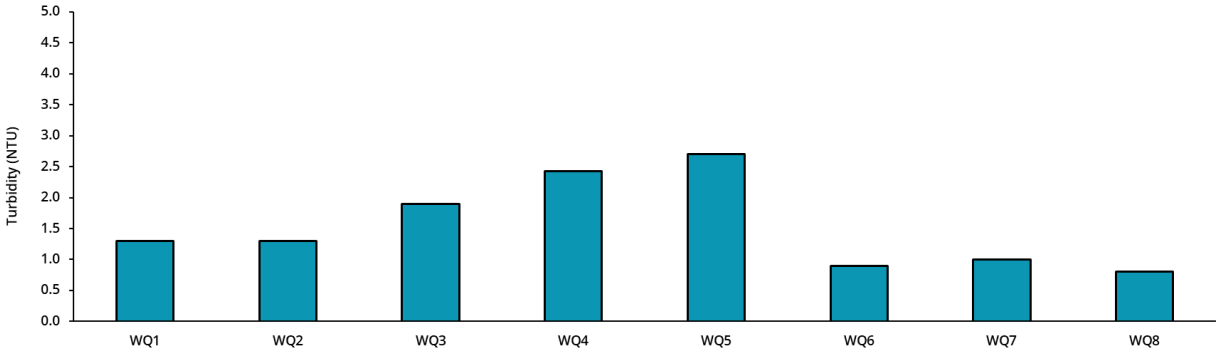

Figure 4-3 Turbidity recorded at each site.

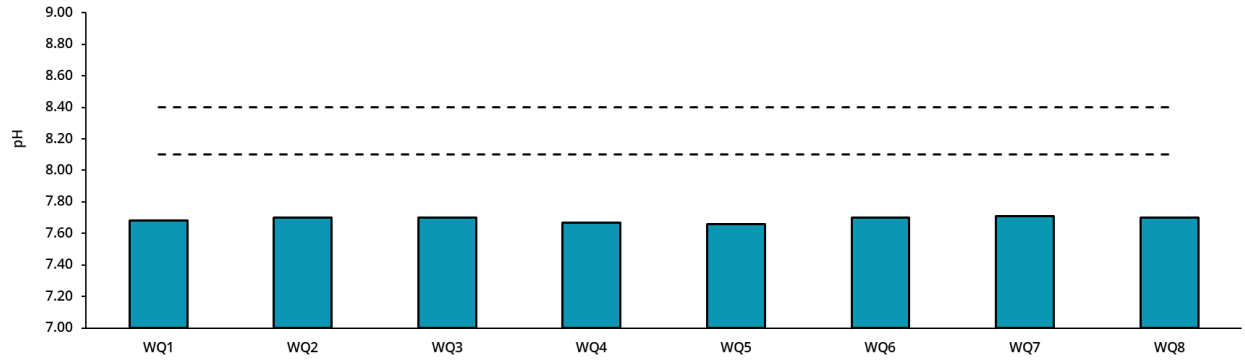

Figure 4-4 pH recorded at each site. Dotted lines indicate upper and lower WQO values (DES, 2010).

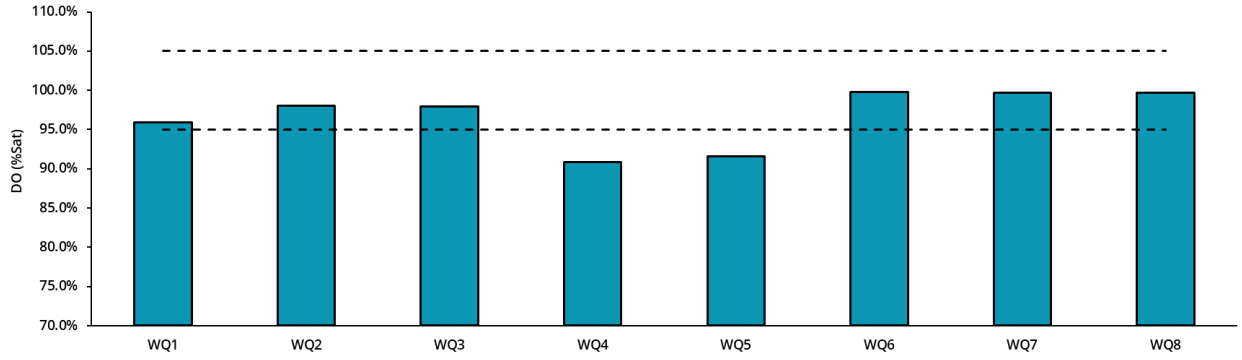

Figure 4-5 Dissolved oxygen (%Sat) (DO) recorded at each site. Dotted lines indicate WQO values (DES, 2010).

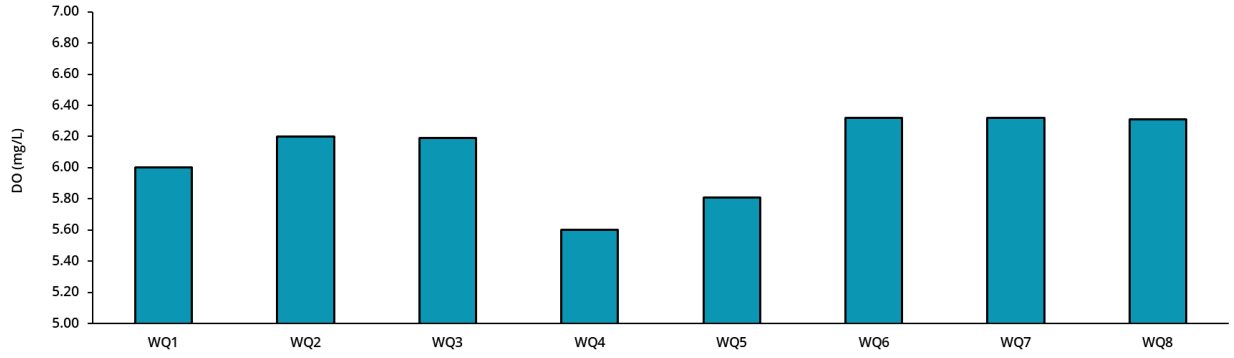

Figure 4-6 Dissolved oxygen (mg/L) (DO) recorded at each site.

4.2 MARINE MACROINVERTEBRATES

This section describes the results from the analysis of benthic grab samples taken

TAXONOMIC RICHNESS AND ABUNDANCE

Taxonomic richness and abundance of macroinvertebrates was generally higher within tidal samples compared to those taken offshore (Figure 4-7).

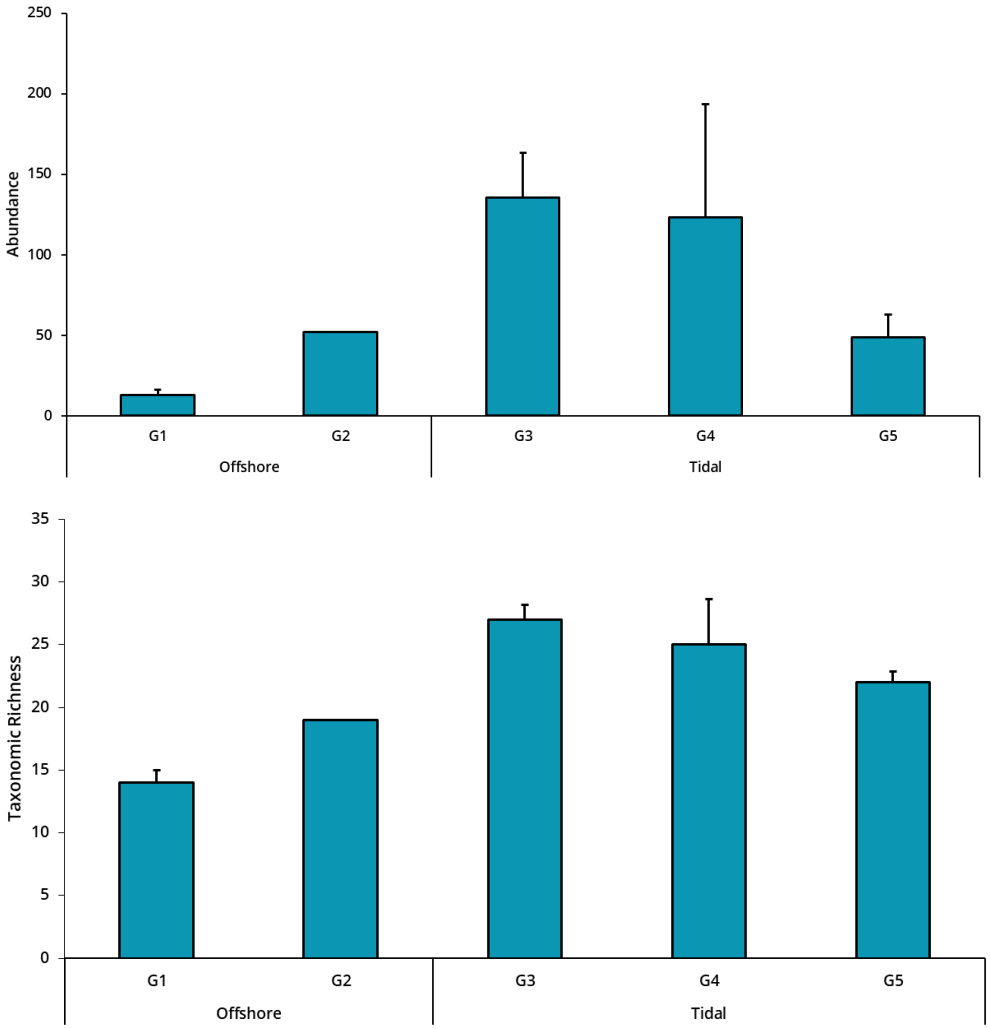

Figure 4-7 Macroinvertebrate mean (±standard error) of abundance (top) and taxonomic richness (bottom)

COMMUNITY ASSEMBLAGES

Macroinvertebrates of the study area were dominated by crustaceans (57%) followed by annelid worms (28%), with a minor component of miscellaneous taxa (11%), molluscs (3%) and echinoderms (1%).

The taxa recorded over the study area were generally all small-bodied and fast-reproducing that are tolerant of a wide range of conditions. The macroinvertebrate communities were highly variable between sites, however tidal sites tended to be dominated by the amphipod crustacean Kamakidae and crustaceans in the order Tanaidacea. Little is known about the ecology of Kamakid amphipods, but they are thought to be tube-building group that prefer fine silty sediments on tidal flats (Jung and Yoon, 2015). Kamakidae have also been recorded amongst mangrove roots on Lizard Island around 30km north-east of the study area (Myers, 2009). Offshore samples contained taxa that are generally associated with more mobile, sandy sediments such as the burrowing sea biscuit Clypeasteridae and the nut shells Nuculidae and Nuculanidae.

Notably, freshwater taxa were observed within tidal sites with Chironominae being present in all tidal sites and Caenidae in G4. These were likely washed down from the nearby creek in a flow event that occurred before sampling.

The macroinvertebrate communities of the study area are likely governed largely by local sediment composition, hydrodynamics and available habitat structure. The taxa present appear to be grouped by those associated with intertidal fine-sediment/mangrove habitat and those associated with subtidal mobile sands.

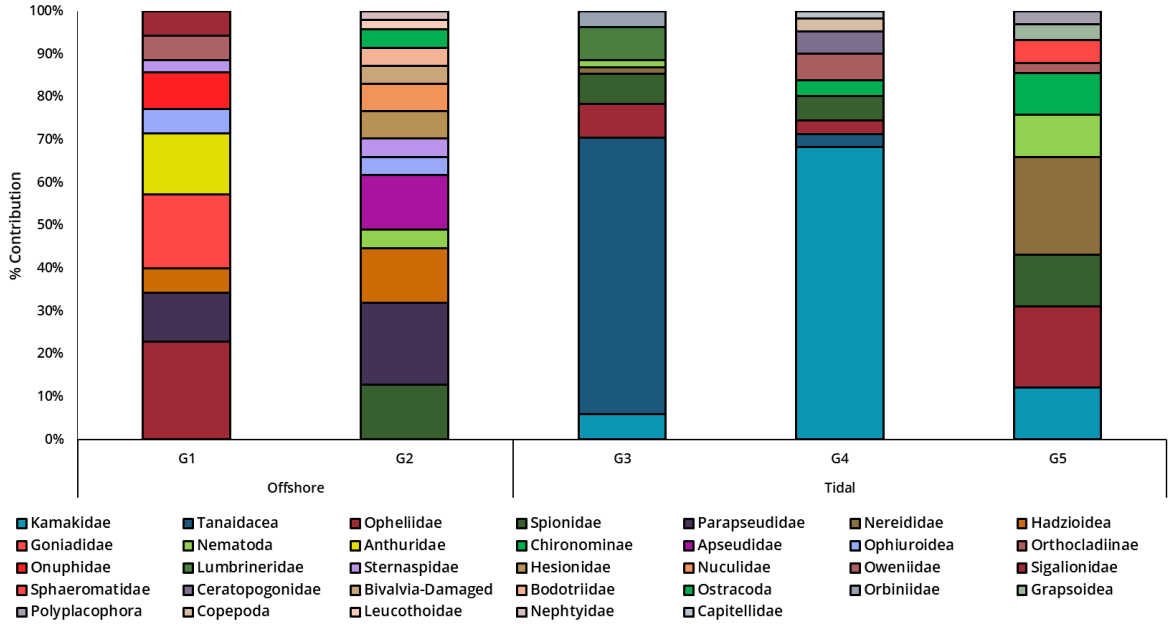

Figure 4-8 Macroinvertebrate community assemblage (90% contributing species)

4.3 REEFS

Literature and mapping sourced during the literature review initially revealed the presence of two distinct offshore reefs within the Study area (Section 3.6, Figure 3-2). With a particular reef, adjacent to the proposed loading facility, being described as comprised of microalgal mats, rock, coral, and sand.

Field surveys undertaken by Hydrobiology using ROV footage and sidescan sonar have since determined that the two offshore reefs are not present (Figure 4-9, Figure 4-10). The Study area contains a single continuous roughly 1.5km long fringing reef which ranges from approximately 10-80m off the shoreline. The reef begins approximately 400m south-west of the proposed loading facility, extending across the cape and ending approximately 900m north-east of the proposed loading facility at the upper end of the cape.

Field surveys of the fringing reef of the Study area involved 3 ROV transects over the reef which revealed a generally rocky reef dominated by microalgal mats and algal forests characterised by *Sargassum.* Coral point count analysis (CPCe) was used to provide estimates of coverage within the reef with macroalgae dominating the reef with 64.2% coverage while maintaining a cumulative 12.9% of hard coral coverage and 3% soft coral coverage. This hard coral community composition was dominated by branching Acroporid corals and to a lesser degree corymbose (4%) and foliose corals (2.3%). No solitary sponges were observed with the exception of symbiotic like macroalgae and sponge forms being observed (3.3%) bare seafloor within the reef constituted approximately 16.5% (Figure 4-12) (Figure 4-11). Example pictures of the reef communities are displayed in Figure 4-12.

Transects revealed what appears to be high composition variability across the extent of the reef with thinner sections of the reef appearing to have lower percentages of coral in contrast to the wider reef edge up to the shelf. Overall, the composition of the fringing reef is characteristic for rocky fringing reefs of the region as described by Ayling et al., (1997), furthermore this composition suggests that the reef described in the desktop study as being comprised of microalgal mats, rock, coral, and sand has been incorrectly mapped and may have instead been described separately from the fringing reef. To reiterate, field surveys revealed no signs of the two reefs identified in the GBRMP mapping.

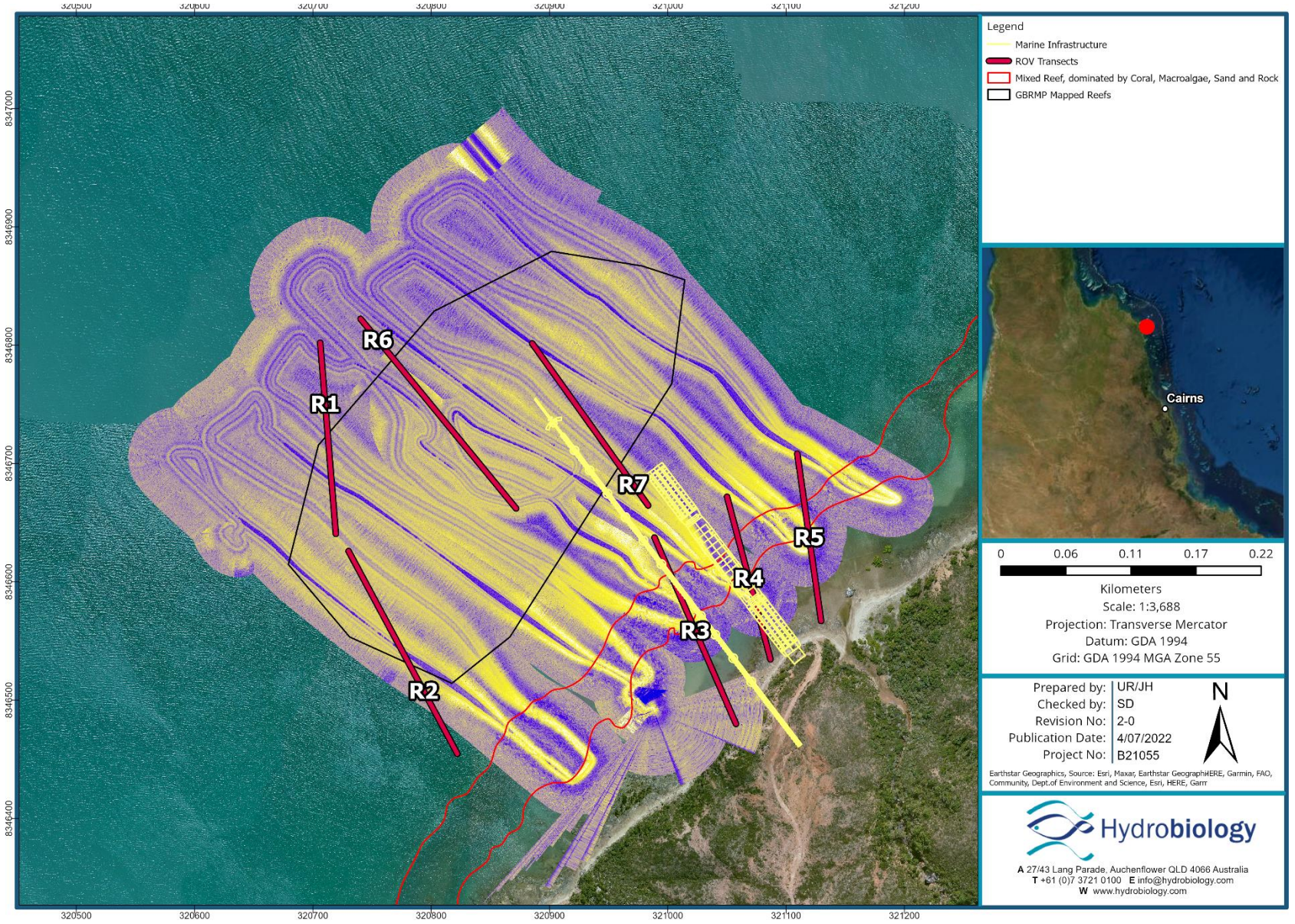

Figure 4-9 Sidescan sonar data for the adjacent GBRMP mapped reef.

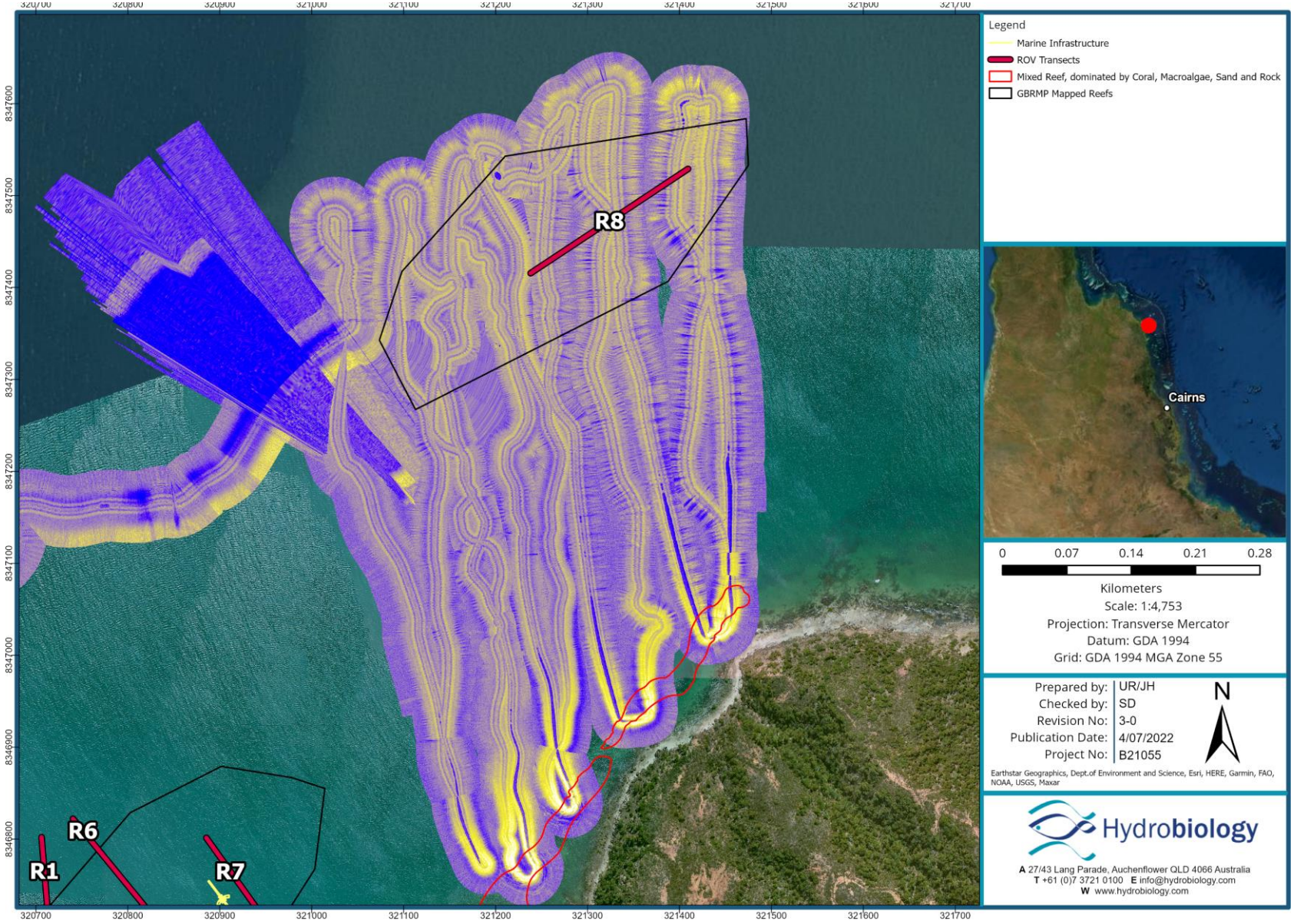

Figure 4-10 Sidescan sonar data for the north-eastern GBRMP mapped reef.

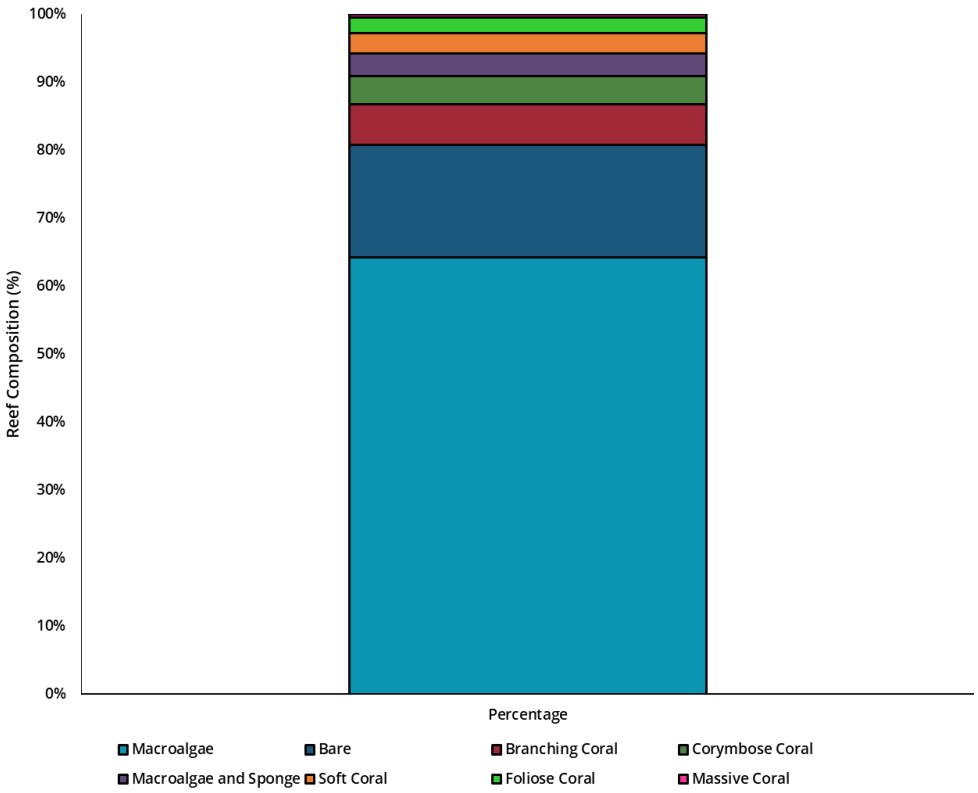

Figure 4-11 Approximate community compositions derived from CPCe analysis within the fringing rocky reef of the Study area.

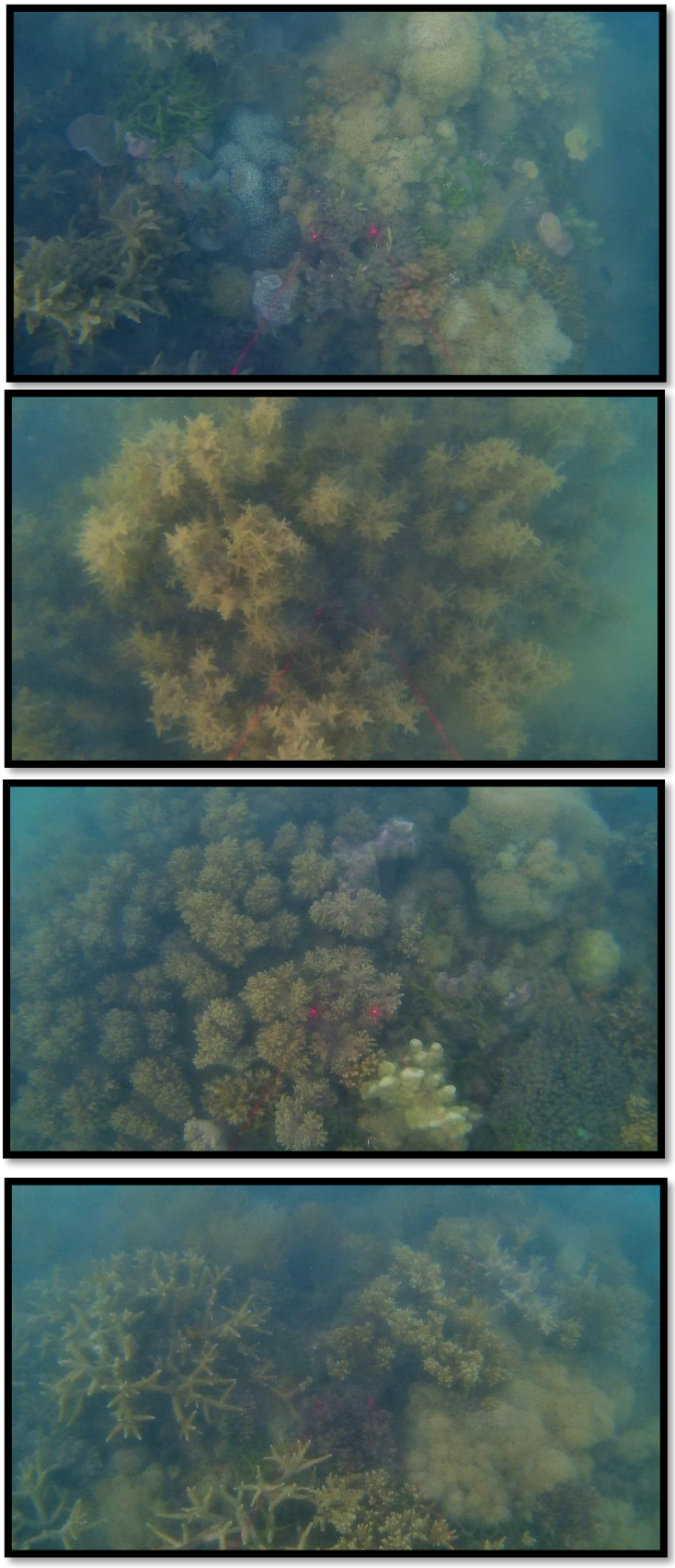

Figure 4-12 Images of the continuous fringing reef located within the Study area

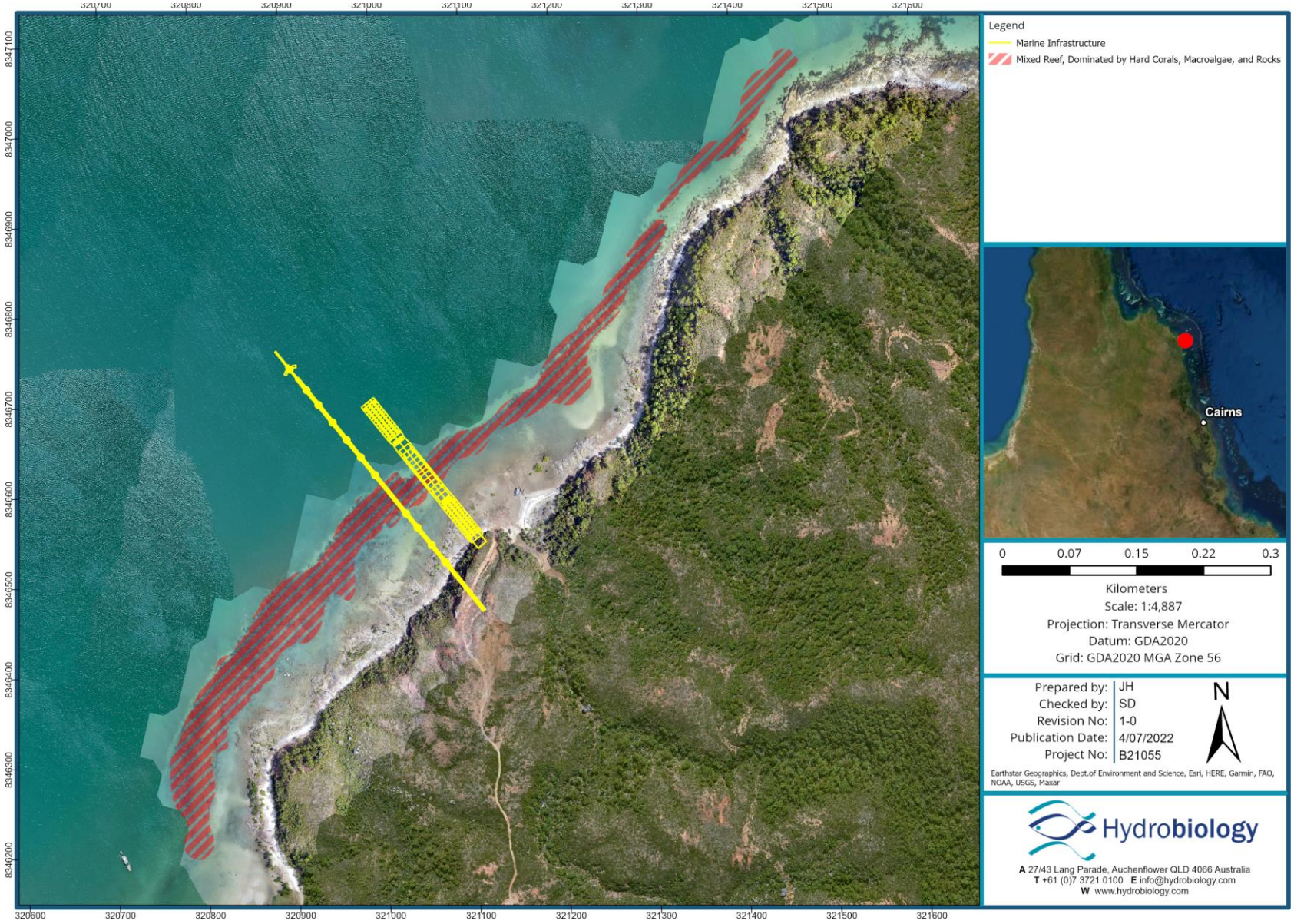

Figure 4-13 Reef systems present within the Study area

4.4 INTERTIDAL ROCKY SHORES

The intertidal shoreline of the Study area can be characterised as rocky substrate that runs parallel to the fringing reef (Figure 4-14). The rock extends continuously except for some sand coverage at the mouth of an unnamed creek to the immediate north-east of the loading facility.

The rocky shore habitat can be characterised as a high energy environment with substantial tidal and wind-driven wave action on unconsolidated substrate (pebbles, gravel, sand). The fauna of the exposed rocky surfaces was generally restricted to molluscs that can tolerate high energy wave action such as chitons, limpets and some snails, in addition to encrusting fauna such as barnacles and oysters. Within the interstices between rocks there was an abundant and diverse micro and macroinvertebrate fauna. These interstices often contained rockpools, providing refugia for a variety of fauna such as crabs, shrimp, fish, anemones and echinoderms such as brittlestars and sea cucumbers. Overall, the rocky shore communities recorded were similar to those described by Ayling et al., (1997). The fauna present on the sandy substrate of the creek mouth was relatively limited included snails and hermit crabs.

The upper littoral zone at the end of the area can be characterised as a bedrock shelf that extends up from base of a steep cliff wall, constituting the headland. These cliff walls vary from 2m to greater than 4m in parts and are only broken in areas where there are flowpaths down from headland and at the creek adjacent to the development site.

Figure 4-14 Images of the rocky intertidal habitat of the Study area.

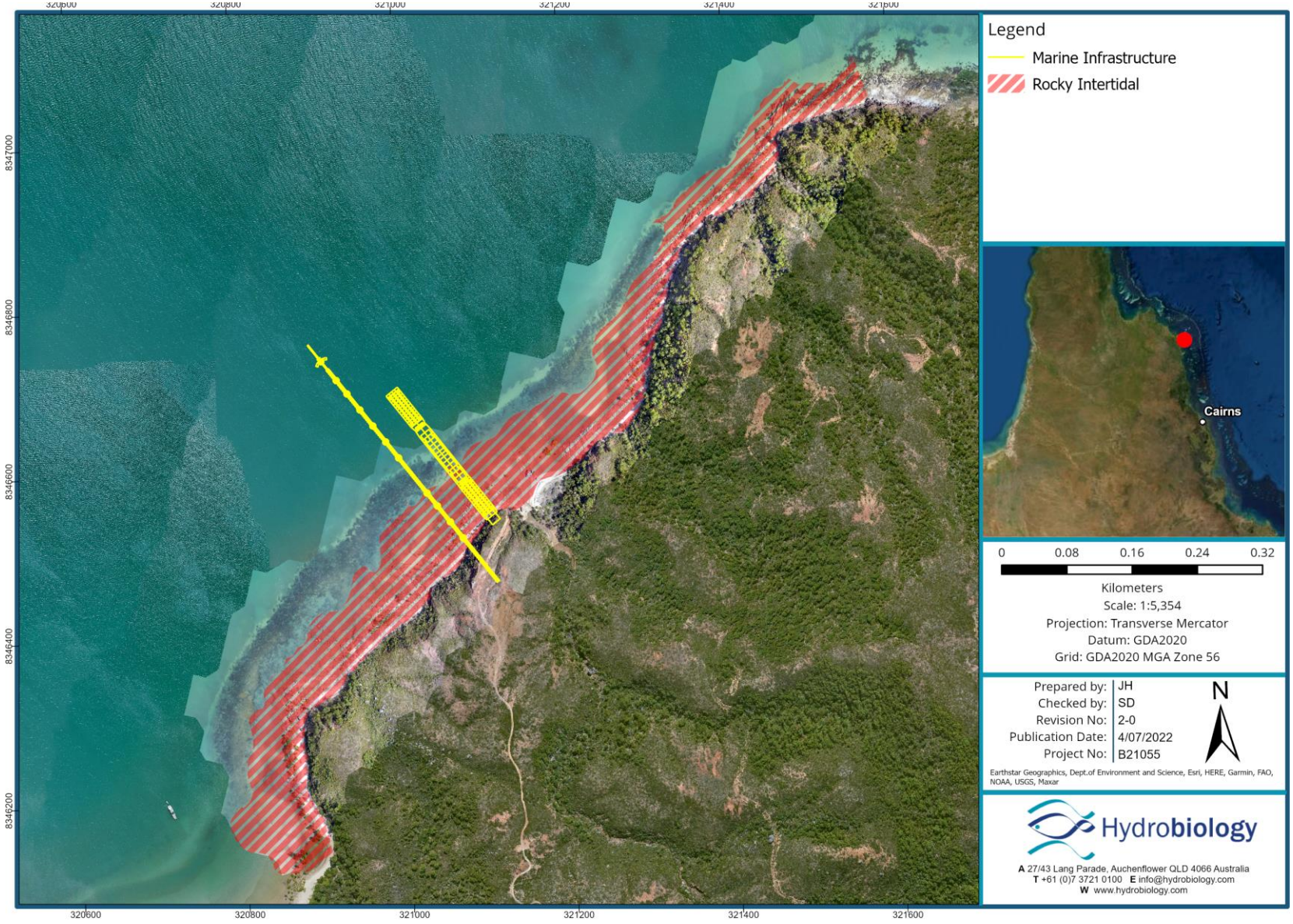

Figure 4-15 Rocky intertidal habitat present within the Study area

4.5 MANGROVES

A mixed community of intertidal mangroves were present along the rocky shores of the Study area. Community density was fairly low and is likely derived by the limited presence of muddy substrates for mangroves to colonise. The community was comprised of four species previously known to the area and was dominated by *Rhizophora stylosa* and to a lesser degree *Avicennia marina* alongside several individuals of *Aegialitis annulata* in addition to three individuals of *Sonneratia alba* also being recorded (Figure 4-16). All species are listed as protected under the Fisheries Act 1994 (Table 4-1).

In relevance to the Study area, mangroves were generally limited to rocky shore environments with the highest coverage being observed on the southernmost portion of the Study area surrounding the loading facility with coverage gradually decreasing towards the end of the cape where the width of the intertidal rock shelf narrows, and the headland cliff heights increase (Figure 4-17).

Table 4-1 Mangrove species recorded within the Study area.

Species	Common Name	Conservation Status
Acanthaceae		
Avicennia marina	Grey Mangrove	Protected – (Fisheries Act 1994)
Lythraceae		
Sonneratia alba	Apple mangrove	Protected – (Fisheries Act 1994)
Plumbaginaceae		
Aegialitis annulata	Club mangrove	Protected – (Fisheries Act 1994)
Rhizophoraceae		
Rhizophora stylosa	Spotted mangrove	Protected – (Fisheries Act 1994)

Figure 4-16 Images of mangroves within the Study area

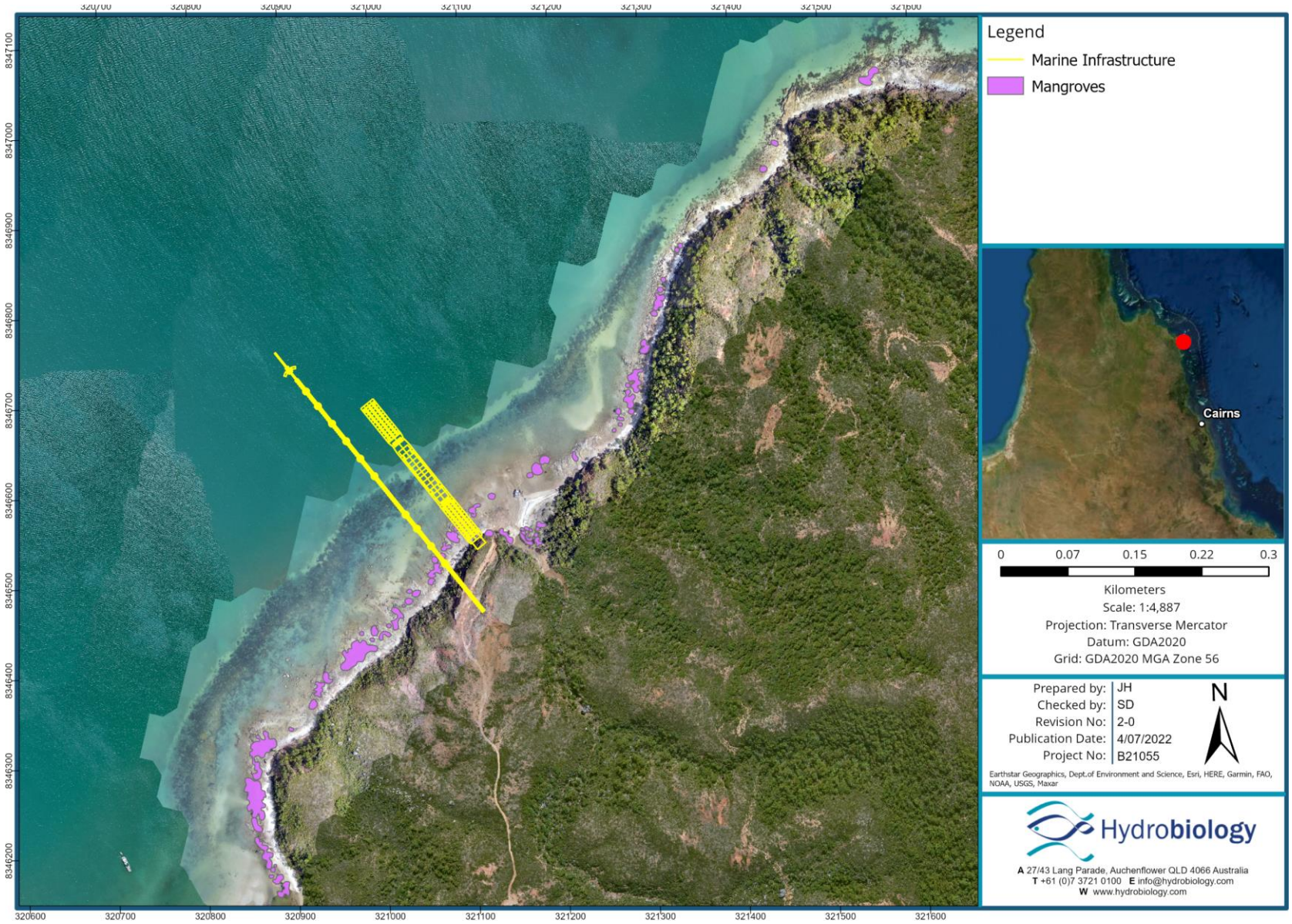

Figure 4-17 Mangroves present within the Study area

4.6 SEAGRASS

Seagrass meadows were generally restricted to the lower intertidal to subtidal zones of the Study area with the largest meadows with respect to area coverage being observed approximately 3–10 m behind the fringing reef, separated by bare sandy substrate (Figure 4-18). Aerial imagery and ROV footage appear to show the meadow stretching continuously down the Cape alongside the full extent of the reef with the remaining seagrass sighted within the Study area being comprised of small indiscriminate patches further off the coast. ROV transects revealed 3 known species present within the Study area, *Halodule uninervis*, *Halophila spinulosa*, and *Halophila ovalis* (Table 4-2).

The seagrass composition and distribution appear to be similar to that described by Ayling et al., (1997) which captured a mix of intertidal and subtidal seagrass beds extending along fringing reefs between Lookout Point and Cape Flattery. However within the Study area, the seagrass meadows and patches were comprised of mixed meadows of *Halophila* and *Halodule* species upon sandy substrates. These were largely dominated by *Halodule uninervis* which is known to be a niche specialist, alongside *Halophila spinulosa* and *Halophila ovalis* both of which are well-recognized generalist niche exploiting species (Campbell, 2018). Seagrass cover fluctuated heavily throughout the meadows with several sparse to thick seagrass areas. Coverage generally ranged between approximately 10-30% seagrass coverage within meadows (Figure 4-19).

The Study area generally maintained low species diversity and coverage due to seagrass being present within deeper waters with the previously discussed *Halophila* and *Halodule* species being found to dominate the seagrass meadows offshore of the reef. *Halophila* species are generally hardier and have the capacity to tolerate the low light penetration of the turbid and deeper waters past the fringing reef, this has likely led to the species outcompeting and displacing the numerous other species of the wider Cape Flattery area (Young and Kirkman 1975; Josselyn et al., 1986). Similar to *Halophila*, *Halodule* species are generally restricted to deeper waters of the lower intertidal to subtidal zones as they are sensitive to exposure during low tides, this is due to susceptibility to air and ultraviolet radiation in contrast to the upper intertidal species known to the wider Cape Flattery area, for instance *Thalassia hemprichii,* which was not observed within the Study area (Lan et al., 2005).

Table 4-2 Seagrass species observed within the Study area.

Species	Common name	Conservation Status
Cymodoceaceae		
Halodule uninervis	Narrowleaf seagrass	Protected – (Fisheries Act 1994)
Hydrocharitaceae		
Halophila ovalis	Dugong grass	Protected – (Fisheries Act 1994)
Halophila spinulosa	Fern seagrass	Protected – (Fisheries Act 1994)

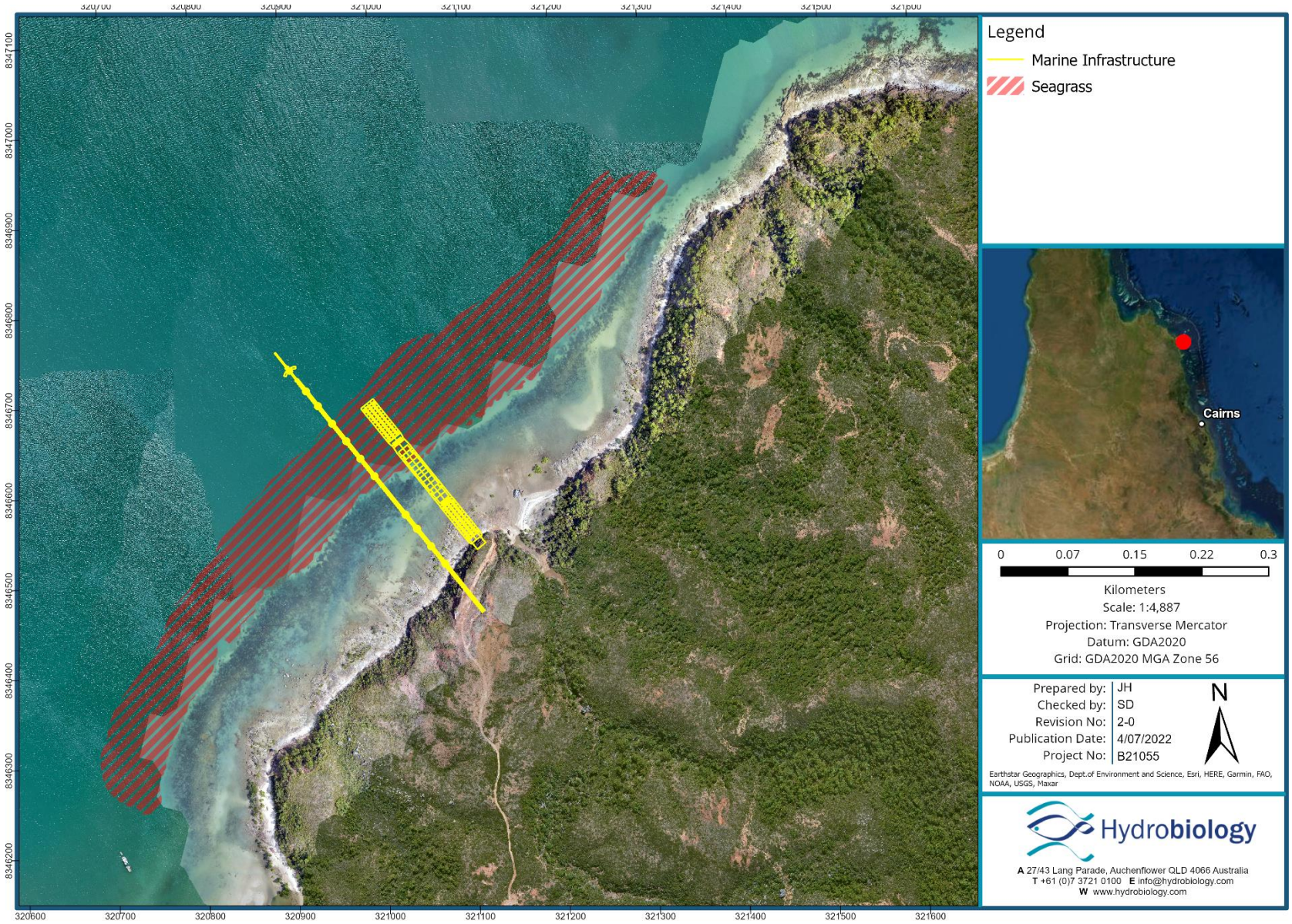

Figure 4-18 Known extent of Seagrass meadows of the Study area as determined during field surveys

Figure 4-19 Seagrass species observed within the Study area, *H. spinulosa* (top) *H. ovalis* (middle), *H. uninervis* (bottom).

4.7 MARINE FAUNA

4.7.1 MARINE REPTILES

COMPOSITION

A single species of marine turtle was detected, the Green sea turtle (*Chelonia mydas*) (Table 4-3). A single adult individual of *Chelonia mydas* was observed through the use of BRUVS (Figure 4-20). No incidental sightings or tracks were noted.

Table 4-3 Marine reptiles detected across each method

Species name	Common name	BRUVS
Cheloniidae		
Chelonia mydas	Green sea turtle	X

X = indicates species detection via the respective method

Figure 4-20 A Green sea turtle (*Chelonia mydas*) detected through the use of a BRUV.

HABITAT AND DIET

The Green Sea turtle (*Chelonia mydas*) has a diet comprised of mainly algae and seagrass, although they will occasionally eat other food sources such as mangroves, fish eggs, jellyfish and sponges. It is estimated that the majority of green sea turtles nest in the north east of Arnhem Land and then remain in the Gulf of Carpentaria to feed (Cogger 2000, Kennett et al. 1998, Limpus & Limpus 2000).

Green sea turtles are often found in shallow benthic foraging habitats such as sub-tidal and tropical tidal coral and rocky reef habitats or inshore seagrass beds. The foraging habitat of adults is generally comprised of algae mats and seagrass beds (Musick & Limpus 1997, Whiting 2000).

NESTING HABITAT

A combination of both unmanned aerial vehicles (UAV) and on foot surveys across approximately 1.5 km's was undertaken along the shoreline of the Study area (Figure 4-22). No signs of marine turtle nesting or shoreline presence were observed in Study area. This is likely due to a lack of habitat and the natural barriers of the Study area which was largely comprised of fringing rocky reefs and rocky shorelines (Figure 4-21).

Figure 4-21 Rocky shorelines of the Study area.

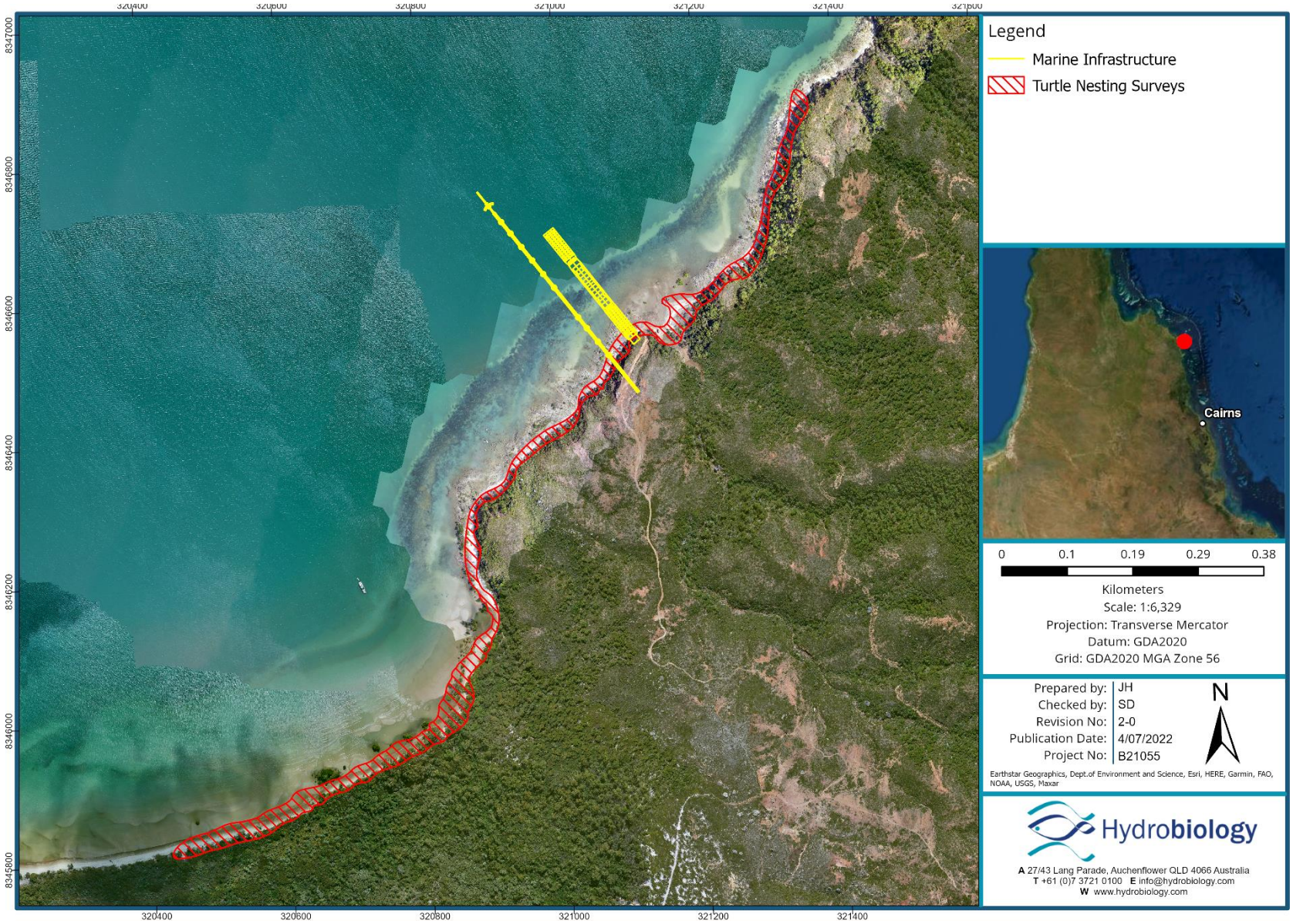

Figure 4-22 Turtle survey extent.

4.7.2 MARINE MAMMALS

No marine mammals were detected during surveys with the exception of incidental detections of Dugongs on the southern region of the cape, approximately 5 km south of the MOF, alongside an unnamed beach adjacent to the Ports North Wharf outside of the Study area. The associated literature review also confirmed Dugongs to be present within the Cape Flattery area (Table 3-6). Past Dugong activity and sightings based off the literature includes recordings by Ports North, (2014) of sightings offshore within the Cape Flattery area and evidence of Dugong feeding trails on seagrass within Cape Flattery noted in surveys by Ayling et al., (1997). Given the past and present recordings of Dugong activity and sightings within the Cape Flattery area, it is highly likely that Dugong populations are also active within seagrass meadows present within the Study area.

4.7.3 FISH

10 species of fish were detected within the marine environment, the majority through the use of BRUVs (n=9), eDNA sampling only detected a single species of fish *Chanos chanos.* Both methods did not detect the presence of any additional conservation significant species (Table 4-4). Six fish families were recorded via the ROV footage (Table 4-5).

Low eDNA fish presence is likely due to viability concerns of samples due to the samples arriving to the laboratory warm on the account of shipping delays. Thus, low DNA concentrations were detected of which the source could not be identified (fish, bacterial, etc) this indicated DNA degradation and as such, the eDNA results do not reflect actual species composition of the area.

Similar issues were present with BRUV footage with low visibility from turbid conditions hampering fish identification. Fish presence was fairly low with close to 80% of total recording times across all BRUV deployments being absent of visible fish (Figure 4-23). The majority of clear sightings were under 2 seconds with Flagtail blanquillo and Glassfish, alongside an individual Green sea turtle maintained the highest mean time visibilities of over 350 seconds.

The six fish families recorded by the ROV are typical reef inhabitants that are well represented in the wider GBR and specifically within the nearby Lizard Island Marine Park, with each family contributing a large number of species to coral reef systems (Steinke et al., 2017) (Table 4-5). The families represent a wide-range of trophic groups including largely planktivorous/grazing species such (damselfish), omnivorous grazers (angelfish and wrasses), specialist herbivorous/coral grazers (parrotfish) and predators (snappers and cods/groupers). It should be noted that the fish recorded by the ROV likely represents a small fraction of the fish present within the study area and that fish identification using ROV imagery is limited by the level of visibility (e.g., turbidity) at the time of sampling.

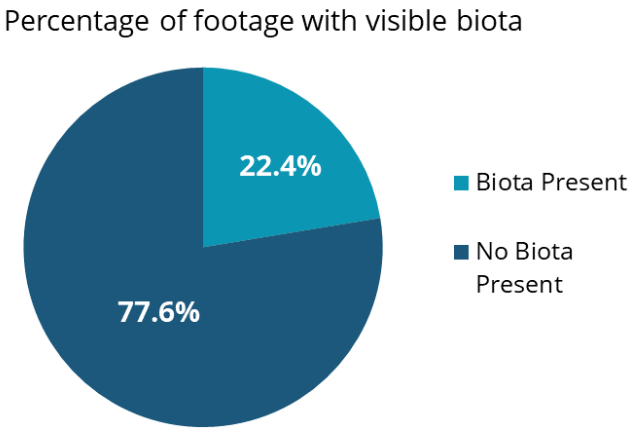

Figure 4-23 Percentage of visible biota within BRUV recordings

Table 4-4 Fish detected in eDNA and BRUVs survey.

Species name	Common name	BRUVS	eDNA
Ambassis			
***Ambassis* sp.**	Glassfish	X	
Carangidae			
Caranx sexfasciatus	Bigeye trevally	X	
Scomberoides commersonnianus	Giant queenfish	X	
Carcharhinidae			
Carcharhinus amblyrhynchos	Grey reef shark	X	
Chanidae			
Chanos chanos	Milkfish		X
Malacanthidae			
Malacanthus brevirostris	Flagtail blanquillo	X	
Mugilidae			
Mugil cephalus	Sea mullet	X	
Scombridae			

Species name	Common name	BRUVS	eDNA
***Scomberomorini* sp.**	Spanish mackerel	X	
Sparidae			
Acanthopagrus australis	yellowfin bream	X	
Tetraodontidae			
Tetractenos hamiltoni	Common toadfish	X	

X = indicates species detection via the respective method

Table 4-5 Fish families recorded from ROV footage.

Family	Common Name
Labridae	Wrasses
Lutjanidae	Snappers
Pomacanthidae	Angelfish
Pomacentridae	Damselfish
Scaridae	Parrot fish
Serranidae	Cods/groupers

5. POTENTIAL IMPACTS

5.1 CONTEXT

Impacts of sand mining on aquatic ecosystems may be direct or indirect. Direct impacts are those in which the construction of marine infrastructure is directly responsible for the ecosystem impact, such as the removal of habitat. Indirect impacts are related to ecosystem changes that are propagated through the system due to physical changes resulting from infrastructure construction. For example, the removal of seagrass may result in increased re-suspension of sediments which can decrease light penetration, further inhibiting seagrass growth.

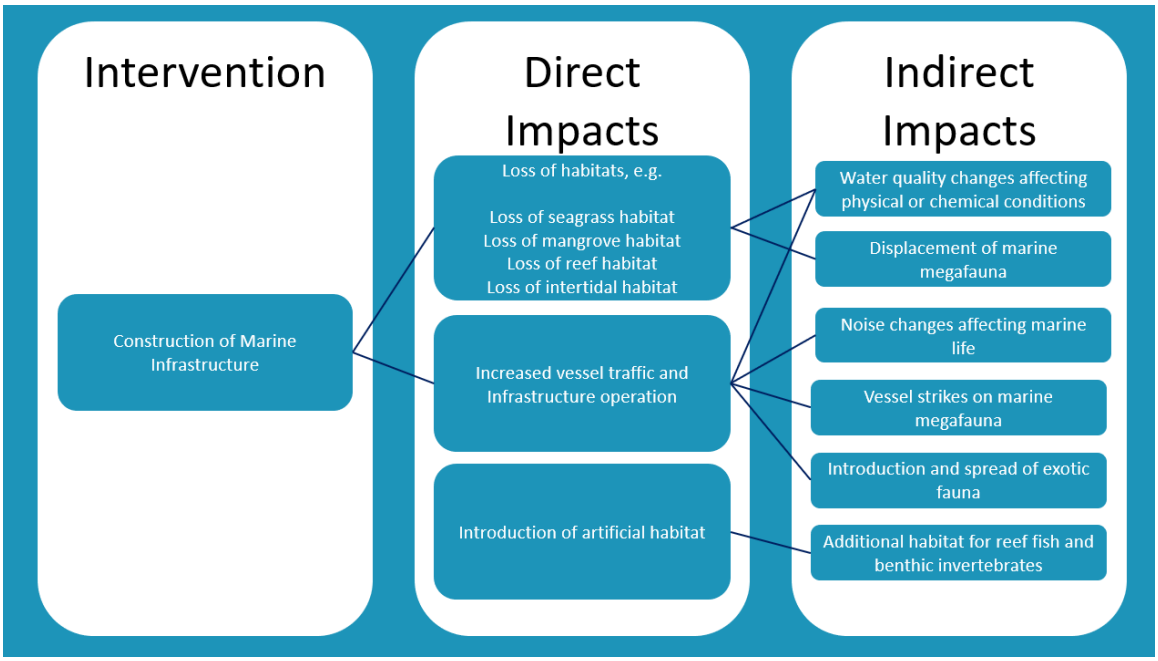

Figure 5-1 Schematic of the impact assessment approach.

5.2 LIMITATIONS

The aquatic impact assessment contains the following limitations:

- Presented impacts are based on data collection from a single seasonal survey in the Study area. Further survey effort may identify additional species that may differ in their habitat and water quality requirements than those identified.
- The presented information is for marine work only and does not consider any on-land components within the ML which are dealt with separately.
- No assessment of coastal morphodynamics or processes was undertaken. The marine infrastructure may impact these processes within the area.
- No assessment of sediment transport or plumes due to construction, vessel traffic and movements has been undertaken to enable a determination of whether these exceed literature trigger values/events for sensitive taxa and habitats.
- This impact assessment is based on the provided concept design (Section 1.2);
- The exact full extent of the seagrass meadows of the study area are unknown, these have been extrapolated based upon data collected and may be in fact be over or under estimated;
- Many threatened or rare marine species known to the region are cryptic and/or migratory, their lack of detection during field surveys cannot prove their absence without further significant field effort over time;
- The baseline survey was implemented based on initial infrastructure plans provided, the marine infrastructure has since been moved. However, these changes are minor.

5.3 CONSTRUCTION PHASE

Construction phase impacts on marine ecological values of the project relate mainly to the physical disturbance to the benthic habitat, particularly the removal and modification of marine habitat. These impacts are primarily associated with the construction of pilings for the jetty and MOF, in addition to a steel ramp leading to the barges. The construction footprints are displayed in Figure 5-2 and the

approximate areas of each habitat impacted are summarised in Table 5-1 with values being represented by both construction pilings for the jetty and MOF and the steel ramp leading to the barges. The impact areas are displayed as a percentage of the total habitat of each type within the study area (as surveyed in the current report) in addition to the total recorded in the wider region as mapped by Ayling et al. (1997).

Table 5-1 Impacted area of each habitat including the percentage of the total area of each habitat within the study area and wider region. The wider region represents values provided by Ayling et al., (1997).

Habitat	Total area of wider region (m²)	Total area within Study Area (m²)	Impacted area (m²)	% of Study Area	% of wider region
Mangrove	900,000	6,415	0	0	0
Seagrass	11,110,000	76,922	400	0.5	0.004
Rocky intertidal*	160,000	77,494	497	0.6	0.3
Reef**	3,250,000	39,445	0	0	0

*Wider region represents combined rocky reefs and intertidal rock from Ayling et al., (1997)

**Wider region represents combined fringing coral reefs and inshore coral reefs from Ayling et al., (1997)

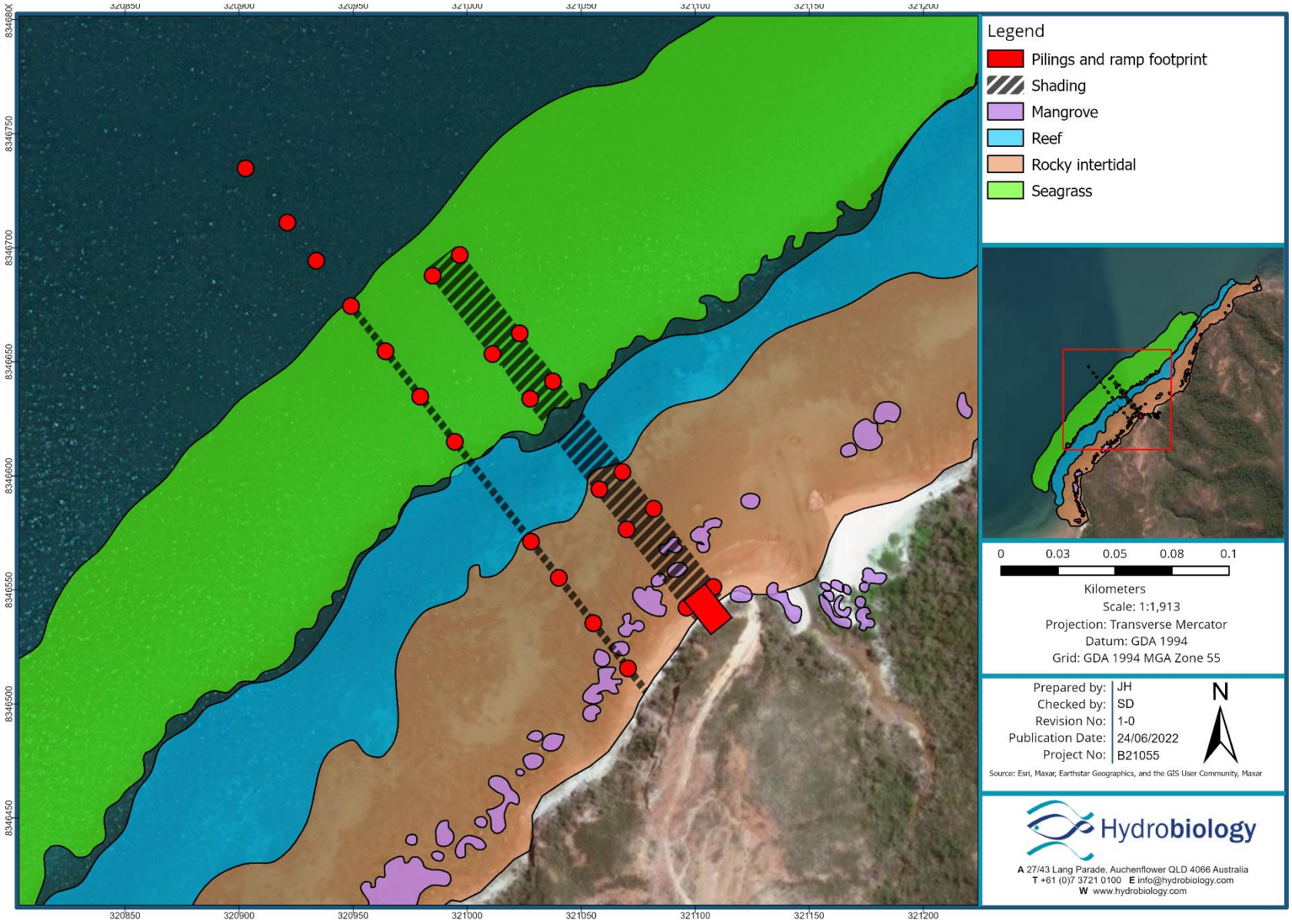

Figure 5-2 Approximate areas of impact from the proposed infrastructure on each habitat.

5.3.1 IMPACTS ON MANGROVE HABITAT

Mangroves provide many ecologically and economically significant services, including erosion protection, nutrient re-cycling and filtration, provision of nursery and breeding grounds for fish including many commercially important species. All mangrove species are listed as protected under the Fisheries Act 1994.

A mixed community of intertidal mangroves were present along the rocky shore within the proposed impact zone. The community was dominated by *Rhizophora stylosa* and to a lesser degree *Avicennia marina* alongside several individuals of *Aegialitis annulata* in addition to very sporadic *Sonneratia alba*.

The marine infrastructure design has been through multiple revisions to reduce the impacts on mangroves, with the latest being the re-positioning of the MOF ramp and pilings. There will be no direct impacts to mangroves from the construction as there are no mangroves present within the jetty and pilings footprint.

Impacts to mangroves can be characterised by the following:

- Impact category: Minor / Short term / Possible = Insignificant
- Sensitivity = Moderate
- Significance = Minor

5.3.2 LOSS OF SEAGRASS HABITAT

Seagrass meadows are important ecosystem engineers that provide a multitude of different ecological benefits such as sediment stabilisation, nutrient cycling, provision of nursery and refuge areas and an important food source for protected species including turtles and dugongs. All seagrass species are listed as protected under the Fisheries Act 1994.

The results from the seagrass survey showed that seagrass was generally restricted to the lower intertidal to subtidal zones of the impact zone, with the largest meadows being observed approximately 3–10 m behind the fringing reef. The seagrass community was largely dominated by *Halodule uninervis,* interspersed with *Halophila spinulosa,* and *Halophila ovalis*.

Direct impact posed by the construction footprint of the jetty and boat ramp will involve the removal of seagrass within the footprints of the jetty and MOF jack-up pilings. Both the jetty and MOF will also result in ongoing shading, albeit localised (approximately 1059m2). Light is an essential element to seagrass resilience and growth, with decreases in light levels increasing seagrass vulnerability to the effects of turbidity (Ralph et al., 2007). The majority of seagrass species are able to respond to reductions in light levels by altering their leaf morphology. A study by Yaakub et al., (2014) determined that when seagrass meadows were subjected to varying degrees of shading stresses, populations either perished or significantly altered their morphologies with decreased leaf lengths, widths, and surface areas this indicates a long-term response by seagrass populations to light deprivation. An additional study by Kirkman et al., (2012) determined that seagrass shoot density was reduced by 84% after 134 days of shading.

It is expected that shading from the jetty and MOF will result in changes within the seagrass meadows affected, ranging from decreases in coverage to undesirably altered morphologies. This would be particularly exacerbated in deeper areas where light penetration is already limited.

It is estimated that construction will require the maximum removal of approximately 400m^2 of seagrass, representing 0.5% of the total known seagrass meadows within the Study area and a further 0.004% of seagrass in the wider region. This impact can be characterised by the following:

- Impact category: Minor / Permanent / Almost certain = Medium
- Sensitivity = Moderate

- Significance = Moderate

The directly impacted area is, in regional context, very small. However, the intact nature of the habitats is the key driver for the significance rating.

5.3.3 LOSS OF ROCKY INTERTIDAL HABITAT

The impact zone contains rocky reef, and bedrock substrates alongside areas of mixed sediment (mud, sands and gravels) that provide habitat for a variety of infaunal (e.g., worms, amphipods and tanaids) and epifaunal macroinvertebrates (gastropods, chitons and crabs), as well as potential foraging areas for fish and birds.

It is estimated that based off the wider infrastructure footprint the construction will require the maximum removal of approximately 497m^2 of the rocky intertidal zone, representing approximately 0.6% of the Study area and 0.3% of the rocky intertidal habitat of the wider region. This impact can be characterised by the following:

- Impact category: Minor / Permanent / Almost certain = Medium
- Sensitivity = Moderate
- Significance = Moderate

The directly impacted area is, in regional context, very small. However, the intact nature of the habitats is the key driver for the significance rating.

5.3.4 IMPACTS ON REEF HABITAT

The marine infrastructure design has been through multiple revisions to reduce direct impacts on reef habitat. The current design includes an extended span between jetty pilings and an extended bridging barge on the NOF structure, removing the need for pilings directly into the reef. There will be no direct impacts to reef habitat as removal will be avoided during construction.

Both the jetty and MOF will result in ongoing shading, albeit localised (approximately 516m2). Shading in a study by Rogers, (1979) studied the effects on coral reefs from shading for 5 weeks, the study found that community functions and composition were impacted by decreases in productivity and respiration which resulted in the death and bleaching of several hard coral species. Ten months after shading had ceased the community had been largely recolonised by algae with no new coral colonisation (Rogers, 1979). It is important to note that recent studies have determined that shading may substantially reduce the degree of bleaching in corals by limiting thermal stressors (Coelho et al., 2017).

It is expected that a continuous reduction in light attenuation would result in alterations to community composition and function within the coral reef populations subjected to shading. This would be particularly exacerbated in deeper areas where light penetration is already limited. Coral bleaching may however be mitigated within shaded areas due to reductions in thermal stressors.

The impacts to reef habitat can be characterised by the following:

- Impact category: Minor / Permanent / Likely = Medium
- Sensitivity = High
- Significance = Moderate

The impacted area is, in regional context, very small. However, the intact nature of the habitats is the key driver for the significance rating.

The pilings of the jetty will provide, over time, an anthropogenic substrate for reef building and thus have some positive impact. The MOF pilings as described will move and will not provide a similar benefit.

5.3.5 CONNECTIVITY

The construction of the jetty and MOF may introduce temporary connectivity issues between fringing reef and intertidal habitats within the Study area. This is primarily due to construction equipment and vehicle traffic, silt curtains and other measures designed to mitigate impacts to adjacent habitats. This impact can be characterised by the following:

- Impact category: Minor / Short term / Likely= Low
- Sensitivity = Moderate
- Significance = Minor

5.3.6 WATER QUALITY

Potential indirect impacts to the marine water of the Study area and the wider receiving environment during construction may occur during construction of the marine infrastructure. These activities may lead to increased degradation of habitat values through sedimentation and decreased soil stability. Other construction impacts to water quality include:

- Erosion and sedimentation
- Litter
- Stockpiles of soil during construction may cause a direct influx of sediment in the surface water runoff from the work sites, particularly from areas of cleared vegetation
- Increased nutrient input which may have flow on effects to vegetation and algal growth
- Contamination of hydrocarbons and other chemicals due to spills
- Sediment and suspended solids as run-off from access roads
- Potential exposure to acid sulfate soils
- Changes to soil chemistry due to:
- Importation of foreign soils
- Exposure of subsoils

EFFECTS FROM PILING

Pile driving during the construction of the proposed Jetty will likely generate minor localised turbidity due to sediment disturbance. These activities will occur within the Jetty Footprint and suspended sediment concentrations are generally below what is associated with dredging.

EFFECTS FROM VESSEL PROP WASH

Numerous studies have investigated sediment resuspension from vessel prop wash which is known to resuspend sediment during movement in coastal areas. Increases in turbidity through suspended sediment is expected during construction from vessels operating within the area. The extent of sediment suspension is unknown; however, studies have determined that vessel traffic have the potential to contribute to a similar amount of sediment resuspension to that of dredging (Hayes et al., 2006). The under keel clearance discussed in Thompson Clarke Shipping (2022) refers to 0.2m for a laden barge or vessel, indicating that prop wash disturbing sandy seabeds is feasible. In the vicinity of the Jetty transhipment facility, there is limited sensitive habitat; potentially sparse seagrass at times. The MOF is substantially closer to more sensitive habitat including seagrass meadows and reef slope, though vessel traffic to the MOF is expected to be substantially less than the Jetty.

EFFECTS FROM LAND RUNOFF

Sediment runoff from land during construction and introduce harmful contaminants and suspended sediments into the marine environment of the study area which can cause adverse effects to the

habitats and biota of the area. Sediment inputs will largely be mitigated via appropriate erosion and sediment control measures which will be defined in the Stormwater Management Plan (SWMP).

This impact can be characterised by the following:

- Impact category: Minor / Short Term / Almost certain = Low
- Sensitivity = Moderate
- Significance = Minor

5.3.7 NOISE

The construction of the jetty will require pile driving which can potentially disturb marine animals, particularly marine mammals (whales and dolphins) and turtles. Underwater noise generated by pile driving can have behavioural impacts such as changes in breathing patterns, changes in vocalisation and avoidance, as well as physiological impacts such as temporary or permanent hearing loss (DPTI, 2012).

This impact can be characterised by the following:

- Impact category: Major / Short Term / Possible = Medium
- Sensitivity = High
- Significance = Moderate

5.3.8 LIGHT POLLUTION

Light pollution can affect the behaviour of some wildlife and may disturb the activities of those active during the night. Artificial light is known to alter the trajectory of newly hatched marine turtles, resulting in increased mortality (Thums *et al.*, 2016). The *National Light Pollution Guidelines for Wildlife* (Commonwealth of Australia, 2020) dictate that light pollution impacts should be considered where there is important habitat for a listed species known to be affected by artificial light within 20 km of a project. This 20 km threshold is based upon a precautionary limit observed for marine turtle hatchlings which can respond to light sources 15-18 km away.

It is noted that within the immediate Study area, no turtle nesting sites were observed due to inappropriate rocky coastline habitat. While turtle nesting is possible on the sandy beach in the local region, it is not considered an essential nesting area by any records, database or publications. However, a nesting record exists from 1996 of the conservation significant Leatherback turtle (*Dermochelys coriacea*) within 4kms of the Study area on the opposite side of the headland past the Port of Flattery (DES, 2022). As the 20 km threshold provides a nominal distance at which artificial light impacts should be considered, not necessarily the distance at which mitigation will be required, it is likely that the mountain between the light source and known turtle nesting will be blocked.

It should be noted that the jetty (at Ports North) associated with the existing silica mine is a current source of artificial light and is situated much closer to the leatherback nesting record (~1km) than the proposed infrastructure.

This impact can be characterised by the following:

- Impact category: Minor / Short Term / Possible = Insignificant
- Sensitivity = Moderate
- Significance = Negligible

5.3.9 VESSEL STRIKE

Construction activities will increase boat traffic in the area, potentially resulting in increased instances of boat strikes. Boat strikes can cause injury or death to marine animals that come to the surface to

breath such as whales, dolphins, and turtles. Shipping frequency is yet to be finalised however, a frequency of a barge every 3 – 4 days is currently be investigated by Thompson Clarke Shipping Pty Ltd (2022) (Refer to Vessel Traffic Management Plan for further information).

No previous recordings of marine cetacean ship strikes have been reported within the area (AMMC, 2021). This is likely underrepresented with studies determining that the true relationship between the likelihood of cetaceans and ship strikes is unknown as many are not reported. There is no known solution to substantially reduce strike risk as where ships and cetaceans occupy the same space, there is always a risk for a collision. Several options are available such as speed reductions, wildlife observers, and the modification of vessel routes to avoid areas of known density such as humpback migration paths (Peel *et al.,* 2015).

This impact can be characterised by the following:

- Impact category: Minor / Short Term / Possible = Insignificant
- Sensitivity = High
- Significance = Minor

5.3.10 INTRODUCTION AND SPREAD OF EXOTIC FAUNA

Increased vessel activity during construction may result in the introduction of non-native and potentially invasive marine species. These species may be carried in the ballast water of vessels or be present in fouling communities residing on vessel hulls. Ballast water is held in vessel tanks for stability with the discharge of ballast water from barges and other vessels maintaining a risk of the introduction of foreign marine species into the local environment.

Potential vectors during construction can include barges carrying equipment and supplies for the construction of infrastructure such as barges transporting piling equipment for jetty construction, or heavy machinery for the construction of the boat ramp.

A management plan is being developed by Thompson Clarke Shipping (2022) to investigate any issues/impacts refer to the "Ship-sourced Pollution Prevention Management Plan"

This impact can be characterised by the following:

- Impact category: Major / Long Term / Possible = Medium
- Sensitivity = Moderate
- Significance = Moderate

5.3.11 WASTE

Waste contamination within the marine environment can lead to contamination and adverse effects on the marine ecosystem health.

During the construction of the marine infrastructure, potential waste is expected to be primarily produced from a loss of construction materials (steel/metal, broken concrete and concrete materials, timber pallets and off cuts, paints and resins) and a loss of excavated material (rock and earth). Waste is not expected to be intentionally left in the marine environment however, a loss of materials during construction is possible.

This impact can be characterised by the following:

- Impact category: Minor / Short Term / Possible = Insignificant
- Sensitivity = Moderate
- Significance = Minor

5.4 OPERATIONAL PHASE

5.4.1 WATER QUALITY

The operation of the proposed marine infrastructure has the following potential impacts to water quality:

- Accidental spills and leaks of hydrocarbons (oils, fuels and hydraulic fluids) and other contaminants associated with vessels and vehicles;
- Introduction of sediments from unsealed and cleared areas;
- Introduction of litter
- Inputs of sewage

EFFECTS FROM VESSEL PROP WASH

Numerous studies have investigated sediment resuspension from vessel prop wash which is known to resuspend sediment during movement in coastal areas. Increases in turbidity through suspended sediment is expected during construction from vessels operating within the area. The extent of sediment suspension is unknown; however, studies have determined that vessel traffic have the potential to contribute to a similar amount of sediment resuspension to that of dredging (Hayes et al., 2006). The under keel clearance discussed in Thompson Clarke Shipping (2022) refers to 0.2m for a laden barge or vessel, indicating that prop wash disturbing sandy seabeds is feasible. In the vicinity of the Jetty transhipment facility, there is limited sensitive habitat; potentially sparse seagrass at times. The MOF is substantially closer to more sensitive habitat including seagrass meadows and reef slope, though vessel traffic to the MOF is expected to be substantially less than the Jetty.

EFFECTS FROM LOSS OF MINED MATERIAL

During the operational phase, mined material will be loaded onto vessels within the marine infrastructure area, due to the proximity to the marine environment it is likely that some loss of product will enter the marine environment during loading. White silica sand of the area is known to have little heavy metal content and a very low impact on marine water quality. With little containment load entering the water from other silica mines within the area (Ports North, 2014; Ayling et al., 1997).

Due to this, there is believed to be only minor effects to the marine environment from lost silica product.

IMPACTS TO SENSITIVE MARINE COMMUNITIES

The nearby seagrass meadows and coral reef communities are particularly sensitive to deterioration in water quality. Increases in turbidity due to substrate disturbance and/or sediment input can decrease light availably for photosynthesis and can smother seagrass and corals if present in excess amounts.

This impact can be characterised by the following:

- Impact category: Minor / Short Term / Possible = Insignificant
- Sensitivity = Moderate
- Significance = Negligible

5.4.2 NOISE

Sudden loud, impulsive or impact noises may cause fauna to become startled, which if occurring over the longer term, may affect feeding and breeding behaviour in some species. These impacts are expected to occur to the fauna using the habitats both within and immediately adjacent to the infrastructure.

Operations at the marine infrastructure is expected to increase background noise, though this would be less than what is experienced during construction. Noise generation during operation will be associated with:

- Increased vehicle movements
- Increased boat activity
- Increased human activity

This impact can be characterised by the following:

- Impact category: Moderate / Long Term / Likely = Low
- Sensitivity = Moderate
- Significance = Moderate

5.4.3 LIGHT POLLUTION

Light pollution can affect the behaviour of some wildlife and may disturb the activities of those active during the night. Artificial light is known to alter the trajectory of newly hatched marine turtles, resulting in increased mortality (Thums *et al.*, 2016). The *National Light Pollution Guidelines for Wildlife* (Commonwealth of Australia, 2020) dictate that light pollution impacts should be considered where there is important habitat for a listed species known to be affected by artificial light within 20 km of a project. This 20 km threshold is based upon a precautionary limit observed for marine turtle hatchlings which can respond to light sources 15-18 km away.

It is noted that within the immediate Study area, no turtle nesting sites were observed due to inappropriate rocky coastline habitat. While turtle nesting is possible on the sandy beach in the local region, it is not considered an essential nesting area by any records, database or publications. However, the conservation significant Leatherback turtle (*Dermochelys coriacea*) is known to nest within 4 kms of the Study area on the opposite side of the headland (DES, 2022). As the 20 km threshold provides a nominal distance at which artificial light impacts should be considered, not necessarily the distance at which mitigation will be required, it is likely that the mountain between the light source and known turtle nesting will be blocked.

It should be noted that the jetty (at Ports North) associated with the existing silica mine is a current source of artificial light and is situated much closer to the leatherback nesting record (~1km) than the proposed infrastructure.

This impact can be characterised by the following:

- Impact category: Minor / Long Term / Possible = Low
- Sensitivity = Moderate
- Significance = Minor

5.4.4 VESSEL STRIKE

Operation activities will increase boat traffic in the area, potentially resulting in increased instances of boat strikes. Boat strikes can cause injury or death to marine animals that come to the surface to breath such as whales, dolphins, and turtles. Shipping frequency is yet to be finalised however, a frequency of a barge every 3 – 4 days is currently be investigated by Thompson Clarke Shipping Pty Ltd (2022) (Refer to *Vessel Traffic Management Plan* for further information).

No previous recordings of marine cetacean ship strikes have been reported within the area (AMMC, 2021). This is likely underrepresented with studies determining that the true relationship between the likelihood of cetaceans and ship strikes is unknown as many are not reported. There is no known solution to substantially reduce strike risk as where ships and cetaceans occupy the same space, there

is always a risk for a collision. Several options are available such as speed reductions, wildlife observers, and the modification of vessel routes to avoid areas of known density such as humpback migration paths (Peel *et al.,* 2015).

This impact can be characterised by the following:

- Impact category: Minor / Long Term / Rare = Low
- Sensitivity = High
- Significance = Moderate

5.4.5 CONNECTIVITY

The operation of the Jetty and MOF present limited connectivity barriers to aquatic flora and fauna as they will be elevated above the waterline. The pilings do not pose a barrier. The MOF is intended to be a moveable structure during inclement weather; this relocation may present a very minor, temporary disturbance to mobile fauna. This impact can be characterised by the following:

- Impact factor: Negligible / Short Term / Likely = Insignificant
- Sensitivity = Moderate
- Significance = Negligible

5.4.6 INTRODUCTION AND SPREAD OF EXOTIC FAUNA

The arrival of vessels to the jetty and boat ramp during operation has the potential to introduce exotic marine species to the area through ballast water and hull fouling. Ballast water is held in vessel tanks for stability with the discharge of ballast water from barges and other vessels maintaining a risk of the introduction of foreign marine species into the local environment.

There are several procedures in place to mitigate the risk of invasive species introductions and their initial spread if they are detected. The *Australian Ballast Water Management Requirements* (DAWE, 2020) describe numerous mitigation methods and controls to implement to reduce the risk of invasive species introduction.

The following methods are approved under *Biosecurity Act 2015* for ballast water management within Australian seas:

- The use of a Ballast Water Management System (BWMS)
- Conduct all ballast water exchange within an acceptable area as defined in the *Australian Ballast Water Management Requirements* (DAWE, 2020)
- The use of low-risk ballast water (such as fresh potable water, high seas water or fresh water from an on-board freshwater production facility)
- The retention of high-risk ballast water on board the vessel
- Discharge to an approved ballast water reception facility.

Potential vectors during operation are generally restricted to barges transporting resources and personnel for the operation of the mine. A management plan is being developed by Thompson Clarke Shipping (2022) to investigate any issues/impacts refer to the "Ship-sourced Pollution Prevention Management Plan".

This impact can be characterised by the following:

- Impact category: Major / Long Term / Possible = Medium
- Sensitivity = High
- Significance = Moderate

5.4.7 WASTE

Waste contamination within the marine environment can lead to contamination and adverse effects on the marine ecosystem health.

During the operation of the Loading terminal, waste is expected to be primarily derived from ship sourced waste. These pollutants are generally described as oil, noxious liquid substances, sewage and garbage, and packaged harmful substances. The Transport *Operations (Marine Pollution) Act 1995 (TOMPA)* and *Transport Operations (Marine Pollution) Regulation 2008* describes requirements for ship sourced waste within Queensland coastal waters and detail the major sourced ship pollutants during operations to be the following:

- Sewage
- Chemicals and chemical residues
- Garbage
- Oil and oily residues or mixtures

Ships operating within Queensland coastal waters must carry applicable pollution prevention documentation, additionally it is an offence to discharge of pollutions within Queensland coastal waters. Potential issues/impacts pertaining to ship-sourced waste has been investigated by Thompson Clarke Shipping (2022). Please refer to the "Ship-sourced Pollution Prevention Management Plan".

This impact can be characterised by the following:

- Impact category: Minor / Short Term / Possible = Insignificant
- Sensitivity = Moderate
- Significance = Negligible

6. AVOIDANCE, MITIGATION AND MANAGEMENT MEASURES

Identified avoidance, mitigation and management measures for the identified construction and operational impacts of the project are detailed in Table 6-1. Monitoring of each environmental aspect will be conducted for the various project phases to ensure the identified mitigation measures are implemented and are successful.

Table 6-1 Potential impacts and proposed avoidance, mitigation, and management measures.

Potential Impact to Aquatic Ecosystem Values	Recommended Avoidance, Mitigation or Management Measure
Construction Phase	
Impacts on mangrove habitat	• The construction footprint will clearly be delineated and minimised as far as practicable • Demarcation of construction zone from habitat protection zones • Active monitoring of incursions into protected zones
Loss of seagrass habitat	• The clearing footprint will clearly be delineated and minimised as far as practicable • Demarcation of construction zone from habitat protection zones • Active monitoring of incursions into protected zones • The MOF has been designed to never make contact with seagrass meadows and will float above the seagrass meadows. • Monitoring of seagrass habitat during construction. Environmental thresholds to be developed and monitored to ensure additional losses of seagrass outside and within the footprint is not occurring as a result of construction.
Loss of intertidal habitat	• The clearing footprint will clearly be delineated and minimised as far as practicable • Demarcation of construction zone from habitat protection zones • Active monitoring of incursions into protected zones • Monitoring of intertidal habitat and fauna within during construction. Environmental thresholds to be developed and monitored to ensure additional losses of intertidal biota outside and within the footprint is not occurring as a result of construction
Impacts on reef habitat	• The construction footprint will be clearly be delineated and minimised as far as practicable • Demarcation of construction zone from habitat protection zones • Active monitoring of incursions into protected zones • The MOF and jetty have been designed to never make contact with reef habitat and will be above the reef. • Post construction, implement a program to demarcate the reef zone as a no-go and no-fishing zone for staff to minimise further disturbance • During MOF relocation exercises due to inclement weather, ensure pilings/footings are reinstated in the same areas • Monitoring of reef habitat and fauna within during construction. Environmental thresholds to be developed and monitored to ensure additional losses of reef habitat are not occurring as a result of construction. If measured impacts exceed designated thresholds and/or unacceptable level of impacts to reef habitats are detected, then adaptive mitigation methods should be adopted. These methods may include:

Potential Impact to Aquatic Ecosystem Values	Recommended Avoidance, Mitigation or Management Measure
	– actively encouraging settlement of reef components (hard and soft corals, sponges, encrusting algae, other epifauna) to submerged aspects of pilings. – undertaking statistically rigorous monitoring of reef establishment until self-sustaining (determined through statistical comparison with control/unimpacted areas of diversity and habitat use), initiate remedial responses if recruitment is unsuccessful which could include installation of habitat enhancements (e.g. settlement plates, 'reef balls' or 'fish hotels') around the pilings and encouraging connection to the natural fringing reef
Water quality	• The clearing footprint will clearly delineated and minimised as far as practicable • Runoff, erosion and sediment control measures will be installed and maintained, as per the requirements outlined in the Project Erosion and Sediment Control Plan (ESCP) and/or SWMP. • All vehicles, plant and equipment required on-site will be in good condition, and will be regularly maintained and inspected for leakages, in order to minimise the risk of contaminant spill • Bulk chemicals and fuels will be stored within the project area at locations away from surface water bodies and will be managed in accordance with: – the WHS Act and regulation – AS 1940:2017 Storage and Flammable or Combustible Substances – AS 3780:2008 The storage and Handling of Corrosive Substances • Refuelling of mobile plant and vehicles will occur at designated areas within the Project. These areas will be suitably distanced from surface water bodies and drainage lines. Spill kits for chemical and hydrocarbon spills will be available at refuelling points. • In the event of an accidental spill or release of contaminants, works will cease immediately, and preventative actions implemented as per the Construction Environment Management Plan (CEMP) • Spill kits will be located at appropriate points during construction and staff instructed in their use • Development of a waste/refuse management plan. • Development of a spills emergency response plan including appropriate spills containment and training that is consistent with good practice. • Good practice and corporate stewardship that will seek to continually improve in areas such as material handling training and waste management. • Vehicle access will be restricted to designated roads • No dredging will be undertaken at all during the construction and operation of the project • Excavators will only work above the highest astronomical tide (HAT) • Piling works will be undertaken via percussion hammered or screwed devices, alongside the implementation of silt fences where on land

Potential Impact to Aquatic Ecosystem Values	Recommended Avoidance, Mitigation or Management Measure
Noise	• Underwater Piling Noise Guidelines (DPTI, 2012) – Avoid pile-driving during times when marine mammals are likely to be breeding, calving or resting in nearby biologically important areas. – All team members involved in pile driving should be briefed on marine mammal identification – A suitably trained person should continually monitor for marine mammals during piling activities. – Pre-start procedure – the presence of marine mammals should be visually monitored by a suitably trained team member for at least 30 minutes before commencement of piling – Soft start procedure – If no marine mammals have been sighted during the pre-start then piling can commence with impact energy increased gradually over a 10 minute period. The soft start procedure should also be used after long (30min) breaks in piling activity. – Normal operating procedure – If no marine mammals have been sighted during the soft start piling may be conducted at full impact energy. Trained crew members should continually monitor for marine mammals during this time. – Stand-by operations procedure If a marine mammal is sighted within the observation zone during the soft start or normal operation procedures, the operator of the piling rig should be placed on stand-by to shut-down the piling rig. An additional trained crew member should continuously monitor the marine mammal in sight. – Shut-down procedure – If marine mammals are sighted within or are about to enter shut-down zone (within 100m) piling should stop immediately. If marine mammals are seen to leave the impact zone or no marine mammals have been observed for 30 mins since shut-down, piling activities may re-commence using the soft-start procedure.
Light	• The construction works should be conducted during daylight hours • All lighting to be directed towards the land and away from the water where practicable • No high intensity/flood lighting to be used • Light only the intended object or area - keep lights close to the ground, directed and shielded • Use light with little or no blue wavelengths • Use non reflective dark coloured surfaces where practicable • Use the lowest intensity appropriate to the task • Observations of wildlife interactions should be documented • Observations of wildlife interactions should be documented and accompanied by relevant information such as weather conditions and moon phase

Potential Impact to Aquatic Ecosystem Values	Recommended Avoidance, Mitigation or Management Measure
Boat strike	• Follow mitigation methods in the *Vessel Traffic Management Plan* (Thompson Clarke Shipping, 2022), and the *National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna* (DEE, 2017) – Go slow areas for turtles and dugong: All vessels must travel off-plane or in displacement mode, and in a way that minimises the chance of a turtle or dugong being struck. Motorised water sports to be prohibited. • Please refer to "Vessel Traffic Management Plan" for further details.
Introduction and spread of exotic fauna	• No vessel hull cleaning (i.e., removal of fouling organisms) to be conducted anywhere within water or on land on the proposed infrastructure • Inspect all machinery for the presence of pests prior to deployment.
Operational Phase	
Impacts on mangrove habitat	• Post-construction, implement a program which may include: – actively encourage recruitment of mangroves within the disturbance areas associated with the Jetty and, where feasible, the MOF – demarcate the intertidal zone as a no-go zone for staff to minimise trampling and further disturbance • undertake statistically rigorous monitoring of mangrove establishment until self-sustaining (determined through recruitment and establishment of mature mangrove), initiate remedial responses if recruitment is unsuccessful which could include active planting or translocation
Impacts on seagrass habitat	• Post-construction, undertake statistically rigorous monitoring of seagrass across the study area (i.e. areas unimpacted and impacted) including quantitative components (% cover, depth range, dry weight) during an appropriate seasonal regime for 5 years with an objective of demonstrating recovery or otherwise. Monitoring will be implemented to determine impacts caused by direct removal due to construction and ongoing impacts caused by shading during operations.
Impacts on intertidal habitat	• Monitoring of intertidal habitat and fauna post-construction. Environmental thresholds to be developed and monitored to ensure additional losses of intertidal biota outside and within the footprint is not occurring as a result of the Project.

Potential Impact to Aquatic Ecosystem Values	Recommended Avoidance, Mitigation or Management Measure
Impacts on reef habitat	• Post-construction monitoring of reef habitat and fauna. Environmental thresholds to be developed and monitored to ensure additional losses of reef habitat are not occurring as a result of construction. If measured impacts exceed designated thresholds and/or unacceptable level of impacts to reef habitats are detected, then adaptive mitigation methods should be adopted. These methods may include: – actively encouraging settlement of reef components (hard and soft corals, sponges, encrusting algae, other epifauna) to submerged aspects of pilings. – undertaking statistically rigorous monitoring of reef establishment until self-sustaining (determined through statistical comparison with control/unimpacted areas of diversity and habitat use), initiate remedial responses if recruitment is unsuccessful which could include installation of habitat enhancements (e.g. settlement plates, 'reef balls' or 'fish hotels') around the pilings and encouraging connection to the natural fringing reef
Water Quality	• Runoff, erosion and sediment control measures will be installed and maintained, as per the requirements outlined in the Project Erosion and Sediment Control Plan (ESCP) and/or SWMP. • All vehicles, plant and equipment required on-site will be in good condition, and will be regularly maintained and inspected for leakages, in order to minimise the risk of contaminant spill • Bulk chemicals and fuels will be stored within the project area at locations away from surface water bodies and will be managed in accordance with: the WHS Act and regulation AS 1940:2017 Storage and Flammable or Combustible Substances AS 3780:2008 The storage and Handling of Corrosive Substances • Refuelling of mobile plant and vehicles will occur at designated areas within the Project. These areas will be suitably distanced from surface water bodies and drainage lines. Spill kits for chemical and hydrocarbon spills will be available at refuelling points. • In the event of an accidental spill or release of contaminants, works will cease immediately, and preventative actions implemented as per the Operational Environment Management Plan (OEMP) • Spill kits will be located at appropriate points and staff instructed in their use • Development of a waste/refuse management plan. • Development of a spills emergency response plan including appropriate spills containment and training that is consistent with good practice. • Good practice and corporate stewardship that will seek to continually improve in areas such as material handling training and waste management. • Vehicle access will be restricted to designated road
Noise	• Noise levels will be monitored periodically and compared to standard guidelines. The following reporting requirements will be followed: Results of noise monitoring

Potential Impact to Aquatic Ecosystem Values	Recommended Avoidance, Mitigation or Management Measure
Light	• All lighting to be directed towards the land and away from the water where practicable • No high intensity/flood lighting to be used • Light only the intended object or area - keep lights close to the ground, directed and shielded • Use light with little or no blue wavelengths • Use the lowest intensity appropriate to the task • Observations of wildlife interactions should be documented • Observations of wildlife interactions should be documented and accompanied by relevant information such as weather conditions and moon phase
Boat strike	• Follow mitigation methods in the *Vessel Traffic Management Plan* (Thompson Clarke Shipping, 2022), and the *National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna* (DEE, 2017) – Go slow areas for turtles and dugong: All vessels must travel off-plane or in displacement mode, and in a way that minimises the chance of a turtle or dugong being struck. Motorised water sports to be prohibited. • "Please refer to "Vessel Traffic Management Plan" for further details
Introduction and spread of exotic aquatic fauna	• No vessel hull cleaning (i.e., removal of fouling organisms) to be conducted anywhere within water or on land on the proposed infrastructure • Follow ballast water guidelines (DAWE, 2020). – Ensure that receiving vessels have a Ballast Water Management Plan (BWMP) • Ballast water must not be exchanged within 12 nautical miles of the Great Barrier Reef • A management plan has been developed by Thompson Clarke Shipping (2022), please refer to the "Ship-sourced Pollution Prevention Management Plan"

6.1 INSPECTIONS AND MONITORING

The below points provide monitoring context for both the construction and operational phases, which will be further detailed in the respective construction environment management plan (CEMP) and operation environment management plan (OEMP). Planned monitoring includes:

- Environmental monitoring, involving the collection of quantitative data to establish whether aquatic values are being impacted as a result of project activities;
- Monitoring implementation of specific environmental management plans and programs; and
- Reporting and analysis of regulated discharges, emissions and waste disposal any other prescribed monitoring in accordance with relevant conditions and management plans.

6.1.1 CONSTRUCTION PHASE

The effectiveness of construction impact mitigation and management measures will be verified during the development and implementation of the CEMP. These will include, but not limited to:

- Visual inspection of hazardous substance storage areas and erosion and sediment control measures. Visual inspections are to be carried out during works and following rainfall events to identify any issues and remedy actions;
- Routine audits to ensure appropriately provisioned spill containment controls and spill response kits are in place during construction;
- Routine monitoring, in accordance with a developed WMP;
- Demarcation of construction zone from habitat protection zones alongside active monitoring of incursions into protected zones by designated officers

6.1.2 OPERATIONAL PHASE

The effectiveness of operational impact mitigation and management measures be verified during the development and implementation of the OEMP. These will include, but not limited to:

- Development and implementation of a receiving environment monitoring program (REMP).
- Upon the collection of sufficient data, site specific water quality objectives shall be developed and used to detect potential impacts to water quality on the receiving environment;
- Monitoring flow, physicochemical and contaminant parameters upstream and downstream of any controlled and authorised releases from stormwater infrastructure;

Development and implementation of habitat monitoring plans for reef, seagrass, and intertidal habitats to detect and monitor change during operation.

7. RESIDUAL IMPACT ASSESSMENT

The following tables summarise the predicted unmitigated and then residual impact, assuming successful implementation of the mitigation measures identified in Table 6-1.

Table 7-1 Impact assessment summary of marine infrastructure construction.

Impact/Activity	Sensitivity	Unmitigated Impact					Residual impact					
		Magnitude	**Duration**	**Likelihood**	**Category**	**Significance**	**Mitigation effect (see Table 6-1)**	**Magnitude**	**Duration**	**Likelihood**	**Category**	**Residual significance**
Impacts on mangrove habitat	Moderate	Minor	Short term	Possible	Insignificant	Minor	Minimise overall loss, encourage re-establishment post-construction	Minor	Long term	Rare	Insignificant	Minor
Loss of seagrass habitat	Moderate	Minor	Permanent	Almost certain	Medium	Moderate	Minimise overall loss, encourage re-establishment post-construction	Minor	Long term	Possible	Low	Minor
Loss of rocky intertidal habitat	Moderate	Minor	Permanent	Almost certain	Medium	Moderate	Minimise overall loss, encourage re-establishment post-construction	Minor	Long term	Possible	Low	Minor
Impacts on reef habitat	High	Minor	Permanent	Likely	Medium	Moderate	Minimise overall loss, encourage re-establishment post-construction	Minor	Short term	Possible	Insignificant	Minor
Connectivity	Moderate	Minor	Short term	Likely	Low	Minor	Reduce duration of connectivity barriers to reduce likelihood of impact	Minor	Short term	Rare	Insignificant	Negligible
Water Quality	Moderate	Minor	Short term	Almost certain	Low	Minor	Reduce duration and likelihood	Minor	Short term	Possible	Insignificant	Negligible
Noise	High	Major	Short term	Possible	Medium	Moderate	Reduce magnitude and likelihood	Minor	Short term	Possible	Insignificant	Minor
Light Pollution	Moderate	Minor	Short term	Possible	Insignificant	Negligible	Reduce likelihood	Minor	Short term	Rare	Insignificant	Negligible
Vessel Strike	High	Minor	Short term	Possible	Insignificant	Minor	Reduce likelihood	Minor	Short term	Rare	Insignificant	Minor

Impact/Activity	Sensitivity	Unmitigated Impact					Residual impact					
		Magnitude	**Duration**	**Likelihood**	**Category**	**Significance**	**Mitigation effect (see Table 6-1)**	**Magnitude**	**Duration**	**Likelihood**	**Category**	**Residual significance**
Introduction of exotic fauna	Moderate	Major	Long term	Possible	Medium	Moderate	Reduce duration and likelihood	Major	Short term	Rare	Low	Minor
Waste	Moderate	Minor	Short term	Possible	Insignificant	Negligible	Reduce magnitude, duration and likelihood	Negligible	Short term	Rare	Insignificant	Negligible

Table 7-2 Impact assessment summary of marine infrastructure operations.

Impact/Activity	Sensitivity	Unmitigated Impact					Residual impact					
		Magnitude	Duration	Likelihood	Category	Significance	Mitigation effect (see Table 6-1)	Magnitude	Duration	Likelihood	Category	Residual significance
Water Quality	Moderate	Minor	Short term	Possible	Insignificant	Negligible	Reduce duration and likelihood	Minor	Short term	Rare	Insignificant	Negligible
Noise	Moderate	Moderate	Long term	Likely	Medium	Moderate	Reduce likelihood	Moderate	Long term	Possible	Low	Minor
Light Pollution	Moderate	Minor	Long term	Possible	Low	Minor	Reduce duration and likelihood	Minor	Short term	Rare	Insignificant	Negligible
Vessel Strike	High	Minor	Long term	Possible	Low	Moderate	Reduce likelihood	Minor	Short term	Rare	Insignificant	Minor
Connectivity	Moderate	Negligible	Short term	Likely	Insignificant	Negligible	Reduce likelihood	Negligible	Short term	Possible	Insignificant	Negligible
Introduction of exotic fauna	Medium	Major	Long term	Possible	Medium	Moderate	Reduce duration and likelihood	Major	Short term	Rare	Low	Minor
Waste	Moderate	Minor	Short term	Possible	Insignificant	Negligible	Reduce magnitude, duration and likelihood	Negligible	Short term	Rare	Insignificant	Negligible

8. CONCLUSION

The present marine habitats detected within the study area are as follows:

- The Study area contains a single continuous roughly 1.5km fringing reef which ranges from approximately 10-80m off the shoreline. The reef is generally rocky, dominated by microalgal mats and algal forests characterised by *Sargassum.* Coverage analysis revealed approximately 64.2% macroalgal coverage while maintaining a cumulative 12.9% of hard coral coverage and 3% soft coral coverage. This hard coral community composition was dominated by branching Acroporid corals and to a lesser degree corymbose (4%) and foliose corals (2.3%). No solitary sponges were observed with the exception of symbiotic like macroalgae and sponge forms being observed (3.3%) bare seafloor within the reef constituted approximately 16.5%.
- Seagrass meadows that were generally restricted to the lower intertidal to subtidal zones of the Study area. These meadows were located approximately 3-10 m behind the reef with 3 known species detected: *Halodule uninervis*, *Halophila spinulosa*, and *Halophila ovalis*. Coverage generally ranged between approximately 10-30% seagrass coverage within meadows generally maintained lower species diversity and coverage due to seagrass being present within deeper waters.
- The coastline of the Study area is characterised by a rocky shore extending in line with the fringing reef. The rocky shore extends continuously with the exception of some sand coverage at the mouth of an unnamed creek to the immediate north-east of the loading facility. The general fauna incidentally observed in these rocky environments during field surveys included snails and hermit crabs on sandy beaches and hardier fauna on the boulder beaches such as barnacles, oysters, chitons, limpets, and snails.
- A mixed community of intertidal mangroves were present along the rocky shores of the Study area. Community density was fairly low and is likely derived by the limited presence of muddy substrates

for mangroves to colonise. The community was comprised of four species previously known to the area and was dominated by *Rhizophora stylosa* and to a lesser degree *Avicennia marina* alongside several individuals of *Aegialitis annulata* in addition to three individuals of *Sonneratia alba* also being recorded.

Water quality within the area was considered to be generally consistent across depths and among sites with the exception of minor differences in sites on top of reef habitat. Fauna assessments were undertaken for macroinvertebrates with analysis revealing that macroinvertebrate taxonomic richness and general abundance were higher within tidal samples taken from the shoreline in contrast to lower diversity and abundance in samples taken further offshore in addition to community composition contrasted between offshore and tidal sites with a generally diverse range of families present within offshore sites, with no taxa appearing to dominate in abundance.

Within marine reptiles a single species marine turtle was detected, the Green sea turtle (*Chelonia mydas*), no additional incidental sightings or tracks were noted. No signs of marine turtle nesting or shoreline presence were observed in Study area. This is likely due to a lack of habitat and the natural barriers of the Study area which was largely comprised of fringing rocky reefs and rocky shorelines.

The construction and operation stages of the project are expected to have negligible to minor residual impact on the marine ecosystem values of the Study area. With the development and implementation of rigorous monitoring and re-establishment programmes within each habitat zone, the impacts of the project can be mitigated. The application of these programmes is important to offset the impacts that the project will incur.

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APPENDIX A. OTHER LISTED MARINE SPECIES

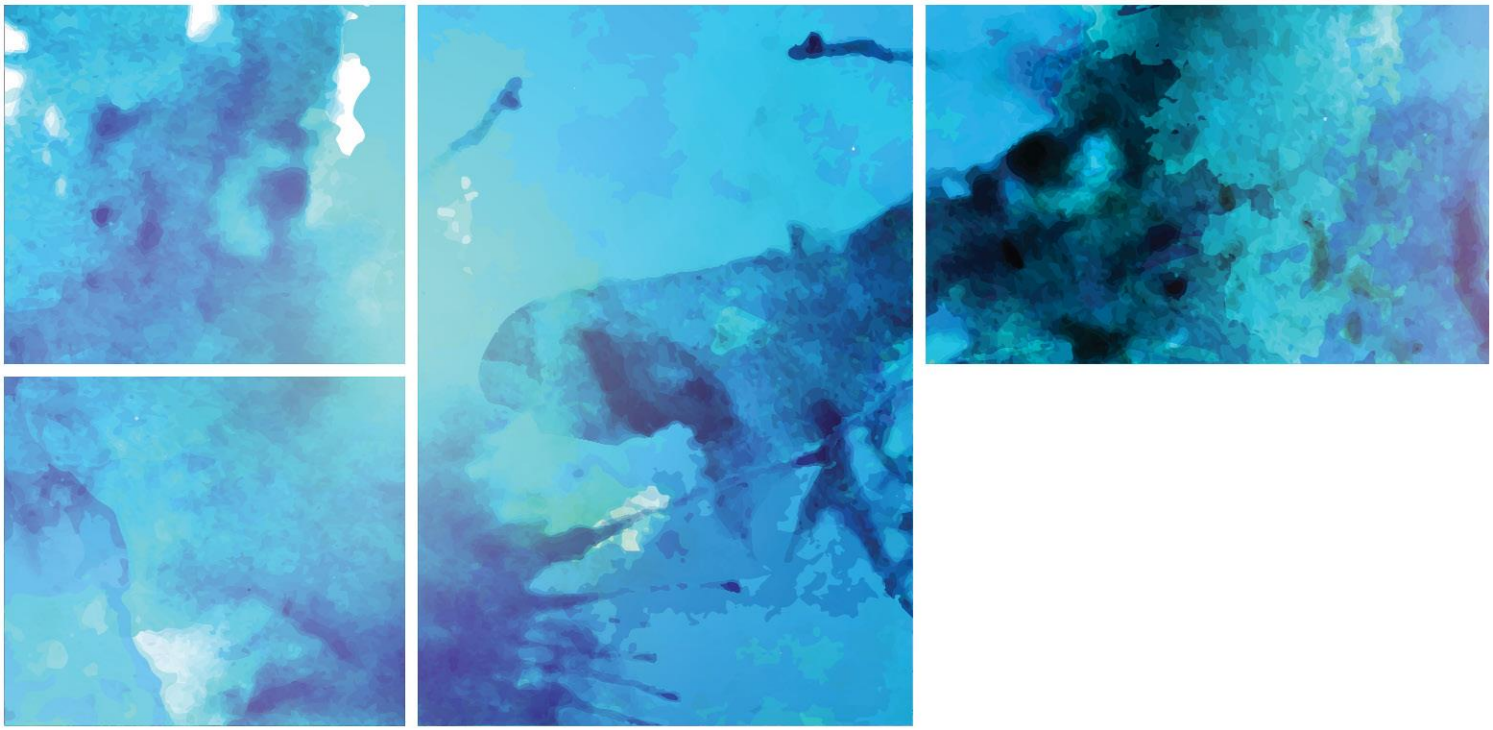


Table 9-1 Listed migratory or Marine species – Likelihood of Occurrence

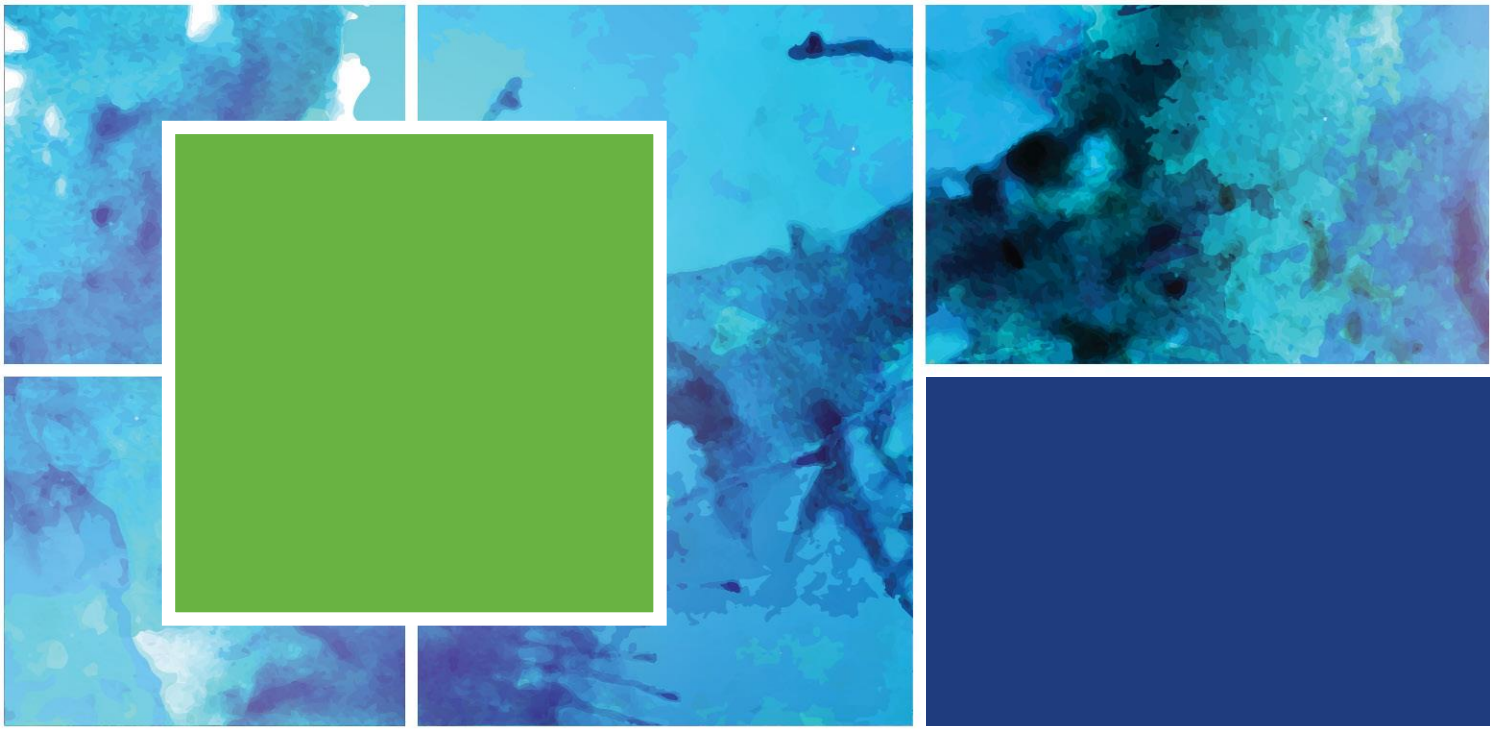
Species	Distribution / Habitat	Likelihood of Occurence
Marine Mammals		
Balaenoptera acutorostrata **Dwarf Minke Whale**	Little is known regarding the population of minke whales which visit the Great Barrier Reef each year. The population generally forms a well-known winter aggregation in the northern section of the reef, especially in Lizard Island, which is roughly 30 km offshore of the project site (Birtles et al., 2002). The species has not been previously recorded in the Study area.	Unlikely
Delphinus delphis **Common Dolphin**	Information on the species habitats is only available outside of Australia. The species have been observed traveling over specific ocean features such as ridges, escarpments and seamounts (Evans, 1994). In the tropical eastern Pacific they are primarily associated with upwelling-modified habitats (Reilly, 1990). The species has not been previously recorded in the Study area.	Unlikely
Grampus griseus **Rissos Dolphin**	The species display a direct preference for depths of 1000 m but also for warm temperate to tropical conditions. Although the species is often observed in pelagic oceanic waters, individuals often traverse over the continental slope (Leatherwood & Reeves, 1983). The species has not been previously recorded in the Study area.	Unlikely
Orcaella heinsohni **Australian Snubfin Dolphin**	Within Australia, the species has been generally recorded almost exclusively in coastal and estuarine environments. It is doubtful that they venture further upstream in river systems (Parra et al., 2002). The species has not been previously recorded in the Study area.	Unlikely
Stenella attenuata **Spotted Dolphin**	This species is known to generally inhabit both oceanic and near-shore habitats within both tropical and warm temperate regions. The species has also been recorded in the shelf and along the continental slopes (Bannister et al.,1996). The species has not been previously recorded in the Study area.	Unlikely

Species	Distribution / Habitat	Likelihood of Occurence
Tursiops truncatus **Bottlenosed Dolphin**	This species is chiefly known to inhabit coastal environments throughout the world. In Australia, they tend to inhabit offshore environments and inshore areas such as estuaries, bays and lagoons, including oceanic islands and reefs (Hale et al., 2000; Ross, 2006). The species has not been previously recorded in the Study area, with its northernmost QLD range being Townsville.	Unlikely
Tursiops aduncus **Spotted Bottlenose Dolphin**	Within Australia, the species is restricted to inshore waters such as estuaries and bays, nearshore waters, coastal areas around islands, shallow offshore waters, and open coast environments (Hale et al., 2000; Kogi et al., 2004).	Unlikely
Marine Reptiles		
Acalyptophis peronii **Horned Seasnake**	The species typically inhabits sandy substrates, in the Gulf of Carpentaria with the highest catch rates of the species being caught around Weipa and Karumba (Guinea & Whiting, 2005; Ward, 2000). The species has not been recorded in the region of the Study area.	Unlikely
Aipysurus duboisii **Dubois Seasnake**	This species is commonly observed in shallow waters in proximity to sheltered coral reefs at depths of roughly 3 to 4 m (McCosker, 1975). The species has not been recorded in the region of the Study area.	Unlikely
Aipysurus eydouxii **Spine-tailed Seasnake**	This species generally occupies shallow estuaries and bays, where it is often connected to soft substrate rather than hard rocks and coral (Ehmann, 1992). The species has not been recorded in the region of the Study area.	Unlikely
Aipysurus laevis **Olive Seasnake**	This species inhabits upper lagoon slopes and lower reef edges of leeward reefs. The seasnake generally occurs on large, sheltered reefs throughout the Australian coast. The species has previously been recorded on reefs in the Study areas surrounds (McCosker, 1975).	Likely

Species	Distribution / Habitat	Likelihood of Occurence
Astrotia stokesii **Stokes Seasnake**	The species inhabits muddy substrates and coastal tidal pools, generally using deeper water near reef crests and channels, but avoids reef flats at low tide (McCosker, 1975). The species has previously been recorded in the Study areas immediate surrounds.	Likely
Disteira major **Oliveheaded Seasnake**	The species has been observed and captured from mud and sandy substrates in depths between 3 to 10 m (Ehmann, 1992). The species has not been recorded in the region of the Study area.	Unlikely
Enhydrina schistosa **Beaked Seasnake**	The species generally occurs in sandy and muddy environments, throughout harbours, estuaries and shallow bays. It is known to frequently travel into the upper freshwater reaches of rivers (Limpus, 1975; Porter et al.,1997). The species has not been recorded in the region of the Study area.	Unlikely
Hydrophis elegans **Elegant Seasnake**	The species inhabits a range of estuarine and marine habitats, these include sandy substrates in less than 2 m to depths 80 m. The species is occasionally found in freshwater habitats in addition to estuaries (Limpus, 1975). The species has previously been recorded in the Study areas surrounds.	Likely
Chitulia ornata **Spotted Seasnake**	The species inhabits a range of habitats, from turbid water in estuaries and clear water near coral reefs (Cogger, 1996). The species has not been recorded in the region of the Study area.	Unlikely
Hydrophis curtus **Spine Bellied Seasnake**	The species generally inhabits muddy and sandy habitats in turbid waters (Limpus, 1975). The species has not been recorded in the region of the Study area.	Unlikely
Hydrophis macdowelli **Small headed Seasnake**	This species has been observed on the northern continental shelf of Australia in depths of up to 50 m. It often inhabits river estuaries and other turbid (muddy) inshore waters (Cogger, 2000). The species has not been recorded in the region of the Study area.	Unlikely

Species	Distribution / Habitat	Likelihood of Occurence
Laticauda colubrina **Sea Krait**	This species inhabits coral and rocky reefs where if hunts amongst the coral crevices of reef slopes and over the reef flats. When not feeding the species gathers on the shore of islands (Tomascik et. al., 1997). The species has not been recorded in the region of the Study area.	Unlikely
Pelamis platurus **Yellow bellied Seasnake**	This species is often observed within a few km of coasts and prefers shallow inshore waters. Regardless, this species is the most pelagic of all sea snakes, regularly being found in open waters far away from reefs and coasts (Karthikeyan & Balasubramanian, 2007). The species has not been recorded in the region of the Study area.	Unlikely

APPENDIX B. DATABASE EXTRACTS



Queensland Government

Department of Environment and Science

Environmental Reports

Regional Ecosystems

Biodiversity Status

For the selected area of interest
Longitude: 145.33384 Latitude: -14.94847 with 2 kilometre radius

Environmental Reports - General Information

The Environmental Reports portal provides for the assessment of selected matters of interest relevant to a user specified location, or area of interest (AOI). All area and derivative figures are relevant to the extent of matters of interest contained within the AOI unless otherwise stated. Please note, if a user selects an AOI via the "central coordinates" option, the resulting assessment area encompasses an area extending for a 2km radius from the input coordinates.

All area and area derived figures included in this report have been calculated via reprojecting relevant spatial features to Albers equal-area conic projection (central meridian = 146, datum Geocentric Datum of Australia 1994). As a result, area figures may differ slightly if calculated for the same features using a different co-ordinate system.

Figures in tables may be affected by rounding.

The matters of interest reported on in this document are based upon available state mapped datasets. Where the report indicates that a matter of interest is not present within the AOI (e.g. where area related calculations are equal to zero, or no values are listed), this may be due either to the fact that state mapping has not been undertaken for the AOI, that state mapping is incomplete for the AOI, or that no matters of interest have been identified within the site.

The information presented in this report should be considered as a guide only and field survey may be required to validate values on the ground.

Important Note to User

Information presented in this report is based upon the Queensland Herbarium's Regional Ecosystem framework. The Biodiversity Status has been used to depict the extent of "Endangered", "Of Concern" and "No Concern at Present" regional ecosystems in all cases, rather than the classes used for the purposes of the *Vegetation Management Act 1999* (VMA). Mapping and figures presented in this document reflect the Queensland Herbarium's Remnant and Pre-clearing Regional Ecosystem Datasets, and not the certified mapping used for the purpose of the VMA.

For matters relevant to vegetation management under the VMA, please refer to the Department of Resources website https://www.dnrme.qld.gov.au/

Please direct queries about these reports to: Queensland.Herbarium@qld.gov.au

Disclaimer

Whilst every care is taken to ensure the accuracy of the information provided in this report, the Queensland Government makes no representations or warranties about its accuracy, reliability, completeness, or suitability, for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which the user may incur as a consequence of the information being inaccurate or incomplete in any way and for any reason.

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Summary Information

The following table provides an overview of the AOI with respect to selected topographic and environmental themes. Refer to **Map 1** for locality information.

Table 1: Area of interest details: Longitude: 145.33384 Latitude: -14.94847 with 2 kilometre radius

Size (ha)	1,256.55
Local Government(s)	Cook Shire, Hope Vale Aboriginal Shire
Bioregion(s)	Cape York Peninsula
Subregion(s)	Starke Coastal Lowlands
Catchment(s)	Jeannie

The table below summarizes the extent of remnant vegetation classed as "Endangered", "Of concern" and "No concern at present" regional ecosystems classified by Biodiversity Status within the area of interest (AOI).

Table 2: Summary table, biodiversity status of regional ecosystems within the AOI

Biodiversity Status	Area (Ha)	% of AOI
Endangered	0.0	0.0
Of concern	42.05	3.35
No concern at present	443.63	35.31
Total remnant vegetation	485.68	38.65

Refer to **Map 2** for further information.

Regional Ecosystems

1. Introduction

Regional ecosystems are vegetation communities in a bioregion that are consistently associated with particular combinations of geology, landform and soil (Sattler and Williams 1999). Descriptions of Queensland's Regional ecosystems are available online from the Regional Ecosystem Description Database (REDD). Descriptions are compiled from a broad range of information sources including vegetation, land system and geology survey and mapping and detailed vegetation site data. The regional ecosystem classification and descriptions are reviewed as new information becomes available. A number of vegetation communities may form a single regional ecosystem and are usually distinguished by differences in dominant species, frequently in the shrub or ground layers and are denoted by a letter following the regional ecosystem code (e.g. a, b, c). Vegetation communities and regional ecosystems are amalgamated into a higher level classification of broad vegetation groups (BVGs).

A published methodology for survey and mapping of regional ecosystems across Queensland (Neldner et al 2020) provides further details on regional ecosystem concepts and terminology.

This report provides information on the type, status, and extent of vegetation communities, regional ecosystems and broad vegetation groups present within a user specified area of interest. Please note, for the purpose of this report, the Biodiversity Status is used. This report has not been developed for application of the *Vegetation Management Act 1999* (VMA). Additionally, information generated in this report has been derived from the Queensland Herbarium's Regional Ecosystem Mapping, and not the regulated mapping certified for the purposes of the VMA. If your interest/matter relates to regional ecosystems and the VMA, users should refer to the Department of Resources website.

https://www.dnrme.qld.gov.au/

With respect to the Queensland Biodiversity Status,

"Endangered" regional ecosystems are described as those where:

- remnant vegetation is less than 10 per cent of its pre-clearing extent across the bioregion; or 10-30% of its pre-clearing extent remains and the remnant vegetation is less than 10,000 hectares, or
- less than 10 per cent of its pre-clearing extent remains unaffected by severe degradation and/or biodiversity loss*, or
- 10-30 per cent of its pre-clearing extent remains unaffected by severe degradation and/or biodiversity loss and the remnant vegetation is less than 10,000 hectares; or
- it is a rare** regional ecosystem subject to a threatening process.***

"Of concern" regional ecosystems are described as those where:

- the degradation criteria listed above for 'Endangered' regional ecosystems are not met and,
- remnant vegetation is 10-30 per cent of its pre-clearing extent across the bioregion; or more than 20 per cent of its pre-clearing extent remains and the remnant extent is less than 10,000 hectares, or
- 10-30 percent of its pre-clearing extent remains unaffected by moderate degradation and/or biodiversity loss.****

and "No concern at present" regional ecosystems are described as those where:

- remnant vegetation is over 30 per cent of its pre-clearing extent across the bioregion, and the remnant area is greater than 10,000 hectares, and
- the degradation criteria listed above for 'Endangered' or 'Of concern' regional ecosystems are not met.

**Severe degradation and/or biodiversity loss is defined as: floristic and/or faunal diversity is greatly reduced but unlikely to recover within the next 50 years even with the removal of threatening processes; or soil surface is severely degraded, for example, by loss of A horizon, surface expression of salinity; surface compaction, loss of organic matter or sheet erosion.*

***Rare regional ecosystem: pre-clearing extent (1000 ha); or patch size (100 ha and of limited total extent across its range).*

****Threatening processes are those that are reducing or will reduce the biodiversity and ecological integrity of a regional ecosystem. For example, clearing, weed invasion, fragmentation, inappropriate fire regime or grazing pressure, or infrastructure development.*

*****Moderate degradation and/or biodiversity loss is defined as: floristic and/or faunal diversity is greatly reduced but unlikely to recover within the next 20 years even with the removal of threatening processes; or soil surface is moderately degraded.*

2. Remnant Regional Ecosystems

The following table identifies the remnant regional ecosystems and vegetation communities mapped within the AOI and provides their short descriptions, Biodiversity Status, and remnant extent within the selected AOI. Please note, where heterogeneous vegetated patches (mixed patches of remnant vegetation mapped as containing multiple regional ecosystems) occur within the AOI, they have been split and listed as individual regional ecosystems (or vegetation communities where present) for the purposes of the table below. In such instances, associated area figures have been generated based upon the estimated proportion of each regional ecosystem (or vegetation community) predicted to be present within the larger mixed patch.

Table 3: Remnant regional ecosystems, description and status within the AOI

Regional Ecosystem	Short Description	BD Status	Area (Ha)	% of AOI
3.10.19	Asteromyrtus lysicephala and Neofabricia myrtifolia dwarf open heath or Schizachyrium pachyarthron closed tussock grassland on sandstone plateaus and headlands	No concern at present	117.35	9.34
3.10.6x4	Eucalyptus tetrodonta +/- Corymbia stockeri subsp. stockeri woodland on sandstone plateaus	No concern at present	102.0	8.12
3.11.19a	Themeda triandra closed tussock grassland or Asteromyrtus lysicephala, Neofabricia myrtifolia, Grevillea pteridifolia dwarf open heathlands on headlands and islands	Of concern	8.41	0.67
3.11.19b	Themeda triandra closed tussock grassland or Asteromyrtus lysicephala, Neofabricia myrtifolia, Grevillea pteridifolia dwarf open heathlands on headlands and islands	Of concern	16.82	1.34
3.11.21	Deciduous vine thicket on metamorphic slopes	Of concern	16.82	1.34
3.2.10	Eucalyptus tetrodonta and Corymbia clarksoniana +/- E. brassiana or Erythrophleum chlorostachys woodland on stabilised dunes	No concern at present	69.25	5.51
3.2.12b	Acacia crassicarpa, Syzygium banksii low closed forest +/- emergent Araucaria cunninghamii var. cunninghamii on coastal dunefields and beach ridges	No concern at present	24.39	1.94
3.2.21a	Neofabricia myrtifolia +/- Jacksonia thesioides open to closed heath on dunefields	No concern at present	130.64	10.4

Refer to **Map 2** for further information. **Map 3** also provides a visual estimate of the distribution of regional ecosystems present before clearing.

Table 4 provides further information in regards to the remnant regional ecosystems present within the AOI. Specifically, the extent of remnant vegetation remaining within the bioregion, the 1:1,000,000 broad vegetation group (BVG) classification, whether the regional ecosystem is identified as a wetland, and extent of representation in Queensland's Protected Area Estate. For a description of the vegetation communities within the AOI and classified according to the 1:1,000,000 BVG, refer to **Table 6**.

Table 4: Remnant regional ecosystems within the AOI, additional information

Regional Ecosystem	Remnant Extent	BVG (1 Million)	Wetland	Representation in protected estate
3.10.19	Pre-clearing 11000 ha; Remnant 2019 11000 ha	29a	None	High
3.10.6x4	Pre-clearing 396000 ha; Remnant 2019 396000 ha	14d	None	High
3.11.19a	Pre-clearing 1000 ha; Remnant 2019 1000 ha	29a	None	High
3.11.19b	Pre-clearing 1000 ha; Remnant 2019 1000 ha	29a	None	High
3.11.21	Pre-clearing 5000 ha; Remnant 2019 5000 ha	7b	None	High
3.2.10	Pre-clearing 36000 ha; Remnant 2019 36000 ha	14b	None	High
3.2.12b	Pre-clearing 24000 ha; Remnant 2019 24000 ha	3a	None	High
3.2.21a	Pre-clearing 58000 ha; Remnant 2019 58000 ha	29a	None	High

Representation in Protected Area Estate: High greater than 10% of pre-clearing extent is represented; Medium 4 - 10% is represented; Low less than 4% is represented, No representation.

The distribution of mapped wetland systems within the area of interest is displayed in **Map 6**.

The following table lists known special values associated with a regional ecosystem type.

Table 5: Remnant regional ecosystems within the AOI, special values

Regional Ecosystem	Special Values
3.10.19	Potential habitat for NCA listed species: Lepturus geminatus
3.10.6x4	Potential habitat for NCA listed species: Acacia guymeri, Cucumis costatus, Dianella incollata, Gardenia psidioides, Homoranthus tropicus, Stemona angusta, Stenanthemum argenteum, Syzygium rubrimolle
3.11.19a	None
3.11.19b	None
3.11.21	Potential habitat for NCA listed species: Dockrillia wassellii
3.2.10	None
3.2.12b	High numbers of endemic plant species. The vulnerable plant species Cycas silvestris and near threatened species Xanthostemon arenarius occur in this ecosystem.
3.2.21a	Potential habitat for NCA listed species: Acacia solenota, Dendrobium bigibbum, Dendrobium johannis, Dockrillia wassellii, Stackhousia sp. (McIvor River J.R.Clarkson 5201)

3. Remnant Regional Ecosystems by Broad Vegetation Group

BVGs are a higher-level grouping of vegetation communities. Queensland encompasses a wide variety of landscapes across temperate, wet and dry tropics and semi-arid climatic zones. BVGs provide an overview of vegetation communities across the state or a bioregion and allow comparison with other states. There are three levels of BVGs which reflect the approximate scale at which they are designed to be used: the 1:5,000,000 (national), 1:2,000,000 (state) and 1:1,000,000 (regional) scales.

A comprehensive description of BVGs is available at:

https://publications.qld.gov.au/dataset/redd/resource/

The following table provides a description of the 1:1,000,000 BVGs present and their associated extent within the AOI.

Table 6: Broad vegetation groups (1 million) within the AOI

BVG (1 Million)	Description	Area (Ha)	% of AOI
14b	Woodlands dominated by Eucalyptus tetrodonta (Darwin stringybark) (or E. megasepala (Melville Island bloodwood)) or E. chartaboma (or E. miniata (Darwin woollybutt)), with Corymbia clarksoniana (grey bloodwood) on erosional surfaces, residual sands and occasionally alluvial plains. (land zones 5, 3, 7, 10, 2) (CYP, GUP, EIU, NWH, [DEU])	69.25	5.51
14d	Woodlands dominated by Corymbia stockeri (or C. hylandii) and Eucalyptus megasepala (or E. tetrodonta (Darwin stringybark)) on sandstone, metamorphic and ironstone ranges. (land zones 10, 11, 12, 7) (CYP, GUP, EIU, [DEU])	102.0	8.12
29a	Open heaths and dwarf open heaths on coastal dunefields, sandplains and headlands. (land zones 5, 2, 3, [7, 10, 12, 11]) (CYP, SEQ, [WET])	273.22	21.74
3a	Evergreen to semi-deciduous, notophyll to microphyll vine forest/ thicket on beach ridges and coastal dunes, occasionally Araucaria cunninghamii (hoop pine) microphyll vine forest on dunes. Pisonia grandis on coral cays. (land zone 2, [5]) (CYP, GUP, SEQ, WET, BRB, CQC) (Tracey 1982 2b)	24.39	1.94
7b	Deciduous microphyll vine thicket on ranges and heavy clay alluvia in northern bioregions. (land zones 3, 12, 11, 10, 7) (CYP, WET)	16.82	1.34

Refer to **Map 4** for further information. **Map 5** also provides a representation of the distribution of vegetation communities as per the 1:5,000,000 BVG believed to be present prior to European settlement.

4. Technical and BioCondition Benchmark Descriptions

Technical descriptions provide a detailed description of the full range in structure and floristic composition of regional ecosystems (e.g. 11.3.1) and their component vegetation communities (e.g. 11.3.1a, 11.3.1b). See:

http://www.qld.gov.au/environment/plants-animals/plants/ecosystems/technical-descriptions/

The descriptions are compiled using site survey data from the Queensland Herbarium's CORVEG database. Distribution maps, representative images (if available) and the pre-clearing and remnant extent (hectares) of each vegetation community derived from the regional ecosystem mapping data are included. The technical descriptions should be used in conjunction with the fields from the regional ecosystem description database (REDD) for a full description of the regional ecosystem.

Technical descriptions include data on canopy height, canopy cover and native plant species composition of the predominant layer, which are attributes relevant to assessment of the remnant status of vegetation under the *Vegetation Management Act 1999*. However, as technical descriptions reflect the full range in structure and floristic composition across the climatic, natural disturbance and geographic range of the regional ecosystem, local reference sites should be used for remnant assessment where possible (Neldner et al. 2020 (PDF))* section 3.3 of:

https://publications.qld.gov.au/dataset/redd/resource/

The technical descriptions are subject to review and are updated as additional data becomes available.

When conducting a BioCondition assessment, these technical descriptions should be used in conjunction with BioCondition benchmarks for the specific regional ecosystem, or component vegetation community.

http://www.qld.gov.au/environment/plants-animals/biodiversity/benchmarks/

Benchmarks are based on a combination of quantitative and qualitative information and should be used as a guide only. Benchmarks are specific to one regional ecosystem vegetation community, however, the natural variability in structure and floristic composition under a range of climatic and natural disturbance regimes has been considered throughout the

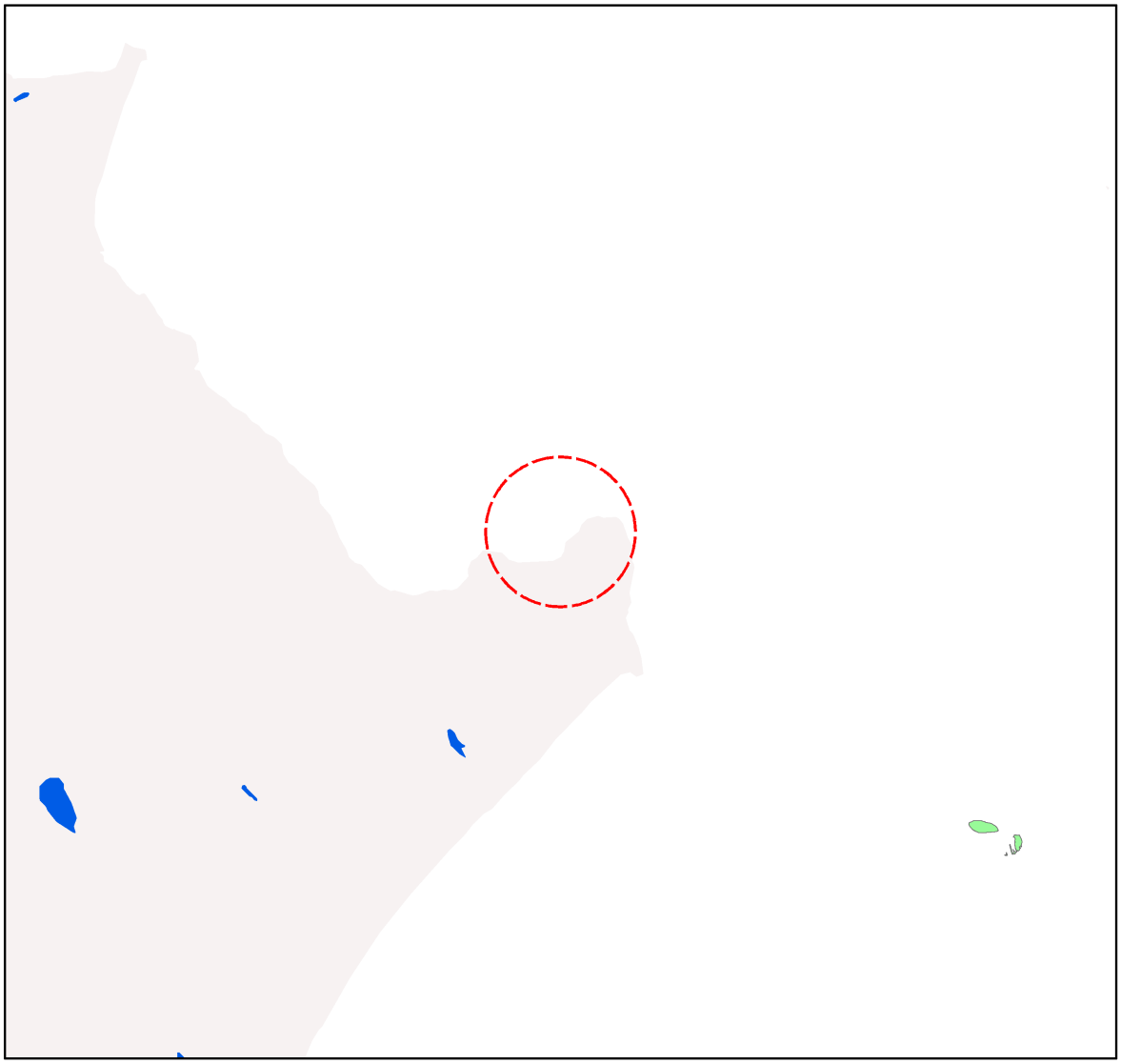
geographic extent of the regional ecosystem. Local reference sites should be used for this spatial and temporal (seasonal and annual) variability.

Table 7: List of remnant regional ecosystems within the AOI for which technical and biocondition benchmark descriptions are available

Regional ecosystems mapped as within the AOI	Technical Descriptions	Biocondition Benchmarks
3.10.19	Not currently available	Not currently available
3.10.6x4	Not currently available	Not currently available
3.11.19a	Not currently available	Not currently available
3.11.19b	Not currently available	Not currently available
3.11.21	Not currently available	Not currently available
3.2.10	Not currently available	Not currently available
3.2.12b	Not currently available	Not currently available
3.2.21a	Not currently available	Not currently available

Maps

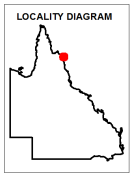
Map 1 - Location



Locality Map

Legend

- 2 kilometre buffer
- Towns
- Highway
- Connector
- Street/Local Road
- Reservoirs
- Lakes
- National Park (Scientific)
- National Park
- National Park (CYPAL)
- Conservation Park
- Resources Reserve
- Forest Reserve
- State Forest
- Timber Reserve
- Nature Refuges
- Coordinated Conservation Areas
- Major rivers/creeks
- Queensland



N

0 1600 3200 4800 6400 8000 m

This product is projected into GDA 1994 Queensland Albers

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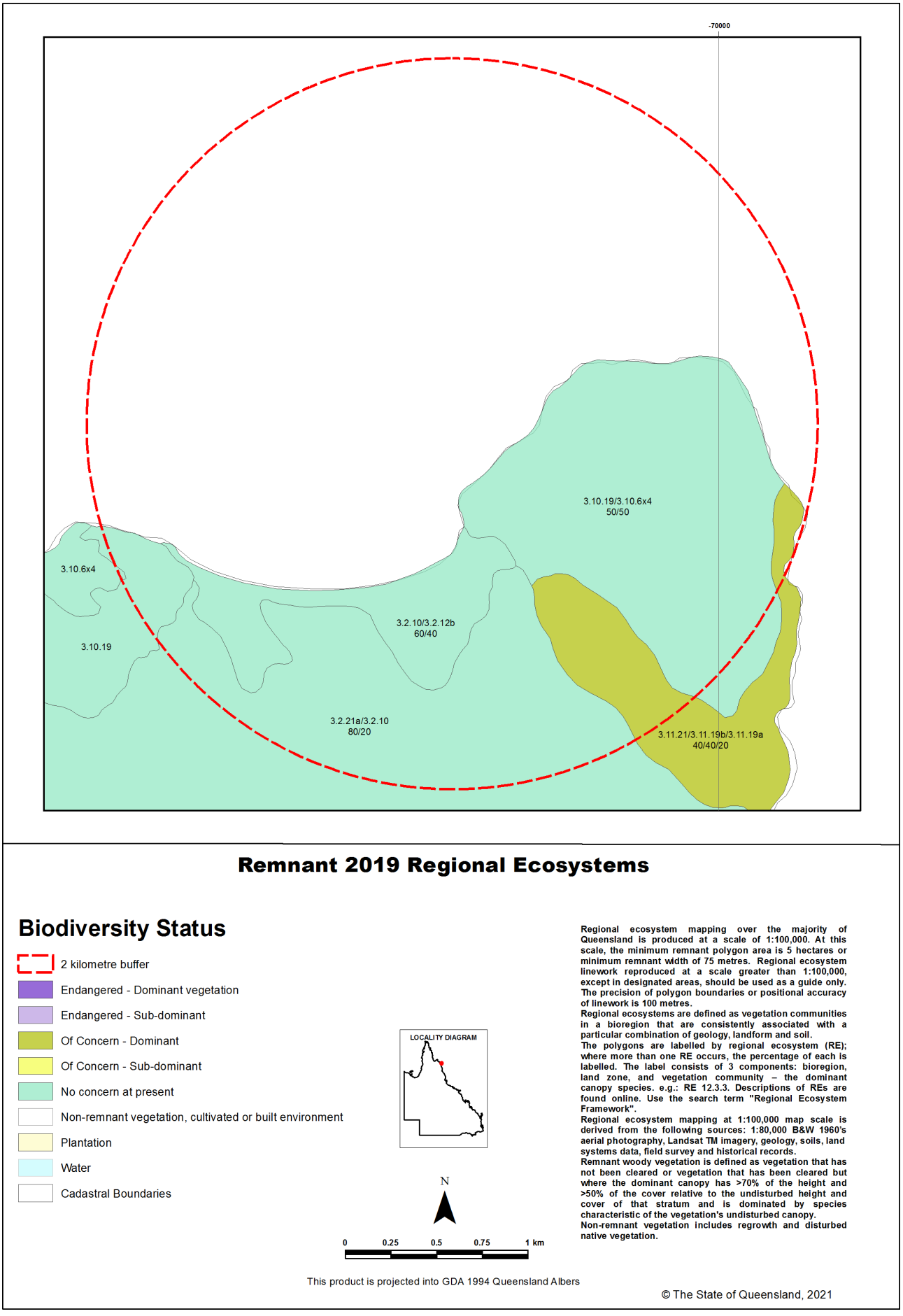
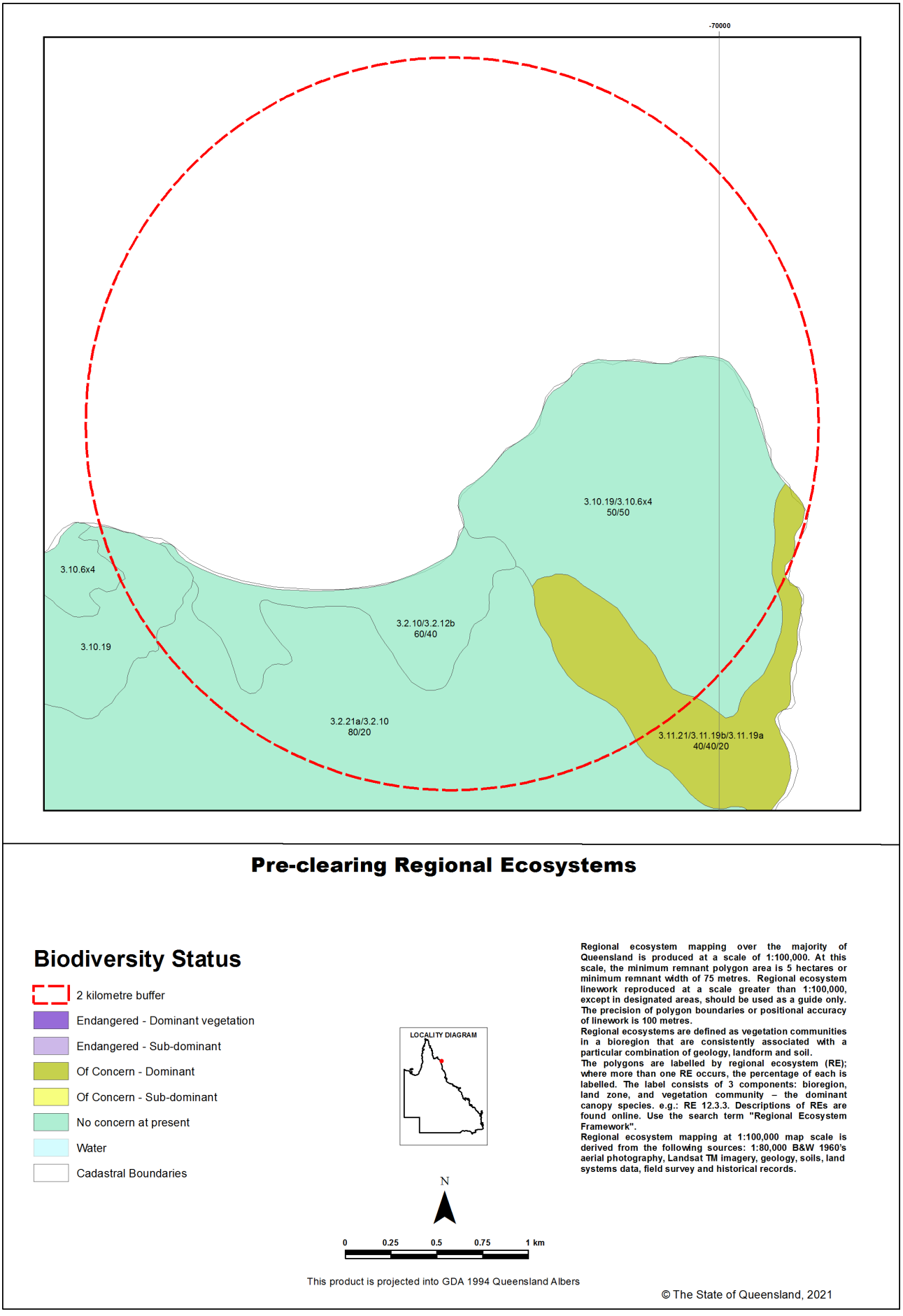
The state of Queensland disclaims all responsibility for information contained in this product and all liability (including without limitation, liability in negligence) for all expenses, losses, damages and costs you may incur as a result of the information being inaccurate or incomplete in any way for any reason.

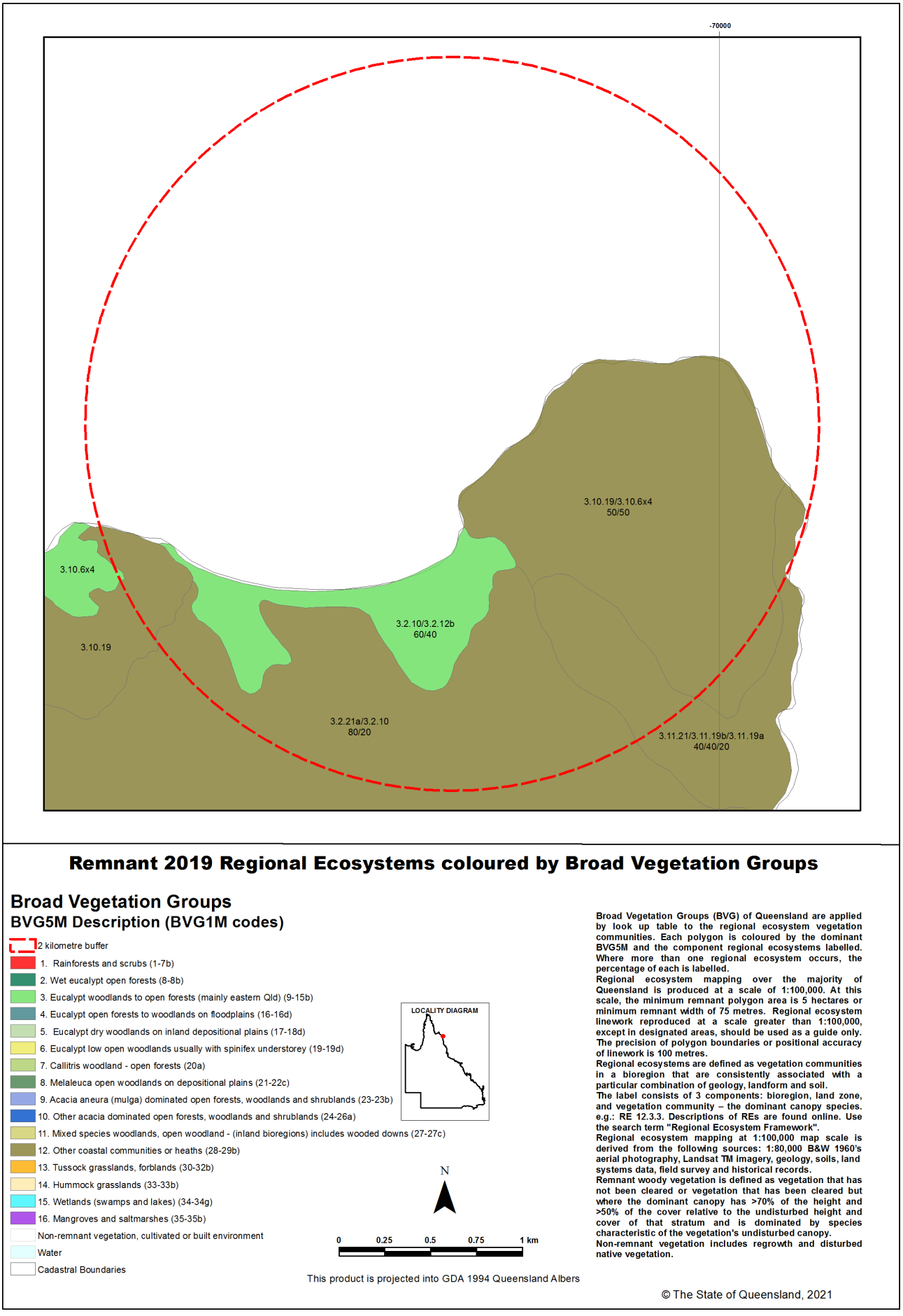
Map 2 - Remnant 2019 regional ecosystems



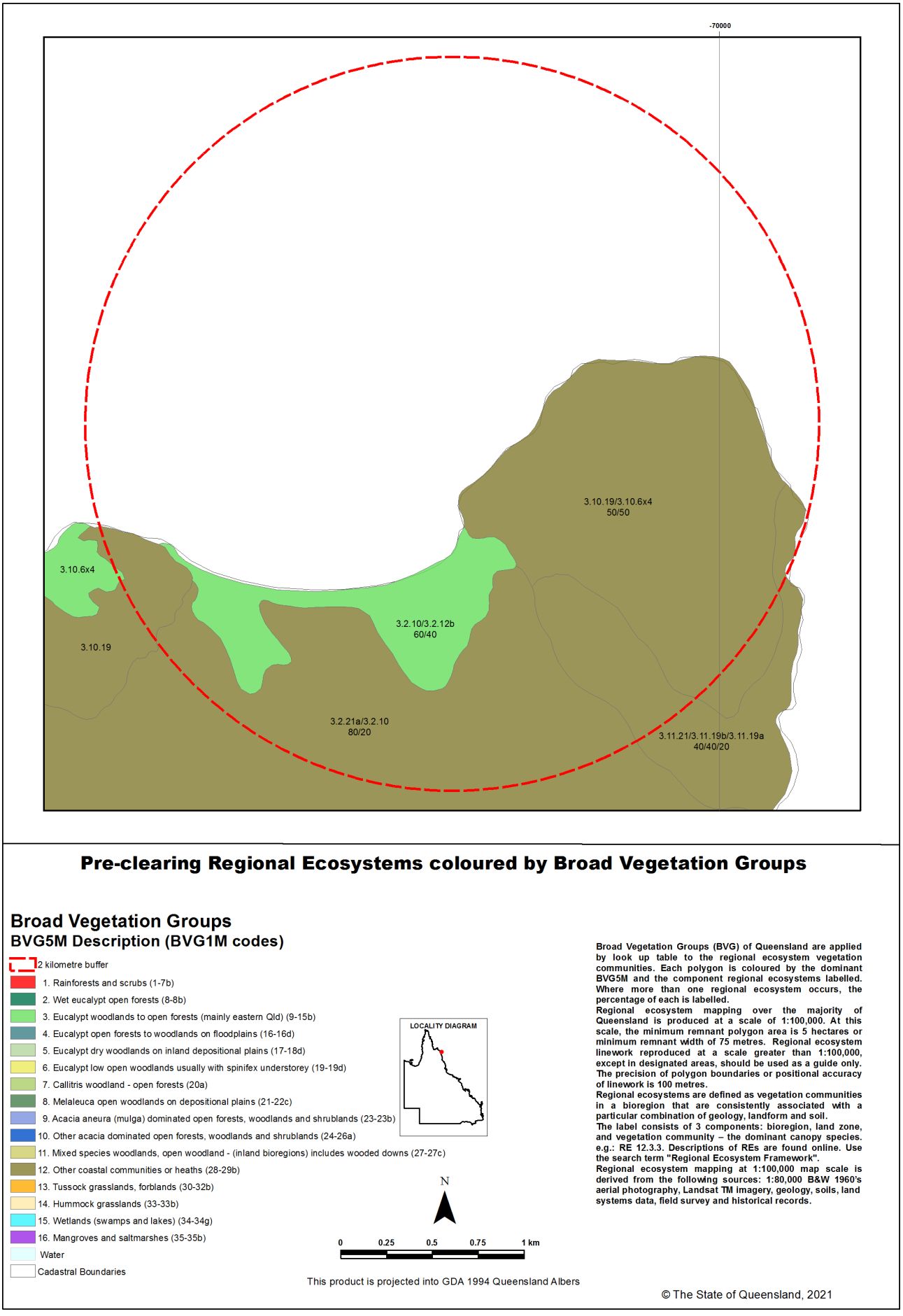
Map 3 - Pre-clearing regional ecosystems



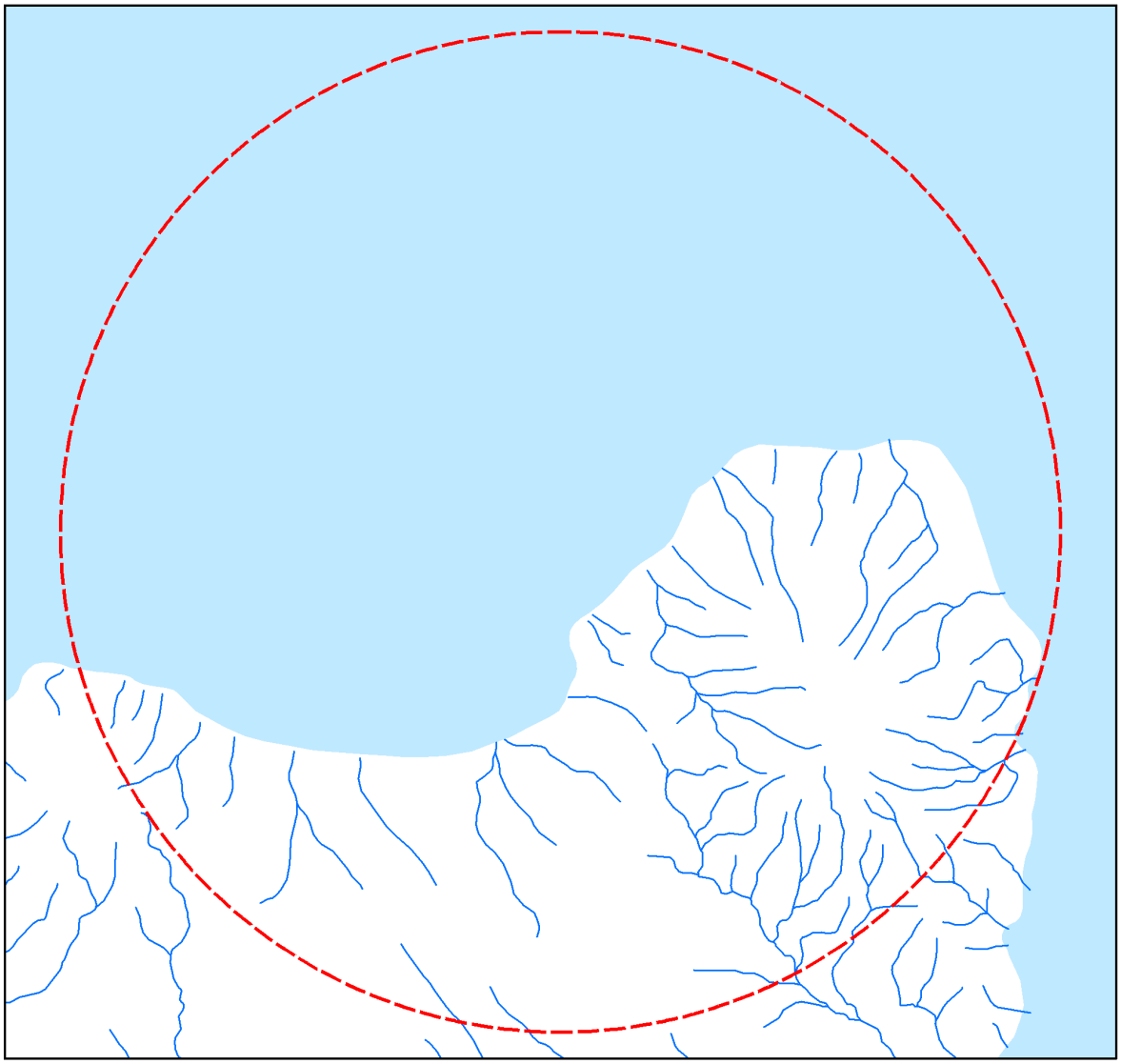
Map 4 - Remnant 2019 regional ecosystems by BVG (5M)



Map 5 - Pre-clearing regional ecosystems by BVG (5M)



Map 6 - Wetlands and waterways



Queensland Wetland Data

Legend

- 2 kilometre buffer
- Towns

Queensland Wetland Data

- Riverine Drainage Lines
- Springs

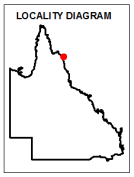
Wetland System - Water Bodies

- Marine Waterbodies
- Estuarine Waterbodies
- Riverine Waterbodies
- Lacustrine Waterbodies
- Palustrine Waterbodies

Wetland System - Regional Ecosystems

- Marine RE
- Estuarine RE
- Riverine RE
- Lacustrine RE
- Palustrine RE
- RE 51-80% wetland (mosaic units)
- RE 1-50% wetland (mosaic units)

LOCALITY DIAGRAM



N

0 240 480 720 960 1200 m

Accuracy information: The positional accuracy of wetland data mapped at a scale of 1:100,000 is +/-100m with a minimum polygon size of 5ha or 75m wide for linear features, except for areas along the east coa st which are mapped at the 1:50,000 scale with a positional accuracy of +/-50m, with a minimum polygon size of 1ha or 35m wide for linear features. Wetlands smaller than 1ha are not delineated on the wetland data. Consideration of the effects of mapped scale is necessary when interpret ing data at a larger scale, e.g. 1:25,000. For property assessment, digital linework should be used as a guide only. The extent of wetlands depicted on this map is based on rectified 2013 Landsat ETM+ imagery supplied by Statewide Landcover and Trees Study (SLATS), Department of Environment and Science. The extent of water bodies is based on the maximum extent of inundation derived from available Landsat imagery up to and including the 2013 imagery.

This product is projected into GDA 1994 Queensland Albers

Links and Other Information Sources

The Department of Environment and Science's Website -

http://www.qld.gov.au/environment/plants-animals/plants/ecosystems/

provides further information on the regional ecosystem framework, including access to links to the Regional Ecosystem Database, Broad Vegetation Group Definitions, Regional Ecosystem and Land zone descriptions.

Descriptions of the broad vegetation groups of Queensland can be downloaded from:

https://publications.qld.gov.au/dataset/redd/resource/

The methodology for mapping regional ecosystems can be downloaded from:

https://publications.qld.gov.au/dataset/redd/resource/

Technical descriptions for regional ecosystems can be obtained from:

http://www.qld.gov.au/environment/plants-animals/plants/ecosystems/technical-descriptions/

Benchmarks can be obtained from:

http://www.qld.gov.au/environment/plants-animals/biodiversity/benchmarks/

For further information associated with the remnant regional ecosystem dataset used by this report, refer to the metadata associated with the Biodiversity status of pre-clearing and Remnant Regional Ecosystems of Queensland dataset (version listed in **Appendix 1**) which is available through the Queensland Government Information System portal,

http://dds.information.qld.gov.au/dds/

The Queensland Globe is a mapping and data application. As an interactive online tool, Queensland Globe allows you to view and explore Queensland maps, imagery (including up-to-date satellite images) and other spatial data, including regional ecosystem mapping. To further view and explore regional ecosystems over an area of interest, access the Biota Globe (a component of the Queensland Globe). The Queensland Globe can be accessed via the following link:

http://www.dnrm.qld.gov.au/mapping-data/queensland-globe

References

Neldner, V.J., Niehus, R.E., Wilson, B.A., McDonald, W.J.F., Ford, A.J. and Accad, A. (2019). The Vegetation of Queensland. Descriptions of Broad Vegetation Groups. Version 4.0. Queensland Herbarium, Department of Environment and Science.

(https://publications.qld.gov.au/dataset/redd/resource/78209e74-c7f2-4589-90c1-c33188359086)

Neldner, V.J., Wilson, B.A., Dillewaard, H.A., Ryan, T.S., Butler, D.W., McDonald, W.J.F, Addicott, E.P. and Appelman, C.N. (2020). Methodology for survey and mapping of regional ecosystems and vegetation communities in Queensland. Version 5.1. Updated March 2020. Queensland Herbarium, Queensland Department of Environment and Science, Brisbane.

(https://publications.qld.gov.au/dataset/redd/resource/6dee78ab-c12c-4692-9842-b7257c2511e4)

Sattler, P.S. and Williams, R.D. (eds) (1999). *The Conservation Status of Queensland's Bioregional Ecosystems*. Environmental Protection Agency, Brisbane.

Appendices

Appendix 1 - Source Data

The dataset listed below is available for download from:

http://www.qld.gov.au/environment/plants-animals/plants/ecosystems/download/

- Regional Ecosystem Description Database

The datasets listed below are available for download from:

http://dds.information.qld.gov.au/dds/

- Biodiversity status of pre-clearing and 2019 remnant regional ecosystems of Queensland
- Pre-clearing Vegetation Communities and Regional Ecosystems of Queensland
- Queensland Wetland Data Version - Wetland lines
- Queensland Wetland Data Version - Wetland points
- Queensland Wetland Data Version - Wetland areas

Appendix 2 - Acronyms and Abbreviations

AOI	- Area of Interest
GDA94	- Geocentric Datum of Australia 1994
GIS	- Geographic Information System
RE	- Regional Ecosystem
REDD	- Regional Ecosystem Description Database
VMA	- *Vegetation Management Act 1999*

Australian Government

Department of Agriculture, Water and the Environment

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 20/08/21 14:49:54

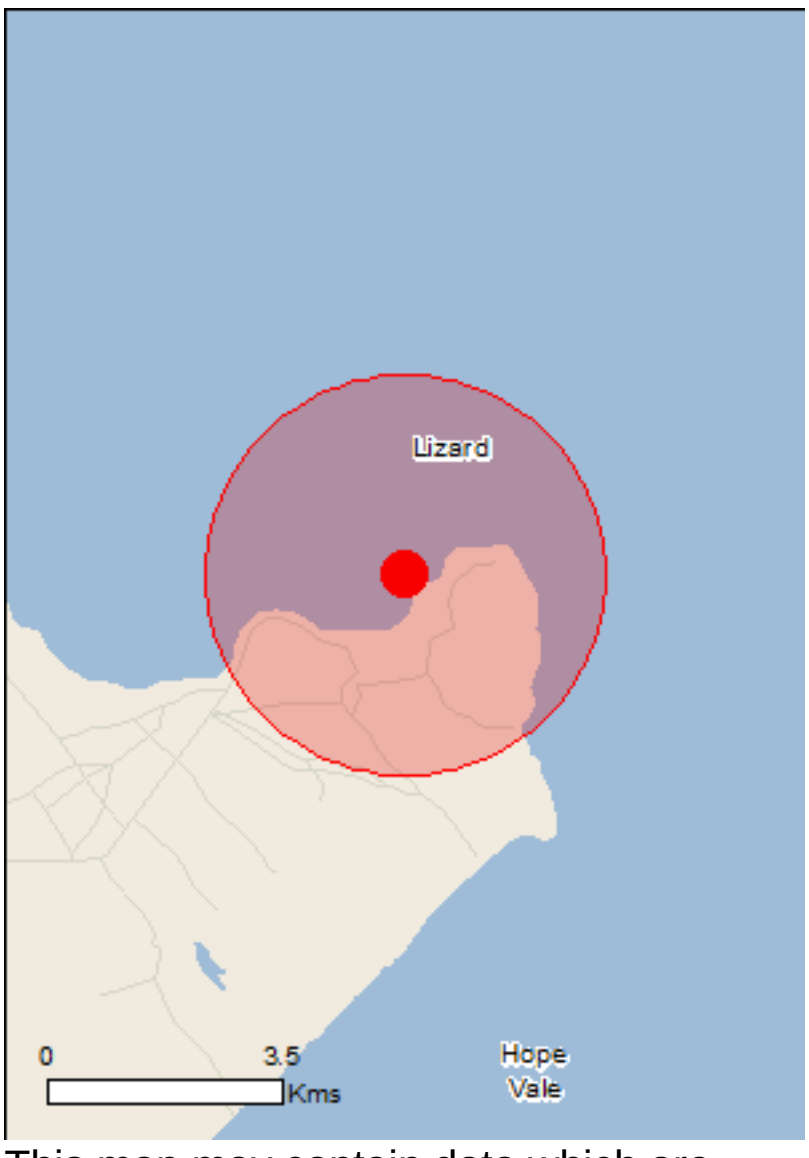
Summary

Details

- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

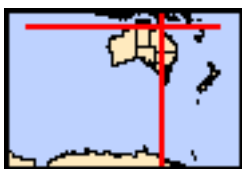
Caveat

Acknowledgements



Coordinates

Buffer: 3.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	1
National Heritage Places:	1
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	36
Listed Migratory Species:	42

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	49
Whales and Other Cetaceans:	12
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	6
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

World Heritage Properties		[Resource Information]
Name	State	Status
Great Barrier Reef	QLD	Declared property

National Heritage Properties		[Resource Information]
Name	State	Status
Natural		
Great Barrier Reef	QLD	Listed place

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat likely to occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area
Fregetta grallaria grallaria White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438]	Vulnerable	Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat likely to occur within area
Limosa lapponica baueri Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Probosciger aterrimus macgillivrayi Palm Cockatoo (Australian) [67033]	Vulnerable	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Fish		

Name	Status	Type of Presence
Stiphodon semoni		
Opal Cling Goby [83909]	Critically Endangered	Species or species habitat may occur within area
Mammals		
Balaenoptera musculus		
Blue Whale [36]	Endangered	Species or species habitat may occur within area
Dasyurus hallucatus		
Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat likely to occur within area
Hipposideros semoni		
Semon's Leaf-nosed Bat, Greater Wart-nosed Horseshoe-bat [180]	Vulnerable	Species or species habitat may occur within area
Macroderma gigas		
Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area
Megaptera novaeangliae		
Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Mesembriomys gouldii rattoides		
Black-footed Tree-rat (north Queensland), Shaggy Rabbit-rat [87620]	Vulnerable	Species or species habitat may occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)		
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat may occur within area
Pteropus conspicillatus		
Spectacled Flying-fox [185]	Endangered	Species or species habitat may occur within area
Rhinolophus robertsi		
Large-eared Horseshoe Bat, Greater Large-eared Horseshoe Bat [87639]	Vulnerable	Species or species habitat likely to occur within area
Xeromys myoides		
Water Mouse, False Water Rat, Yirrkoo [66]	Vulnerable	Species or species habitat may occur within area
Plants		
Dendrobium johannis		
Chocolate Tea Tree Orchid [13585]	Vulnerable	Species or species habitat may occur within area
Eremochloa muricata		
[6469]	Endangered	Species or species habitat known to occur within area
Myrmecodia beccarii		
Ant Plant [11852]	Vulnerable	Species or species habitat likely to occur within area
Vappodes phalaenopsis		
Cooktown Orchid [78894]	Vulnerable	Species or species habitat may occur within area
Reptiles		
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area

Name	Status	Type of Presence
Egernia rugosa		
Yakka Skink [1420]	Vulnerable	Species or species habitat may occur within area
Eretmochelys imbricata		
Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Lepidochelys olivacea		
Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding likely to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sharks		
Carcharodon carcharias		
White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Pristis pristis		
Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron		
Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus		
Common Noddy [825]		Foraging, feeding or related behaviour known to occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Fregata ariel		
Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Fregata minor		
Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat likely to occur within area
Sternula albifrons		
Little Tern [82849]		Species or species habitat may occur within area
Migratory Marine Species		
Anoxypristis cuspidata		
Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat likely to occur within area
Balaenoptera edeni		
Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus		
Blue Whale [36]	Endangered	Species or species habitat may occur within area
Carcharhinus longimanus		
Oceanic Whitetip Shark [84108]		Species or species habitat may occur within area
Carcharodon carcharias		
White Shark, Great White Shark [64470]	Vulnerable	Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding likely to occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat likely to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]		Species or species habitat likely to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Foraging, feeding or related behaviour known to occur within area
Migratory Terrestrial Species		
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat likely to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat likely to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat likely to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat likely to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]		
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat likely to occur within area
Anous stolidus Common Noddy [825]		Foraging, feeding or related behaviour known to occur within area
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat likely to occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat may occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat likely to occur

Name	Threatened	Type of Presence within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat likely to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Sterna albifrons Little Tern [813]		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat may occur within area
Mammals		
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Reptiles		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur

Name	Threatened	Type of Presence
		within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Enhydrina schistosa Beaked Seasnake [1126]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis mcdowelli null [25926]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [1111]		Species or species habitat may occur within area
Lapemis hardwickii Spine-bellied Seasnake [1113]		Species or species habitat may occur within area
Laticauda colubrina a sea krait [1092]		Species or species habitat may occur within area
Laticauda laticaudata a sea krait [1093]		Species or species habitat may occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans		[Resource Information]
Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area

Name	Status	Type of Presence
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Orcaella brevirostris Irrawaddy Dolphin [45]		Species or species habitat likely to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Foraging, feeding or related behaviour known to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

Invasive Species	[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat known to occur within area
Mammals		
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Felis catus		
Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Sus scrofa		
Pig [6]		Species or species habitat likely to occur within area
Plants		
Lantana camara		
Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Reptiles		
Ramphotyphlops braminus		
Flowerpot Blind Snake, Brahminy Blind Snake, Cacing Besi [1258]		Species or species habitat may occur within area

Nationally Important Wetlands	[Resource Information]
Name	State
Cape Flattery Dune Lakes	QLD

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-14.9484 145.33384

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Queensland Government

Department of Environment and Science

Environmental Reports

Matters of State Environmental Significance

For the selected area of interest
Longitude: 145.33384 Latitude: -14.94847 with 2 kilometre radius

Environmental Reports - General Information

The Environmental Reports portal provides for the assessment of selected matters of interest relevant to a user specified location, or area of interest (AOI). All area and derivative figures are relevant to the extent of matters of interest contained within the AOI unless otherwise stated. Please note, if a user selects an AOI via the "central coordinates" option, the resulting assessment area encompasses an area extending for a 2km radius from the point of interest.

All area and area derived figures included in this report have been calculated via reprojecting relevant spatial features to Albers equal-area conic projection (central meridian = 146, datum Geocentric Datum of Australia 1994). As a result, area figures may differ slightly if calculated for the same features using a different co-ordinate system.

Figures in tables may be affected by rounding.

The matters of interest reported on in this document are based upon available state mapped datasets. Where the report indicates that a matter of interest is not present within the AOI (e.g. where area related calculations are equal to zero, or no values are listed), this may be due either to the fact that state mapping has not been undertaken for the AOI, that state mapping is incomplete for the AOI, or that no values have been identified within the site.

The information presented in this report should be considered as a guide only and field survey may be required to validate values on the ground.

Please direct queries about these reports to: Planning.Support@des.qld.gov.au

Disclaimer

Whilst every care is taken to ensure the accuracy of the information provided in this report, the Queensland Government makes no representations or warranties about its accuracy, reliability, completeness, or suitability, for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which the user may incur as a consequence of the information being inaccurate or incomplete in any way and for any reason.

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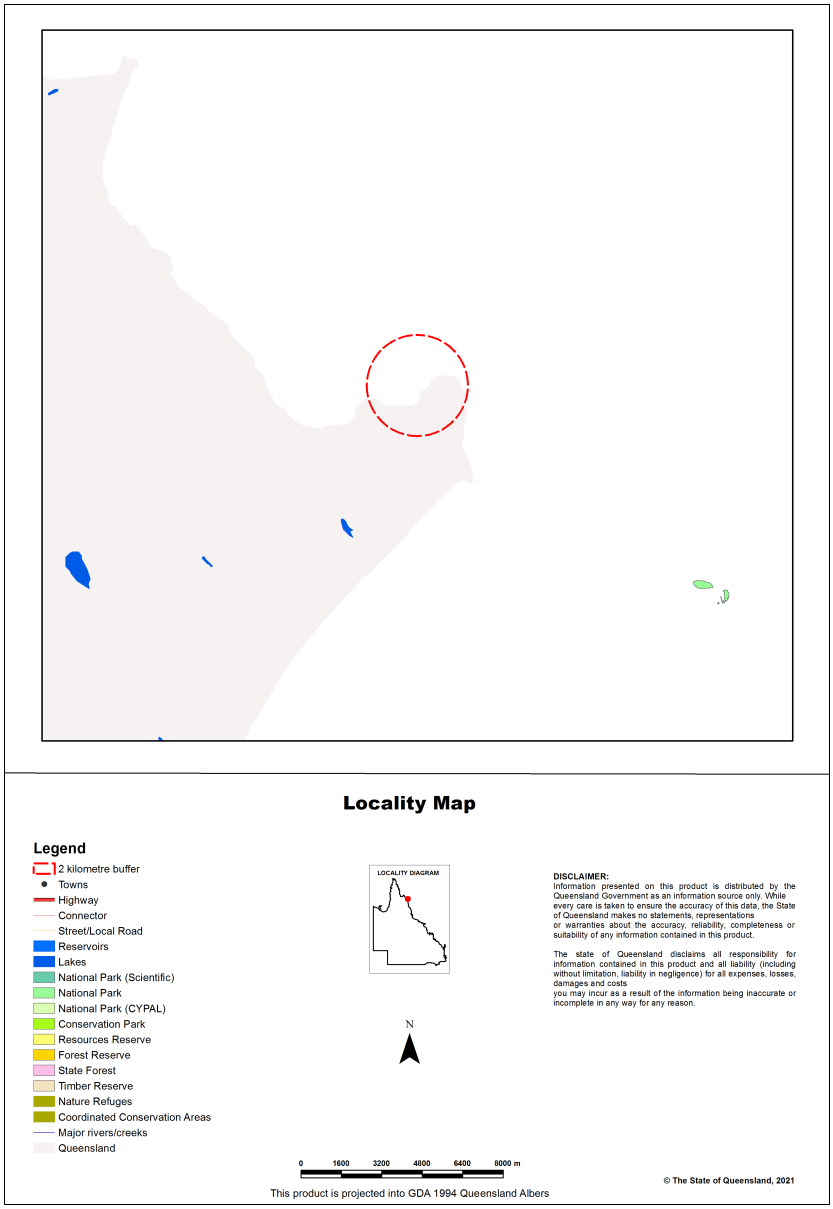
Assessment Area Details

The following table provides an overview of the area of interest (AOI) with respect to selected topographic and environmental values.

Table 1: Summary table, details for AOI Longitude: 145.33384 Latitude: -14.94847

Size (ha)	1,256.55
Local Government(s)	Cook Shire, Hope Vale Aboriginal Shire
Bioregion(s)	Cape York Peninsula
Subregion(s)	Starke Coastal Lowlands
Catchment(s)	Jeannie



Matters of State Environmental Significance (MSES)

MSES Categories

Queensland's State Planning Policy (SPP) includes a biodiversity State interest that states:

'The sustainable, long-term conservation of biodiversity is supported. Significant impacts on matters of national or state environmental significance are avoided, or where this cannot be reasonably achieved; impacts are minimised and residual impacts offset.'

The MSES mapping product is a guide to assist planning and development assessment decision-making. Its primary purpose is to support implementation of the SPP biodiversity policy. While it supports the SPP, the mapping does not replace the regulatory mapping or environmental values specifically called up under other laws or regulations. Similarly, the SPP biodiversity policy does not override or replace specific requirements of other Acts or regulations.

The SPP defines matters of state environmental significance as:

- Protected areas (including all classes of protected area except coordinated conservation areas) under the *Nature Conservation Act 1992* ;

- Marine parks and land within a 'marine national park', 'conservation park', 'scientific research', 'preservation' or 'buffer' zone under the *Marine Parks Act 2004* ;

- Areas within declared fish habitat areas that are management A areas or management B areas under the Fisheries Regulation 2008;

- Threatened wildlife under the *Nature Conservation Act 1992* and special least concern animals under the Nature Conservation (Wildlife) Regulation 2006;

- Regulated vegetation under the *Vegetation Management Act 1999* that is:

    • Category B areas on the regulated vegetation management map, that are 'endangered' or 'of concern' regional ecosystems;

    • Category C areas on the regulated vegetation management map that are 'endangered' or 'of concern' regional ecosystems;

    • Category R areas on the regulated vegetation management map;

    • Regional ecosystems that intersect with watercourses identified on the vegetation management watercourse and drainage feature map;

    • Regional ecosystems that intersect with wetlands identified on the vegetation management wetlands map;

- Strategic Environmental Areas under the *Regional Planning Interests Act 2014* ;

- Wetlands in a wetland protection area of wetlands of high ecological significance shown on the Map of Queensland Wetland Environmental Values under the Environment Protection Regulation 2019;

- Wetlands and watercourses in high ecological value waters defined in the Environmental Protection (Water) Policy 2009, schedule 2;

- Legally secured offset areas.

MSES Values Present

The MSES values that are present in the area of interest are summarised in the table below:

Table 2: Summary of MSES present within the AOI

1a Protected Areas- estates	0.0 ha	0.0 %
1b Protected Areas- nature refuges	0.0 ha	0.0 %
1c Protected Areas- special wildlife reserves	0.0 ha	0.0 %
2 State Marine Parks- highly protected zones	0.0 ha	0.0 %
3 Fish habitat areas (A and B areas)	0.0 ha	0.0 %
4 Strategic Environmental Areas (SEA)	0.0 ha	0.0 %
5 High Ecological Significance wetlands on the map of Referable Wetlands	0.0 ha	0.0 %
6a High Ecological Value (HEV) wetlands	0.0 ha	0.0 %
6b High Ecological Value (HEV) waterways **	0.0 km	Not applicable
7a Threatened (endangered or vulnerable) wildlife	41.17 ha	3.3%
7b Special least concern animals	0.0 ha	0.0 %
7c i Koala habitat area - core (SEQ)	0.0 ha	0.0 %
7c ii Koala habitat area - locally refined (SEQ)	0.0 ha	0.0 %
8a Regulated Vegetation - Endangered/Of concern in Category B (remnant)	60.94 ha	4.8%
8b Regulated Vegetation - Endangered/Of concern in Category C (regrowth)	0.0 ha	0.0 %
8c Regulated Vegetation - Category R (GBR riverine regrowth)	0.0 ha	0.0 %
8d Regulated Vegetation - Essential habitat	0.0 ha	0.0 %
8e Regulated Vegetation - intersecting a watercourse **	6.6 km	Not applicable
8f Regulated Vegetation - within 100m of a Vegetation Management Wetland	0.0 ha	0.0 %
9a Legally secured offset areas- offset register areas	0.0 ha	0.0 %
9b Legally secured offset areas- vegetation offsets through a Property Map of Assessable Vegetation	0.0 ha	0.0 %

Additional Information with Respect to MSES Values Present

MSES - State Conservation Areas

1a. Protected Areas - estates

(no results)

1b. Protected Areas - nature refuges

(no results)

1c. Protected Areas - special wildlife reserves

(no results)

2. State Marine Parks - highly protected zones

(no results)

3. Fish habitat areas (A and B areas)

(no results)

Refer to **Map 1 - MSES - State Conservation Areas** for an overview of the relevant MSES.

MSES - Wetlands and Waterways

4. Strategic Environmental Areas (SEA)

(no results)

5. High Ecological Significance wetlands on the Map of Queensland Wetland Environmental Values

(no results)

6a. Wetlands in High Ecological Value (HEV) waters

(no results)

6b. Waterways in High Ecological Value (HEV) waters

(no results)

Refer to **Map 2 - MSES - Wetlands and Waterways** for an overview of the relevant MSES.

MSES - Species

7a. Threatened (endangered or vulnerable) wildlife

Values are present

7b. Special least concern animals

Not applicable

7c i. Koala habitat area - core (SEQ)

Not applicable

7c ii. Koala habitat area - locally refined (SEQ)

Not applicable

Threatened (endangered or vulnerable) wildlife habitat suitability models

Species	Common name	NCA status	Presence
Boronia keysii		V	None
Calyptorhynchus lathami	Glossy black cockatoo	V	None
Casuarius casuarius johnsonii	Sthn population cassowary	E	None
Crinia tinnula	Wallum froglet	V	None
Denisonia maculata	Ornamental snake	V	None
Litoria freycineti	Wallum rocketfrog	V	None
Litoria olongburensis	Wallum sedgefrog	V	None
Melaleuca irbyana		E	None
Petaurus gracilis	Mahogany Glider	E	None
Petrogale persephone	Proserpine rock-wallaby	E	None
Phascolarctos cinereus	Koala - outside SEQ*	V	None
Pezoporus wallicus wallicus	Eastern ground parrot	V	None
Taudactylus pleione	Kroombit tinkerfrog	E	None
Xeromys myoides	Water Mouse	V	None

**For koala model, this includes areas outside SEQ. Check 7c SEQ koala habitat for presence/absence.*

Threatened (endangered or vulnerable) wildlife species records

Scientific name	Common name	NCA status	EPBC status	Migratory status
Ctenotus rawlinsoni	Cape heath ctenotus	V		
Crocodylus porosus	estuarine crocodile	V		M-B/E

Special least concern animal species records

(no results)

**Nature Conservation Act 1992 (NCA) Status- Endangered (E), Vulnerable (V) or Special Least Concern Animal (SL). Environment Protection and Biodiversity Conservation Act 1999 (EPBC) status: Critically Endangered (CE) Endangered (E), Vulnerable (V)*

Migratory status (M) - China and Australia Migratory Bird Agreement (C), Japan and Australia Migratory Bird Agreement (J), Republic of Korea and Australia Migratory Bird Agreement (R), Bonn Migratory Convention (B), Eastern Flyway (E)

To request a species list for an area, or search for a species profile, access Wildlife Online at:

https://www.qld.gov.au/environment/plants-animals/species-list/

Refer to **Map 3a - MSES - Species - Threatened (endangered or vulnerable) wildlife and special least concern animals** and **Map 3b - MSES - Species - Koala habitat area (SEQ)** for an overview of the relevant MSES.

MSES - Regulated Vegetation

For further information relating to regional ecosystems in general, go to:
https://www.qld.gov.au/environment/plants-animals/plants/ecosystems/
For a more detailed description of a particular regional ecosystem, access the regional ecosystem search page at:
https://environment.ehp.qld.gov.au/regional-ecosystems/

8a. Regulated Vegetation - Endangered/Of concern in Category B (remnant)

Regional ecosystem	Vegetation management polygon	Vegetation management status
3.11.21/3.11.19b/3.11.19a	O-dom	rem_oc
3.10.19/3.10.6x2/3.2.7	O-subdom	rem_oc

8b. Regulated Vegetation - Endangered/Of concern in Category C (regrowth)

Not applicable

8c. Regulated Vegetation - Category R (GBR riverine regrowth)

Not applicable

8d. Regulated Vegetation - Essential habitat

Not applicable

8e. Regulated Vegetation - intersecting a watercourse**

A vegetation management watercourse is mapped as present

8f. Regulated Vegetation - within 100m of a Vegetation Management wetland

Not applicable

Refer to **Map 4 - MSES - Regulated Vegetation** for an overview of the relevant MSES.

MSES - Offsets

9a. Legally secured offset areas - offset register areas

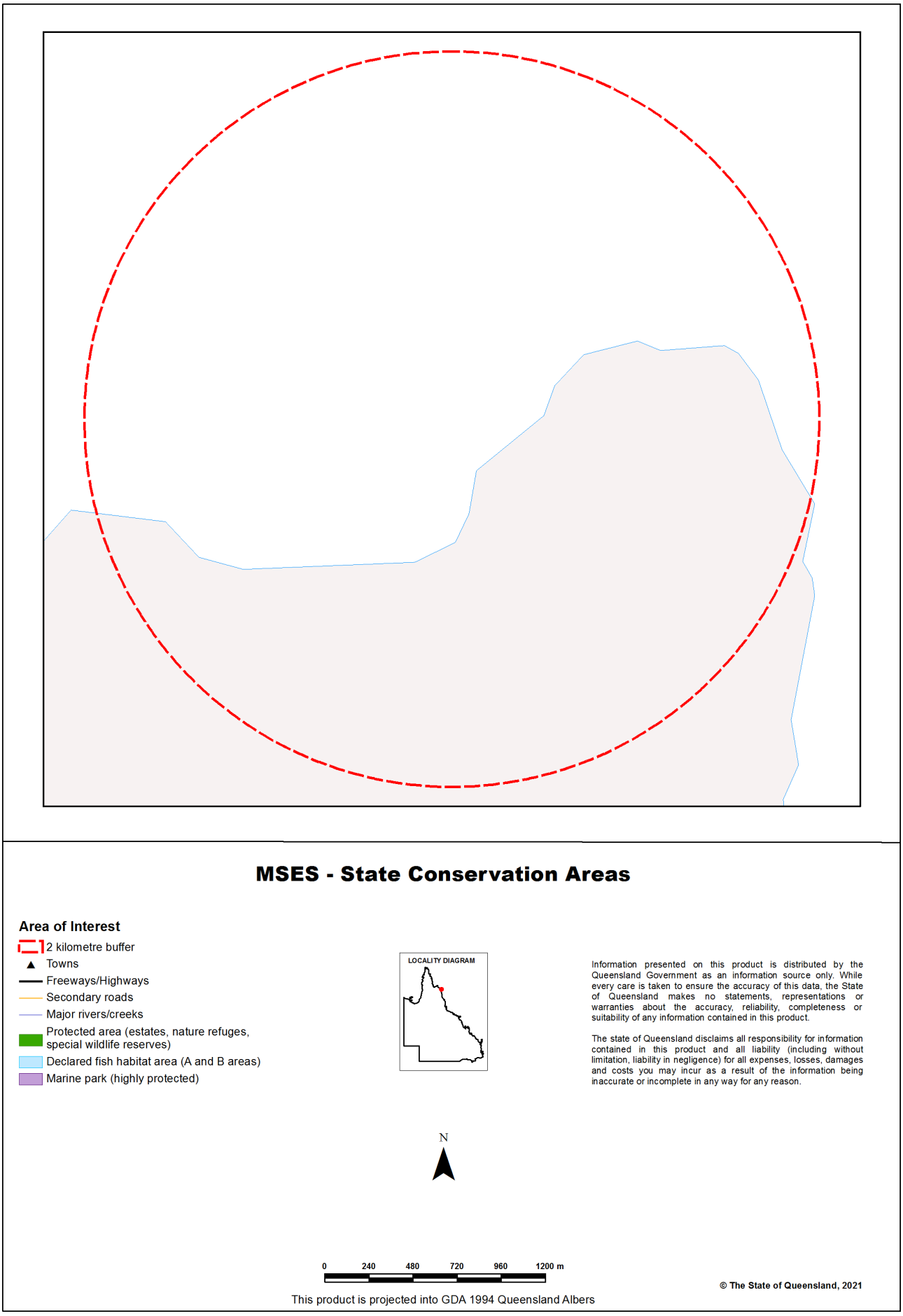
(no results)

9b. Legally secured offset areas - vegetation offsets through a Property Map of Assessable Vegetation

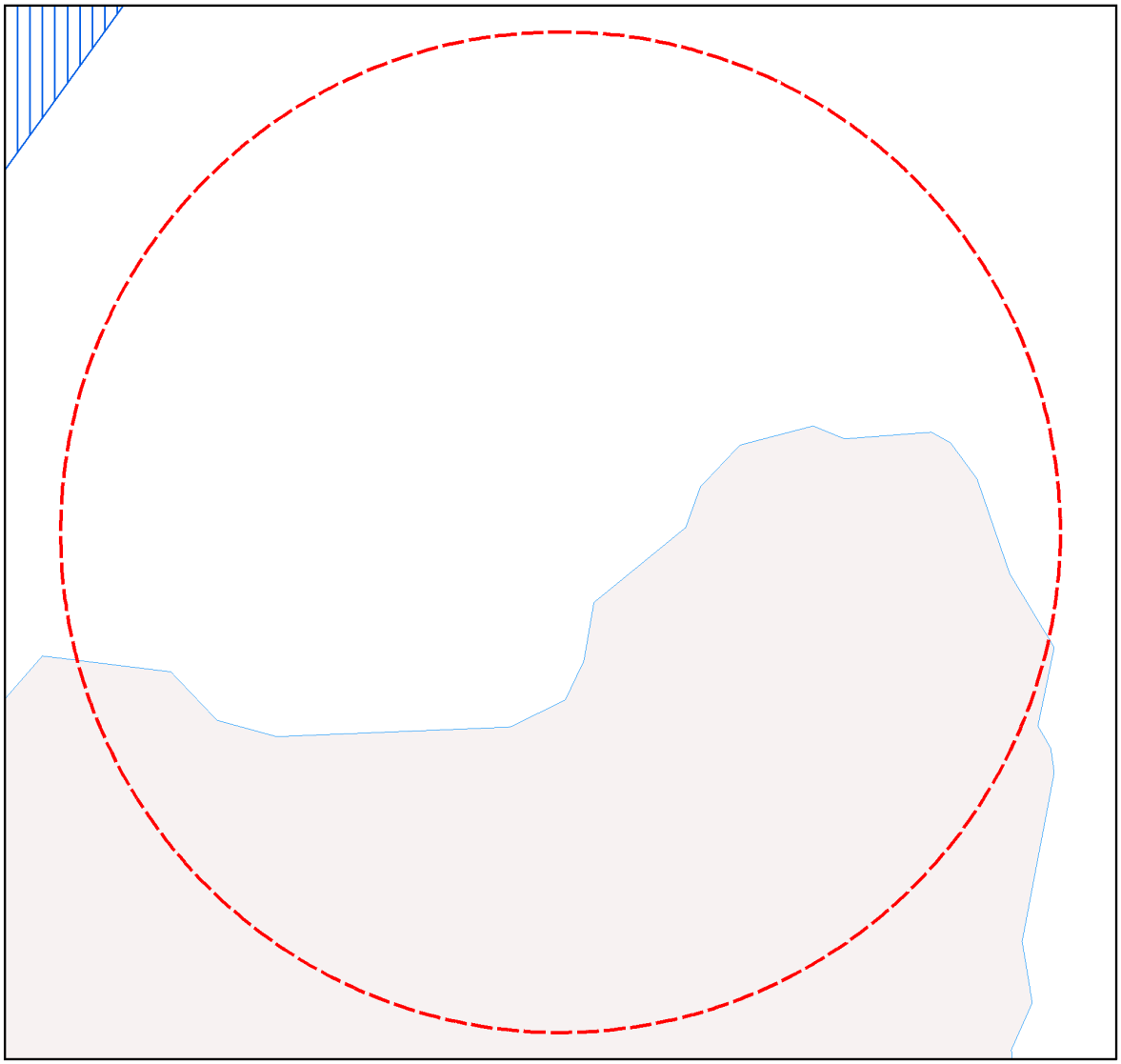
(no results)

Refer to **Map 5 - MSES - Offset Areas** for an overview of the relevant MSES.

Map 1 - MSES - State Conservation Areas



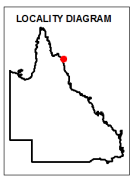
Map 2 - MSES - Wetlands and Waterways

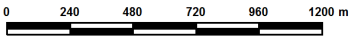


MSES - Wetlands and Waterways

Area of Interest

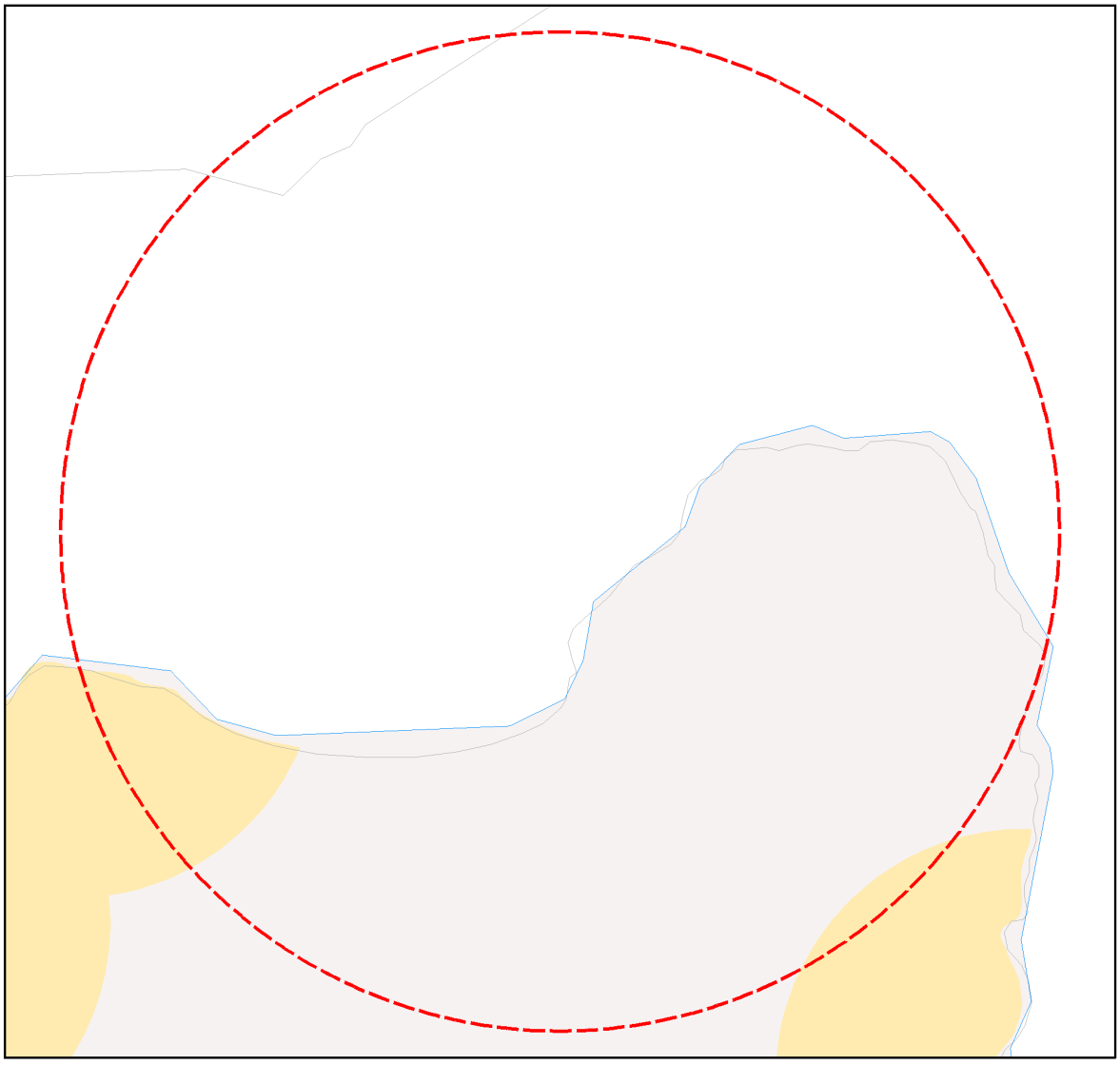
- 2 kilometre buffer
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Declared high ecological value waters (watercourse)
- Strategic environmental area (designated precinct)
- Declared high ecological value waters (wetland)
- High ecological significance wetlands





This product is projected into GDA 1994 Queensland Albers

Map 3a - MSES - Species - Threatened (endangered or vulnerable) wildlife and special least concern animals

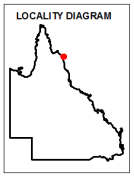


MSES - Species
Threatened (endangered or vulnerable) wildlife and special least concern animals

Area of Interest

- 2 kilometre buffer
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Wildlife habitat (special least concern)
- Wildlife habitat (endangered or vulnerable)

LOCALITY DIAGRAM



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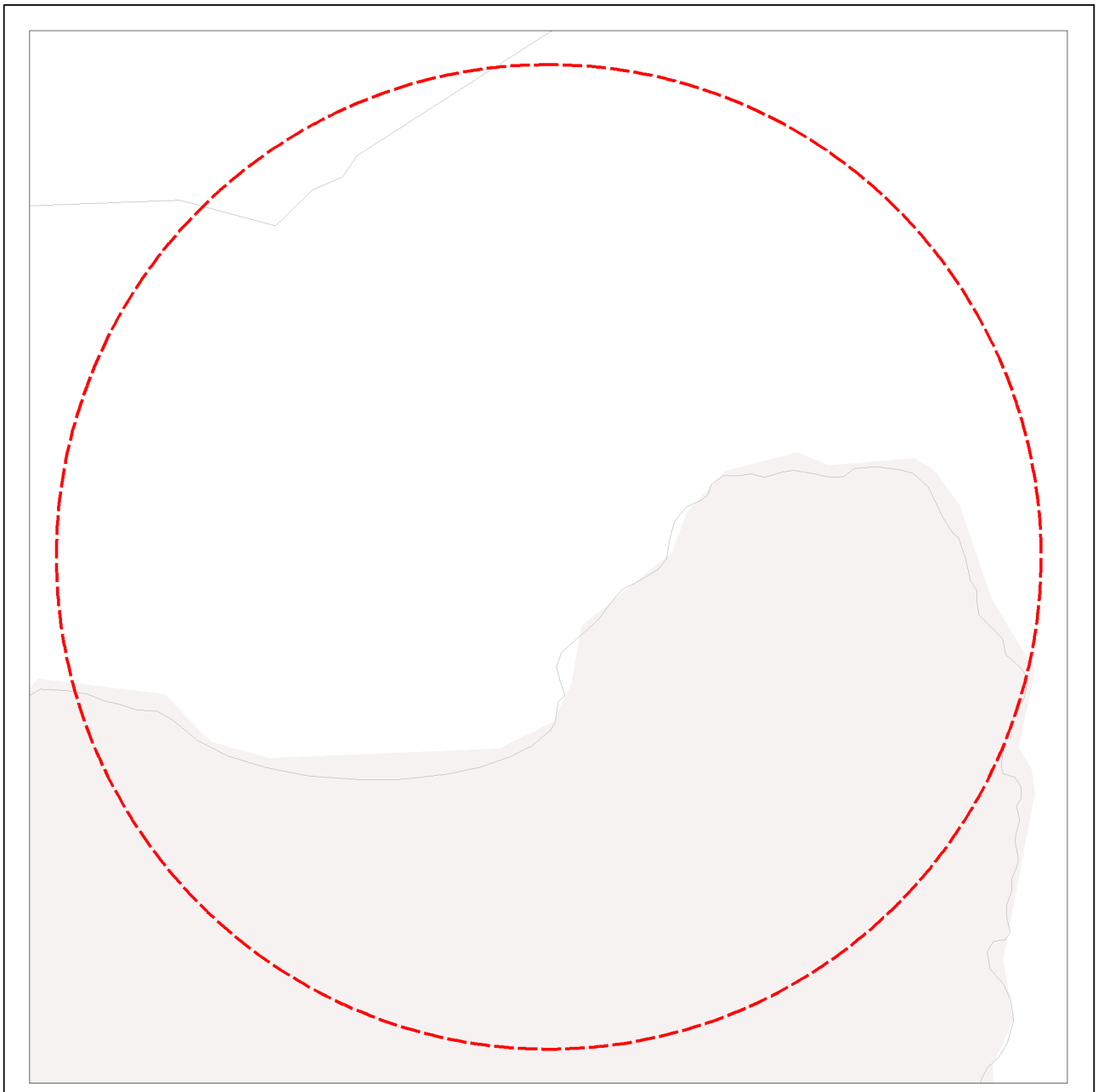
N

0 240 480 720 960 1200 m

This product is projected into GDA 1994 Queensland Albers

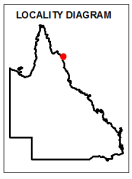
Map 3b - MSES - Species - Koala habitat area (SEQ)



MSES - Species
Koala habitat area (SEQ)

Area of Interest
- 2 kilometre buffer
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Koala habitat area (core)
- Koala habitat area (locally refined)

LOCALITY DIAGRAM



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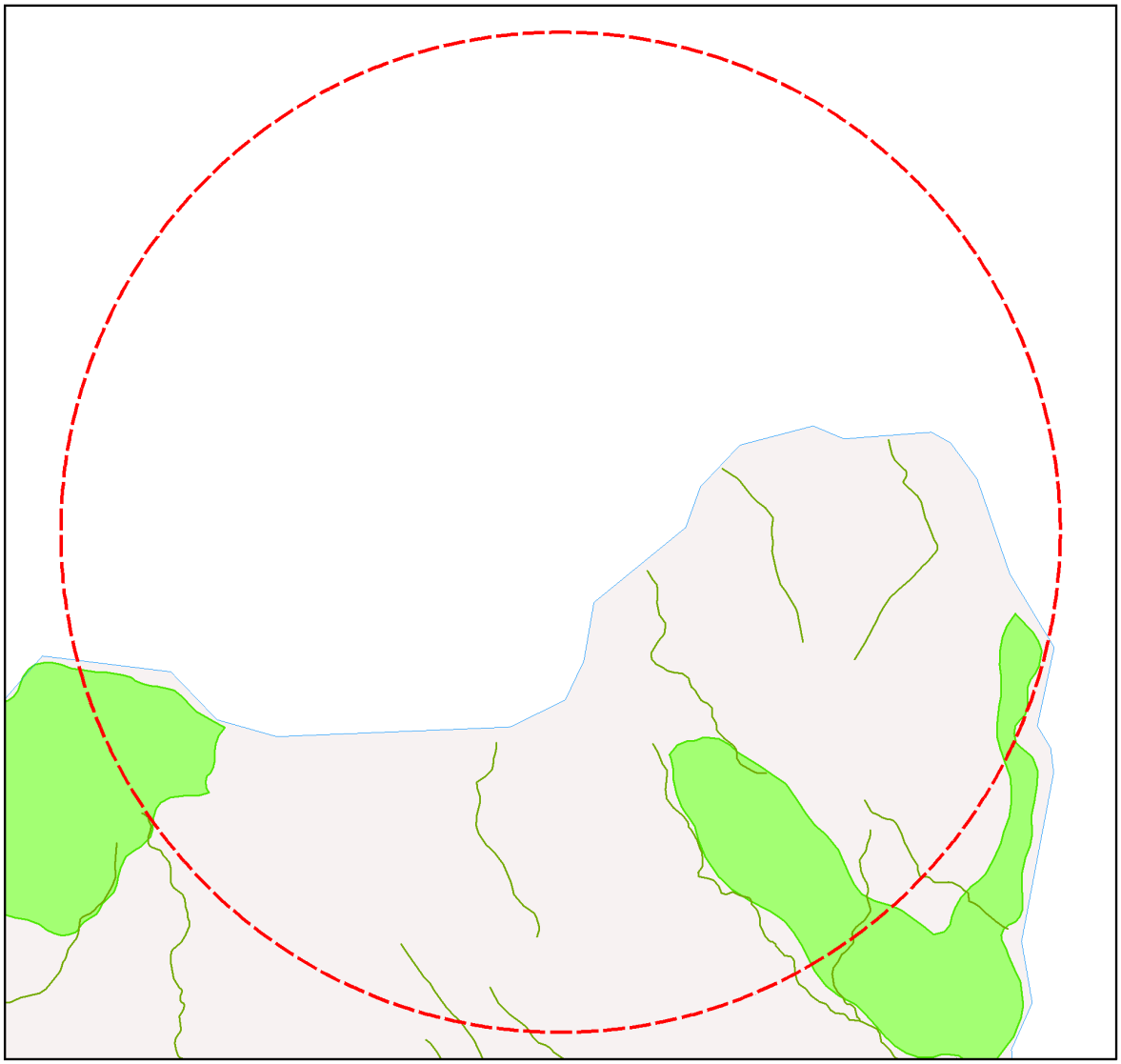
The represented layers for SEQ 'koala habitat area-core' and 'koala habitat area- locally refined' in MSES are sourced directly from the regulatory mapping under the Nature Conservation (Koala) Conservation Plan 2017. Whilst every effort is made to ensure the information remains current, there may be delays between updating versions. Please refer to the original mapping for the most recent version. See https://environment.des.qld.gov.au/wildlife/animals/living-with/koalas/mapping

The koala habitat mapping within South East Queensland uses regional ecosystem linework compiled at a scale varying from 1:25,000 to 1:100,000. Linework should be used as a guide only. The positional accuracy of regional ecosystem data mapped at a scale of 1:100,000 is +/- 100 metres.

0 210 420 630 840 1,050 m

This product is projected into GDA 1994 Queensland Albers

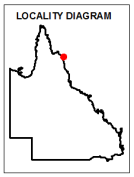
Map 4 - MSES - Regulated Vegetation



MSES - Regulated Vegetation

Area of Interest

- 2 kilometre buffer
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Regulated vegetation (intersecting a watercourse)
- Regulated vegetation (100m from wetland)
- Regulated vegetation (category B - endangered or of concern)
- Regulated vegetation (category C - endangered or of concern)
- Regulated vegetation (category R - GBR riverine)
- Regulated vegetation (essential habitat)

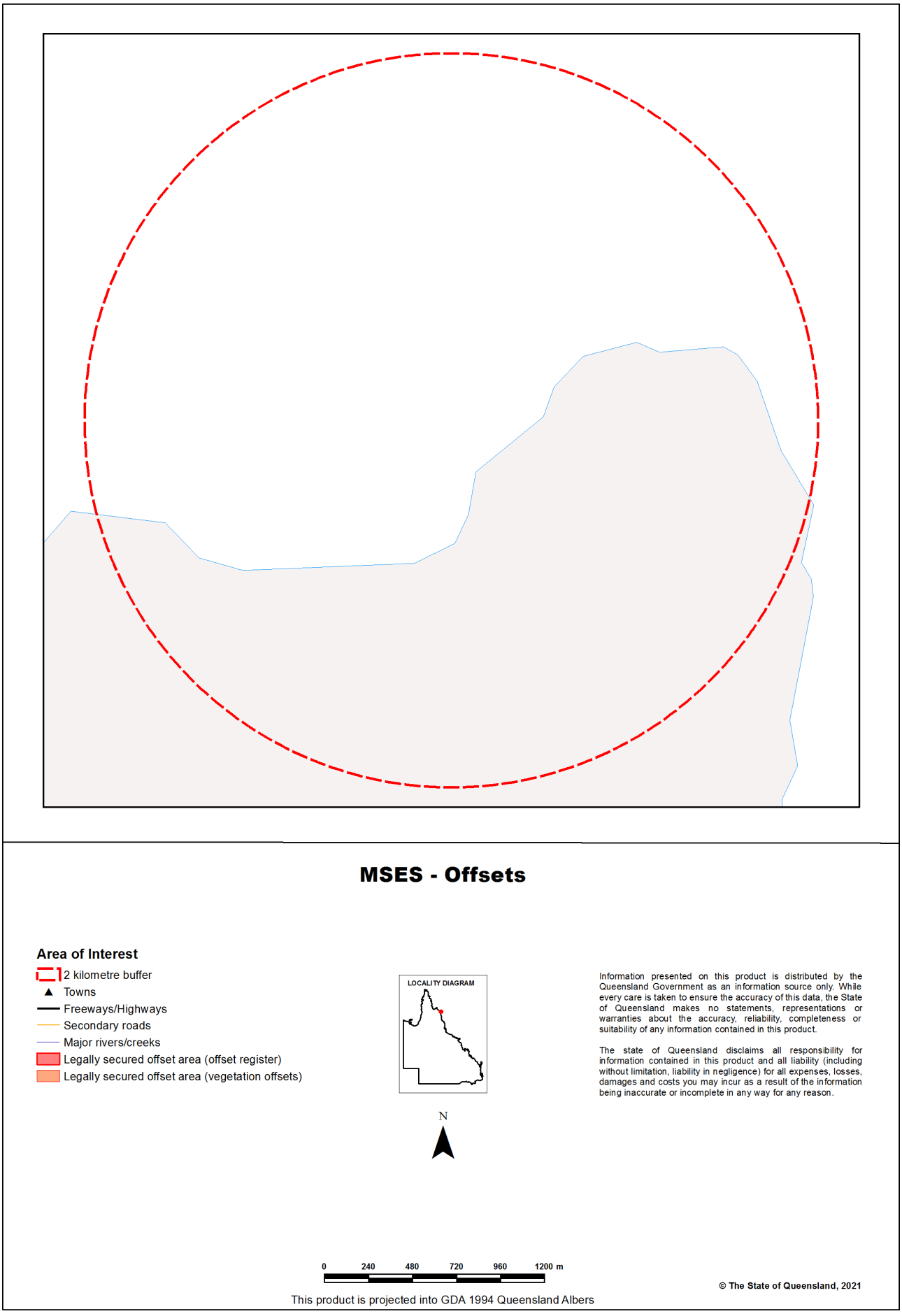


N

0 240 480 720 960 1200 m

This product is projected into GDA 1994 Queensland Albers

Map 5 - MSES - Offset Areas



Appendices

Appendix 1 - Matters of State Environmental Significance (MSES) methodology

MSES mapping is a regional-scale representation of the definition for MSES under the State Planning Policy (SPP). The compiled MSES mapping product is a guide to assist planning and development assessment decision-making. Its primary purpose is to support implementation of the SPP biodiversity policy. While it supports the SPP, the mapping does not replace the regulatory mapping or environmental values specifically called up under other laws or regulations. Similarly, the SPP biodiversity policy does not override or replace specific requirements of other Acts or regulations.

The Queensland Government's "Method for mapping - matters of state environmental significance for use in land use planning and development assessment" can be downloaded from:

http://www.ehp.qld.gov.au/land/natural-resource/method-mapping-mses.html .

Appendix 2 - Source Data

The datasets listed below are available on request from:

http://qldspatial.information.qld.gov.au/catalogue/custom/index.page

- Matters of State environmental significance

Note: MSES mapping is not based on new or unique data. The primary mapping product draws data from a number of underlying environment databases and geo-referenced information sources. MSES mapping is a versioned product that is updated generally on a twice-yearly basis to incorporate the changes to underlying data sources. Several components of MSES mapping made for the current version may differ from the current underlying data sources. To ensure accuracy, or proper representation of MSES values, it is strongly recommended that users refer to the underlying data sources and review the current definition of MSES in the State Planning Policy, before applying the MSES mapping.

Individual MSES layers can be attributed to the following source data available at QSpatial:

MSES layers	**current QSpatial data (http://qspatial.information.qld.gov.au)**
Protected Areas-Estates, Nature Refuges, Special Wildlife Reserves	- Protected areas of Queensland - Nature Refuges - Queensland - Special Wildlife Reserves- Queensland
Marine Park-Highly Protected Zones	Moreton Bay marine park zoning 2008
Fish Habitat Areas	Queensland fish habitat areas
Strategic Environmental Areas-designated	Regional Planning Interests Act - Strategic Environmental Areas
HES wetlands	Map of Queensland Wetland Environmental Values
Wetlands in HEV waters	HEV waters: - EPP Water intent for waters Source Wetlands: - Queensland Wetland Mapping (Current version 5) Source Watercourses: - Vegetation management watercourse and drainage feature map (1:100000 and 1:250000)
Wildlife habitat (threatened and special least concern)	-WildNet database species records - habitat suitability models (various) - SEQ koala habitat areas under the Koala Conservation Plan 2019
VMA regulated regional ecosystems	Vegetation management regional ecosystem and remnant map
VMA Essential Habitat	Vegetation management - essential habitat map
VMA Wetlands	Vegetation management wetlands map
Legally secured offsets	Vegetation Management Act property maps of assessable vegetation. For offset register data-contact DES
Regulated Vegetation Map	Vegetation management - regulated vegetation management map

Appendix 3 - Acronyms and Abbreviations

AOI	- Area of Interest
DES	- Department of Environment and Science
EP Act	- *Environmental Protection Act 1994*
EPP	- Environmental Protection Policy
GDA94	- Geocentric Datum of Australia 1994
GEM	- General Environmental Matters
GIS	- Geographic Information System
MSES	- Matters of State Environmental Significance
NCA	- *Nature Conservation Act 1992*
RE	- Regional Ecosystem
SPP	- State Planning Policy
VMA	- *Vegetation Management Act 1999*

Queensland Government

Department of Environment and Science

Environmental Reports

Biodiversity and Conservation Values

Biodiversity Planning Assessments and Aquatic Conservation Assessments

For the selected area of interest
Longitude: 145.33384 Latitude: -14.94847 with 2 kilometre radius

Environmental Reports - General Information

The Environmental Reports portal provides for the assessment of selected matters of interest relevant to a user specified location, or Area of Interest (AOI). All area and derivative figures are relevant to the extent of matters of interest contained within the AOI unless otherwise stated. Please note, if a user selects an AOI via the "Central co-ordinates" option, the resulting assessment area encompasses an area extending from 2km radius from the point of interest.

All area and area derived figures included in this report have been calculated via reprojecting relevant spatial features to Albers equal-area conic projection (central meridian = 146, datum Geocentric Datum of Australia 1994). As a result, area figures may differ slightly if calculated for the same features using a different co-ordinate system.

Figures in tables may be affected by rounding.

The matters of interest reported on in this document are based upon available state mapped datasets. Where the report indicates that a matter of interest is not present within the AOI (e.g. where area related calculations are equal to zero, or no values are listed), this may be due either to the fact that state mapping has not been undertaken for the AOI, that state mapping is incomplete for the AOI, or that no values have been identified within the site.

The information presented in this report should be considered as a guide only and field survey may be required to validate values on the ground.

Please direct queries about these reports to: biodiversity.planning@des.qld.gov.au

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Summary Information

Tables 1 to 8 provide an overview of the AOI with respect to selected topographic and environmental values.

Table 1: Area of interest details: Longitude: 145.33384 Latitude: -14.94847

Size (ha)	1,256.55
Local Government(s)	Cook Shire, Hope Vale Aboriginal Shire
Bioregion(s)	Cape York Peninsula
Subregion(s)	Starke Coastal Lowlands
Catchment(s)	Jeannie

The following table identifies available Biodiversity Planning Assessments (BPAs) and Aquatic Conservation Assessments (ACAs) with respect to the AOI.

Table 2: Available Biodiversity Planning and Aquatic Conservation Assessments

Assessment Type	Assessment Area and Version
Biodiversity Planning Assessment(s)	Cape York v1.1
Aquatic Conservation Assessment(s) (riverine)	Cape York Catchments v1.1
Aquatic Conservation Assessment(s) (non-riverine)	Cape York Catchments v1.1

Table 3: Remnant regional ecosystems within the AOI as per the Qld Herbarium's 'biodiversity status'

Biodiversity Status	Area (Ha)	% of AOI
Endangered	0.0	0.0
Of concern	42.05	3.35
No concern at present	443.63	35.31

The following table identifies the extent and proportion of the user specified area of interest (AOI) which is mapped as being of "State", "Regional" or "Local" significance via application of the Queensland Department of Environment and Science's *Biodiversity Assessment and Mapping Methodology* (BAMM).

Table 4: Summary table, biodiversity significance

Biodiversity significance	Area (Ha)	% of AOI
State Habitat for EVNT taxa	46.24	3.68
State	481.59	38.33
Regional	0.0	0.0
Local or Other Values	0.0	0.0

Table 5: Non-riverine wetlands intersecting the AOI

Non-riverine wetland types intersecting the area of interest	#
(No Records)	

NB. The figures presented in the table above are derived from the relevant non-riverine Aquatic Conservation Assessment(s). Later releases of wetland mapping produced via the Queensland Wetland Mapping Program may provide more recent

information in regards to wetland extent.

Table 6: Named waterways intersecting the AOI

(no results)

Refer to **Map 1** for general locality information.

The following two tables identify the extent and proportion of the user specified AOI which is mapped as being of "Very High", "High", "Medium", "Low", or "Very Low" aquatic conservation value for riverine and non-riverine wetlands via application of the Queensland Department of Environment and Science's *Aquatic Biodiversity Assessment and Mapping Method* (AquaBAMM).

Table 7: Summary table, aquatic conservation significance (riverine)

Aquatic conservation significance (riverine wetlands)	Area (Ha)	% of AOI
Very High	508.79	40.49
High	0.0	0.0
Medium	0.0	0.0
Low	0.0	0.0
Very Low	0.0	0.0

Table 8: Summary table, aquatic conservation significance (non-riverine)

Aquatic conservation significance (non-riverine wetlands)	Area (Ha)	% of AOI
(No Records)		

Biodiversity Planning Assessments

Introduction

The Department of Environment and Science (DES) attributes biodiversity significance on a bioregional scale through a Biodiversity Planning Assessment (BPA). A BPA involves the integration of ecological criteria using the *Biodiversity assessment and Mapping Methodology* (BAMM) and is developed in two stages: 1) **diagnostic criteria**, and 2) **expert panel criteria**. The diagnostic criteria are based on existing data which is reliable and uniformly available across a bioregion, while the expert panel criteria allows for the refinement of the mapped information from the diagnostic output by incorporating local knowledge and expert opinion.

The BAMM methodology has application for identifying areas with various levels of significance solely for biodiversity reasons. These include threatened ecosystems or taxa, large tracts of habitat in good condition, ecosystem diversity, landscape context and connection, and buffers to wetlands or other types of habitat important for the maintenance of biodiversity or ecological processes. While natural resource values such as dryland salinity, soil erosion potential or land capability are not dealt with explicitly, they are included to some extent within the biodiversity status of regional ecosystems recognised by the DES.

Biodiversity Planning Assessments (BPAs) assign three levels of overall biodiversity significance.

- **State significance** - areas assessed as being significant for biodiversity at the bioregional or state scales. They also include areas assessed by other studies/processes as being significant at national or international scales. In addition, areas flagged as being of State significance due to the presence of endangered, vulnerable and/or near threatened taxa, are identified as "State Habitat for EVNT taxa".
- **Regional significance** - areas assessed as being significant for biodiversity at the subregional scale. These areas have lower significance for biodiversity than areas assessed as being of State significance.
- **Local significance and/or other values** - areas assessed as not being significant for biodiversity at state or regional scales. Local values are of significance at the local government scale.

For further information on released BPAs and a copy of the underlying methodology, go to:

http://www.qld.gov.au/environment/plants-animals/biodiversity/planning/

The GIS results can be downloaded from the Queensland Spatial Catalogue at:

http://qspatial.information.qld.gov.au/geoportal/

The following table identifies the extent and proportion of the user specified AOI which is mapped as being of "State", "Regional" or "Local" significance via application of the BAMM.

Table 9: Summary table, biodiversity significance

Biodiversity significance	Area (Ha)	% of AOI
State Habitat for EVNT taxa	46.24	3.68
State	481.59	38.33
Regional	0.0	0.0
Local or Other Values	0.0	0.0

Refer to **Map 2** for further information.

Diagnostic Criteria

Diagnostic criteria are based on existing data which is reliable and uniformly available across a bioregion. These criteria are diagnostic in that they are used to filter the available data and provide a "first-cut" or initial determination of biodiversity significance. This initial assessment is then combined through a second group of other essential criteria.

A description of the individual diagnostic criteria is provided in the following sections.

Criteria A. Habitat for EVNT taxa: Classifies areas according to their significance based on the presence of endangered, vulnerable and/or rare (EVNT) taxa. EVNT taxa are those scheduled under the *Nature Conservation Act 1992* and/or the

Environment Protection and Biodiversity Conservation Act 1999. It excludes highly mobile fauna taxa which are instead considered in Criterion H and brings together information on EVNT taxa using buffering of recorded sites or habitat suitability models (HSM) where available.

Criteria B. Ecosystem value: Classifies on the basis of biodiversity status of regional ecosystems, their extent in protected areas (presence of poorly conserved regional ecosystems), the presence of significant wetlands; and areas of national importance such as the presence of Threatened Ecological Communities, World Heritage areas and Ramsar sites. Ecosystem value is applied at a bioregional (**B1**) and regional (**B2**) scale.

Criteria C. Tract size: Measures the relative size of tracts of vegetation in the landscape. The size of any tract is a major indicator of ecological significance, and is also strongly correlated with the long-term viability of biodiversity values. Larger tracts are less susceptible to ecological edge effects and are more likely to sustain viable populations of native flora and fauna than smaller tracts.

Criteria D. Relative size of regional ecosystems: Classifies the relative size of each regional ecosystem unit within its bioregion (**D1**) and its subregion (**D2**). Remnant units are compared with all other occurrences with the same regional ecosystem. Large examples of a regional ecosystem are more significant than smaller examples of the same regional ecosystem because they are more representative of the biodiversity values particular to the regional ecosystem, are more resilient to the effects of disturbance, and constitute a significant proportion of the total area of the regional ecosystem.

Criteria F. Ecosystem diversity: Is an indicator of the number of regional ecosystems occurring within an area. An area with high ecosystem diversity will have many regional ecosystems and ecotones relative to other areas within the bioregion.

Criteria G. Context and connection: Represents the extent to which a remnant unit incorporates, borders or buffers areas such as significant wetlands, endangered ecosystems; and the degree to which it is connected to other vegetation.

A summary of the biodiversity status based upon the diagnostic criteria is provided in the following table.

Table 10: Summary of biodiversity significance based upon diagnostic criteria with respect to the AOI

Biodiversity significance	Description	Area (Ha)	% of AOI
State	Remnant contains at least 1 Endangered or 2 Vulnerable or Near Threatened species (A)	46.24	3.68
State	Significant Wetland (B1)	461.0	36.69

Assessment of diagnostic criteria with respect to the AOI

The following table reflects an assessment of the individual diagnostic criteria noted above in regards to the AOI.

Table 11: Assessment of individual diagnostic criteria with respect to the AOI

Diagnostic Criteria	Very High Rating - Area (Ha)	Very High Rating - % of AOI	High Rating - Area (Ha)	High Rating - % of AOI	Medium Rating - Area (Ha)	Medium Rating - % of AOI	Low Rating - Area (Ha)	Low Rating - % of AOI
A: Habitat for EVNT Taxa	46.24	3.7			441.57	35.1		
B1: Ecosystem Value (Bioregion)	507.24	40.4						
B2: Ecosystem Value (Subregion)	202.71	16.1			243.01	19.3	42.09	3.3
C: Tract Size			487.81	38.8				
D1: Relative RE Size (Bioregion)	244.8	19.5			18.86	1.5	224.15	17.8
D2: Relative RE Size (Subregion)	244.8	19.5			243.01	19.3		
F: Ecosystem Diversity	263.66	21.0	224.15	17.8				
G: Context and Connection	183.15	14.6	325.24	25.9				

Other Essential Criteria

Other essential criteria (also known as expert panel criteria) are based on non-uniform information sources and which may rely more upon expert opinion than on quantitative data. These criteria are used to provide a "second-cut" determination of biodiversity significance, which is then combined with the diagnostic criteria for an overall assessment of relative biodiversity significance. A summary of the biodiversity status based upon the other essential criteria is provided in the following table.

Table 12: Summary of biodiversity significance based upon other essential criteria with respect to the AOI

Biodiversity significance	Description	Area (Ha)	% of AOI
State	Refer to Expert Panel data for additional information	40.31	3.21
State	Remnant contains Special Biodiversity Values (view Expert Panel data for further information) (I)	487.52	38.8

A description of each of the other essential criteria and associated assessment in regards to the AOI is provided in the following sections.

Criteria H. Essential and general habitat for priority taxa: Priority taxa are those which are at risk or of management concern, taxa of scientific interest as relictual (ancient or primitive), endemic taxa or locally significant populations (such as a flying fox camp or heronry), highly specialised taxa whose habitat requirements are complex and distributions are not well correlated with any particular regional ecosystem, taxa important for maintaining genetic diversity (such as complex spatial patterns of genetic variation, geographic range limits, highly disjunct populations), taxa critical for management or monitoring of biodiversity (functionally important or ecological indicators), or economic and culturally important taxa.

Criteria I. Special biodiversity values: areas with special biodiversity values are important because they contain multiple taxa in a unique ecological and often highly biodiverse environment. Areas with special biodiversity values can include the following:

- Ia - centres of endemism - areas where concentrations of taxa are endemic to a bioregion or subregion are found.
- Ib - wildlife refugia (Morton *et al*. 1995), for example, islands, mound springs, caves, wetlands, gorges, mountain ranges and topographic isolates, ecological refuges, refuges from exotic animals, and refuges from clearing. The latter may include large areas that are not suitable for clearing because of land suitability/capability.
- Ic - areas with concentrations of disjunct populations.
- Id - areas with concentrations of taxa at the limits of their geographic ranges.
- Ie - areas with high species richness.
- If - areas with concentrations of relictual populations (ancient and primitive taxa).
- Ig - areas containing REs with distinct variation in species composition associated with geomorphology and other environmental variables.
- Ih - an artificial waterbody or managed/manipulated wetland considered by the panel/s to be of ecological significance.
- Ii - areas with a high density of hollow-bearing trees that provide habitat for animals.
- Ij - breeding or roosting sites used by a significant number of individuals.
- Ik - climate change refuge.

The following table identifies the value and extent area of the Other Essential Criteria H and I within the AOI.

Table 13: Relative importance of expert panel criteria (H and I) used to access overall biodiversity significance with respect to the AOI

Expert Panel	Very High Rating - Area (Ha)	Very High Rating - % of AOI	High Rating - Area (Ha)	High Rating - % of AOI	Medium Rating - Area (Ha)	Medium Rating - % of AOI	Low Rating - Area (Ha)	Low Rating - % of AOI
H: Core Habitat Priority Taxa	195.57	15.6			319.99	25.5		
Ia: Centres of Endemism	477.02	38.0						
Ib: Wildlife Refugia	487.53	38.8						
Ic: Disjunct Populations	487.53	38.8						
Id: Limits of Geographic Ranges	426.23	33.9						
Ie: High Species Richness	454.81	36.2						
If: Relictual Populations	426.23	33.9						

Expert Panel	Very High Rating - Area (Ha)	Very High Rating - % of AOI	High Rating - Area (Ha)	High Rating - % of AOI	Medium Rating - Area (Ha)	Medium Rating - % of AOI	Low Rating - Area (Ha)	Low Rating - % of AOI
Ig: Variation in Species Composition	447.02	35.6	30.0	2.4				
Ih: Artificial Wetland								
Ii: Hollow Bearing Trees								
Ij: Breeding or Roosting Site			477.02	38.0				
Ik: Climate Refugia								

NB. Whilst biodiversity values associated with Criteria I may be present within the site (refer to tables 12 and 15), for the New England Tableland and Central Queensland Coast BPAs, area and % area figures associated with Criteria Ia through to Ij cannot be listed in the table above (due to slight variations in data formats between BPAs).

Criteria J. Corridors: areas identified under this criterion qualify either because they are existing vegetated corridors important for contiguity, or cleared areas that could serve this purpose if revegetated. Some examples of corridors include riparian habitats, transport corridors and "stepping stones".

Bioregional and subregional conservation corridors have been identified in the more developed bioregions of Queensland through the BPAs, using an intensive process involving expert panels. Map 3 displays the location of corridors as identified under the Statewide Corridor network. The Statewide Corridor network incorporates BPA derived corridors and for bioregions where no BPA has been assessed yet, corridors derived under other planning processes. *Note: as a result of updating and developing a statewide network, the alignment of corridors may differ slightly in some instances when compared to those used in individual BPAs.*

The functions of these corridors are:

- **Terrestrial** Bioregional corridors, in conjunction with large tracts of remnant vegetation, maintain ecological and evolutionary processes at a landscape scale, by:

  • Maintaining long term evolutionary/genetic processes that allow the natural change in distributions of species and connectivity between populations of species over long periods of time;

  • Maintaining landscape/ecosystems processes associated with geological, altitudinal and climatic gradients, to allow for ecological responses to climate change;

  • Maintaining large scale seasonal/migratory species processes and movement of fauna;

  • Maximising connectivity between large tracts/patches of remnant vegetation;

  • Identifying key areas for rehabilitation and offsets; and

- **Riparian** Bioregional Corridors also maintain and encourage connectivity of riparian and associated ecosystems.

The location of the corridors is determined by the following principles:

- Terrestrial

  • Complement riparian landscape corridors (i.e. minimise overlap and maximise connectivity);

  • Follow major watershed/catchment and/or coastal boundaries;

  • Incorporate major altitudinal/geological/climatic gradients;

  • Include and maximise connectivity between large tracts/patches of remnant vegetation;

  • Include and maximise connectivity between remnant vegetation in good condition; and

- Riparian

  • Located on the major river or creek systems within the bioregion in question.

The total extent of remnant vegetation triggered as being of "State", "Regional" or "Local" significance due to the presence of an overlying BPA derived terrestrial or riparian corridor within the AOI, is provided in the following table. For further information on how remnant vegetation is triggered due to the presence of an overlying BPA derived corridor, refer to the relevant landscape BPA expert panel report(s).

Table 14: Extent of triggered remnant vegetation due to the presence of BPA derived corridors with respect to the AOI

Biodiversity Significance	Area (Ha)	% of AOI
State	0.0	0.0
Regional	0.0	0.0
Local	0.0	0.0

NB: area figures associated with the extent of corridor triggered remnant vegetation are only available for those bioregions where a BPA has been undertaken.

Refer to **Map 3** for further information.

Threatening process/condition (Criteria K) - areas identified by experts under this criterion may be used to amend (upgrade or downgrade) biodiversity significance arising from the "first-cut" analysis. The condition of remnant vegetation is affected by threatening processes such as weeds, ferals, grazing and burning regime, selective timber harvesting/removal, salinity, soil erosion, and climate change.

Assessment of Criteria K with respect to the AOI is not currently included in the "Biodiversity and Conservation Values" report, as it has not been applied to the majority of Queensland due to data/information limitations and availability.

Special Area Decisions

Expert panel derived "Special Area Decisions" are used to assign values to Other Essential Criteria. The specific decisions which relate to the AOI in question are listed in the table below.

Table 15: Expert panel decisions for assigning levels of biodiversity significance with respect to the AOI

Decision Number	Description	Panel Recommended Significance	Criteria Values
cyp_fa_11	High precision records for priority taxa of State significance are contained within the remnant.	State	Criteria H: VERY HIGH
cyp_fa_13	Low precision records for priority taxa of State significance are contained within the remnant.	State	Criteria H: MEDIUM
cyp_fl_02	Grassland RE's less than 10,000ha	State	Ib (wildlife refugia): HIGH / VERY HIGH Ig (distinct variation in species composition): VERY HIGH
cyp_fl_07	Heath	State	Ia (centre of endemism): VERY HIGH Ib (topographic isolate and refuge from clearing): VERY HIGH Ic (disjunct populations): VERY HIGH Id (geographic range limits): VERY HIGH Ie (high species richness): VERY HIGH If (relictual populations): VERY HIGH Ig (distinct variation in species composition): HIGH Ij (breeding/roosting site): HIGH
cyp_fl_16	High precision records for priority taxa of State significance are contained within the remnant.	State	Criteria H: VERY HIGH
cyp_fl_17	High precision records for priority taxa of Regional significance are contained within the remnant.	Regional	Criteria H: HIGH
cyp_fl_18	Low precision records for priority taxa of State significance are contained within the remnant.	State	Criteria H: MEDIUM
cyp_fl_19	Low precision records for priority taxa of Regional significance are contained within the remnant.	Regional	Criteria H: MEDIUM

Decision Number	Description	Panel Recommended Significance	Criteria Values
cyp_l_07	Dunefields - east and west coast	State	Ib (topographic isolate and refuge from clearing): VERY HIGH Ic (disjunct populations): HIGH Ie (high species richness): VERY HIGH
cyp_l_29	Cape Bedford / Cape Flattery	State	Ia (centre of endemism): VERY HIGH Ib (topographic isolate and refuge from clearing): VERY HIGH Ic (disjunct populations): VERY HIGH Ig (distinct variation in species composition): VERY HIGH Ij (breeding/roosting site): VERY HIGH

Expert panel decision descriptions:

cyp_fa_11

Remnant contains core habitat for priority taxa with high precision records

cyp_fa_13

Remnant contains core habitat for priority taxa with low precision records

cyp_fl_02

RE's including 3.3.57, 3.3.62, 3.5.30, 3.8.4, 3.9.8, 3.12.30, 3.12.31, 3.12.32, 3.12.29 and 3.11.19a.

Under threat from thickening. Many less than 1000ha.

Habitat for threatened bird species, general concern about the loss of grasslands on CYP (Crowley Garnett 1998).

cyp_fl_07

Heath communities are nationally restricted and uncommon. CYP contains the largest areas of heathland in Australia, and these examples are largely undisturbed (Abrahams **et al.** 1995).

cyp_fl_16

Remnant contains core habitat for priority taxa with high precision records

cyp_fl_17

Remnant contains habitat for priority taxa with high precision records

cyp_fl_18

Remnant contains core habitat for priority taxa with low precision records

cyp_fl_19

Remnant contains habitat for priority taxa with low precision records

cyp_l_07

Dunefield rise - prograding dune systems, associated vine scrubs and trapped wetlands. Bird rookeries. Threatened species present. Holocene on west coast, quaternary on east coast.

This decision, combined with cyp_fa_02, cyp_fa_05 and gup_l_03, encompasses all of the Gulf Plains Important Bird Area within CYP (Dutson **et al.** 2009). The IBA values include a significant breeding population of the Sarus Crane (**Grus anitgone**) and the coast is used by > 1% of the global population of a large number of wader species, e.g. Black-tailed Godwit (**Limosa limosa**), Great Knot (**Calidris tenuirostris**) and Eastern Curlew (**Numenius madagascariensis**).

Implemented in ACA as - ar_nr_ec_03; cl_nr_ec_02; du_nr_ec_05; em_nr_ec_02, en_nr_ec_01, ho_nr_ec_03; ic_nr_ec_01; ic_nr_ec_02; ja_nr_ec_04; je_nr_ec_02; jj_nr_ec_04; lo_nr_ec_02; mw_nr_ec_03; op_nr_ec_05; sw_nr_ec_02; we_nr_ec_05; wt_nr_ec_01.

cyp_l_29

Sand country, basalt, sandstone country

From Abrahams **et al.** (1995):

- gegenwalle (Counter-wall) dunes

- large elongate parabolic dunes;

- representative of dune landforms and dune vegetation found in North Queensland;

- high wilderness quality

- largest diversity of dune landforms of any of the dune systems in Northern Australia;

- some of the best examples of evergreen mesophyll/notophyll vine forest on the Peninsula, as well as some other rare vine thicket communities;

- only known habitat of two rare skink species (**Ctenotus rawlinsoni** and **Lerista ingrami**);

- habitat of several threatened plant species and regionally uncommon vegetation types;

- the dune lakes contain a unique faunal assemblage;

- the evergreen notophyll vine forests of the area support several plant species that have widely disjunct populations;

- large roosting populations of the endangered Little Tern (**Sterna albifrons**)

Encompasses ACA decision je_nr_ec_01.

Aquatic Conservation Assessments

Introduction

The Aquatic Biodiversity Assessment and Mapping Method or AquaBAMM (Clayton *et al.* 2006), was developed to assess conservation values of wetlands in queensland, and may also have application in broader geographical contexts. It is a comprehensive method that uses available data, including data resulting from expert opinion, to identify relative wetland conservation/ecological values within a specified study area (usually a catchment). The product of applying this method is an Aquatic Conservation Assessment (ACA) for the study area.

An ACA using AquaBAMM is non-social, non-economic and identifies the conservation/ecological values of wetlands at a user-defined scale. It provides a robust and objective conservation assessment using criteria, indicators and measures that are founded upon a large body of national and international literature. The criteria, each of which may have variable numbers of indicators and measures, are naturalness (aquatic), naturalness (catchment), diversity and richness, threatened species and ecosystems, priority species and ecosystems, special features, connectivity and representativeness. An ACA using AquaBAMM is a powerful decision support tool that is easily updated and simply interrogated through a geographic information system (GIS).

Where they have been conducted, ACAs can provide a source of baseline wetland conservation/ecological information to support natural resource management and planning processes. They are useful as an independent product or as an important foundation upon which a variety of additional environmental and socio-economic elements can be added and considered (i.e. an early input to broader 'triple-bottom-line' decision-making processes). An ACA can have application in:

- determining priorities for protection, regulation or rehabilitation of wetlands and other aquatic ecosystems
- on-ground investment in wetlands and other aquatic ecosystems
- contributing to impact assessment of large-scale development (e.g. dams)
- water resource and strategic regional planning prcesses

For a detailed explanation of the methodology please refer to the summary and expert panel reports relevant to the ACA utilised in this assessment. These reports can be accessed at Wetland *Info*:

http://wetlandinfo.des.qld.gov.au/wetlands/assessment/assessment-methods/aca

The GIS results can be downloaded from the Queensland Spatial Catalogue at:

http://qspatial.information.qld.gov.au/geoportal/

Explanation of Criteria

Under the AquaBAMM, eight criteria are assessed to derive an overall conservation value. Similar to the Biodiversity Assessment and Mapping Methodology, the criteria may be primarily diagnostic (quantitative) or primarily expert opinion (qualitative) in nature. The following sections provide a brief description of each of the 8 criteria.

Criteria 1. Naturalness - Aquatic: This attribute reflects the extent to which a wetland's (riverine, non-riverine, estuarine) aquatic state of naturalness is affected through relevant influencing indicators which include: presence of exotic flora and fauna; presence of aquatic communities; degree of habitat modification and degree of hydrological modification.

Criteria 2. Naturalness - Catchment: The naturalness of the terrestrial systems of a catchment can have an influence on many wetland characteristics including: natural ecological processes e.g. nutrient cycling, riparian vegetation, water chemistry, and flow. The indicators utilised to assess this criterion include: presence of exotic flora and/or fauna; riparian, catchment and flow modification.

Criteria 3. Naturalness - Diversity and Richness: This criterion is common to many ecological assessment methods and can include both physical and biological features. It includes such indicators as species richness, riparian ecosystem richness and geomorphological diversity.

Criteria 4. Threatened Species and Ecosystems: This criterion evaluates ecological rarity characteristics of a wetland. This includes both species rarity and rarity of communities / assemblages. The communities and assemblages are best represented by regional ecosystems. Species rarity is determined by NCA and EPBC status with Endangered, Vulnerable or Near-threatened species being included in the evaluation. Ecosystem rarity is determined by regional ecosystem biodiversity status i.e. Endangered, Of Concern, or Not of Concern.

Criteria 5. Priority Species and Ecosystems: Priority flora and fauna species lists are expert panel derived. These are aquatic, semi-aquatic and riparian species which exhibit at least 1 particular trait in order to be eligible for consideration. For

flora species the traits included:

- It forms significant macrophyte beds (in shallow or deep water).
- It is an important food source.
- It is important/critical habitat.
- It is implicated in spawning or reproduction for other fauna and/or flora species.
- It is at its distributional limit or is a disjunct population.
- It provides stream bank or bed stabilisation or has soil binding properties.
- It is a small population and subject to threatening processes.

Fauna species are included if they meet at least one of the following traits:

- It is endemic to the study area (>75 per cent of its distribution is in the study area/catchment).
- It has experienced, or is suspected of experiencing, a serious population decline.
- It has experienced a significant reduction in its distribution and has a naturally restricted distribution in the study area/catchment.
- It is currently a small population and threatened by loss of habitat.
- It is a significant disjunct population.
- It is a migratory species (other than birds).
- A significant proportion of the breeding population (>one per cent for waterbirds, >75 per cent other species) occurs in the waterbody (see Ramsar criterion 6 for waterbirds).
- Limit of species range.

See the individual expert panel reports for the priority species traits specific to an ACA.

Criteria 6. Special Features: Special features are areas identified by flora, fauna and ecology expert panels which exhibit characteristics beyond those identified in other criteria and which the expert panels consider to be of the highest ecological importance. Special feature traits can relate to, but are not solely restricted to geomorphic features, unique ecological processes, presence of unique or distinct habitat, presence of unique or special hydrological regimes e.g. spring-fed streams. Special features are rated on a 1 - 4 scale (4 being the highest).

Criteria 7. Connectivity: This criterion is based on the concept that appropriately connected aquatic ecosystems are healthy and resilient, with maximum potential biodiversity and delivery of ecosystem services.

Criteria 8. Representativeness: This criterion applies primarily to non-riverine assessments, evaluates the rarity and uniqueness of a wetland type in relation to specific geographic areas. Rarity is determined by the degree of wetland protection within "protected Areas" estate or within an area subject to the *Fisheries Act 1994*, *Coastal Protection and Management Act 1995*, or *Marine Parks Act 2004*. Wetland uniqueness evaluates the relative abundance and size of a wetland or wetland management group within geographic areas such as catchment and subcatchment.

Riverine Wetlands

Riverine wetlands are all wetlands and deepwater habitats within a channel. The channels are naturally or artificially created, periodically or continuously contain moving water, or connecting two bodies of standing water. AquaBAMM, when applied to riverine wetlands uses a discrete spatial unit termed subsections. A subsection can be considered as an area which encompasses discrete homogeneous stream sections in terms of their natural attributes (i.e. physical, chemical, biological and utilitarian values) and natural resources. Thus in an ACA, an aquatic conservation significance score is calculated for each subsection and applies to all streams within a subsection, rather than individual streams as such.

Please note, the area figures provided in Tables 16 and 17, are derived using the extent of riverine subsections within the AOI. Refer to **Map 5** for further information. A summary of the conservation significance of riverine wetlands within the AOI is provided in the following table.

Table 16: Overall level/s of riverine aquatic conservation significance

Aquatic conservation significance (riverine wetlands)	Area (Ha)	% of AOI
Very High	508.79	40.49

Aquatic conservation significance (riverine wetlands)	Area (Ha)	% of AOI
High	0.0	0.0
Medium	0.0	0.0
Low	0.0	0.0
Very Low	0.0	0.0

The individual aquatic conservation criteria ratings for riverine wetlands within the AOI are listed below.

Table 17: Level/s of riverine aquatic conservation significance based on selected criteria

Criteria	Very High Rating - Area (Ha)	Very High Rating - % of AOI	High Rating - Area (Ha)	High Rating - % of AOI	Medium Rating - Area (Ha)	Medium Rating - % of AOI	Low Rating - Area (Ha)	Low Rating - % of AOI
1. Naturalness aquatic			508.79	40.5				
2. Naturalness catchment	508.79	40.5						
3. Diversity and richness	508.79	40.5						
4. Threatened species and ecosystems			508.79	40.5				
5. Priority species and ecosystems	508.79	40.5						
6. Special features	508.79	40.5						
7. Connectivity								
8. Representative-ness								

The table below lists and describes the relevant expert panel decisions used to assign conservation significance values to riverine wetlands within the AOI.

Table 18: Expert panel decisions for assigning overall levels of riverine aquatic conservation significance

Decision number	Special feature	Catchment	Criteria/Indicator/Measure	Conservation rating (1-4)
je_r_ec_02	Mangroves	Jeannie	6.3.1	4

4 is the highest rating/value

Expert panel decision descriptions:

je_r_ec_02

Significant marine vegetation - high species diversity (30spp.). Important ecological role (eg fish nursery areas) that supports local and off-shore fisheries (Abrahams et al. 1995).

Also implemented as BPA decision(s): cyp_fl_08

Non-riverine Wetlands

Non-riverine wetlands include both lacustrine and palustrine wetlands, however, do not currently incorporate estuarine, marine or subterranean wetland types. A summary of the conservation significance of non-riverine wetlands within the AOI is provided in the following table. Refer to **Map 6** for further information.

Table 19: Overall level/s of non-riverine aquatic conservation significance

Aquatic conservation significance (non-riverine wetlands)	Area (Ha)	% of AOI
(No Records)		

The following table provides an assessment of non-riverine wetlands within the AOI and associated aquatic conservation criteria values.

Table 20: Level/s of non-riverine aquatic conservation significance based on selected criteria

Criteria	Very High Rating - Area (Ha)	Very High Rating - % of AOI	High Rating - Area (Ha)	High Rating - % of AOI	Medium Rating - Area (Ha)	Medium Rating - % of AOI	Low Rating - Area (Ha)	Low Rating - % of AOI
(No Records)								

The table below lists and describes the relevant expert panel decisions used to assign conservation significance values to non-riverine wetlands within the AOI.

Table 21: Expert panel decisions for assigning overall levels of non-riverine aquatic conservation significance.

Decision number	Special feature	Catchment	Criteria/Indicator/Measure	Conservation rating (1-4)
(No Records)				

4 is the highest rating/value

Expert panel decision descriptions:

(No Records)

Threatened and Priority Species

Introduction

This chapter contains a list of threatened and priority flora and/or fauna species that have been recorded on, or within 4km of the Assessment Area.

The information presented in this chapter with respect to species presence is derived from compiled databases developed primarily for the purpose of BPAs and ACAs. Data is collated from a number of sources and is updated periodically.

It is important to note that the list of species provided in this report, may differ when compared to other reports generated from other sources such as the State government's WildNet, Herbrecs or the federal government's EPBC database for a number of reasons.

Records for threatened and priority species are filtered and checked based on a number of rules including:

- Taxonomic nomenclature - current scientific names and status,
- Location - cross-check co-ordinates with location description,
- Taxon by location - requires good knowledge of the taxon and history of the record,
- Duplicate records - identify and remove,
- Expert panels - check records and provide new records,
- Flora cultivated records excluded,
- Use precise records less than or equal to 2000m,
- Use recent records greater than or equal to 1975 animals, greater than or equal to 1950 plants.

Threatened Species

Threatened species are those species classified as "Endangered" or "Vulnerable" under the *Environment Protection and Biodiversity Conservation Act 1999* or "Endangered", "Vulnerable" or "Near threatened" under the *Nature Conservation Act 1992*.

The following threatened species have been recorded on, or within approximately 4km of the AOI.

Table 22: Threatened species recorded on, or within 4km of the AOI

Species	Common name	NCA status	EPBC status	Back on Track rank	Migratory species*	Wetland species**	Identified flora/fauna
Crocodylus porosus	estuarine crocodile	V		Low	Y	Y	FA
Ctenotus rawlinsoni	Cape heath ctenotus	V		Low			FA
Dendrobium johannis	brown antelope orchid	V	V	Low			FL
Dermochelys coriacea	leatherback turtle	E	E	Critical	Y		FA

NB. Please note that the threatened species listed in this section are based upon the most recently compiled DES internal state-wide threatened species dataset. This dataset may contain additional records that were not originally available for inclusion in the relevant individual BPAs and ACAs.

**JAMBA - Japan-Australia Migratory Bird Agreement; CAMBA - China-Australia Migratory Bird Agreement; ROKAMBA - Republic of Korea-Australia Migratory Bird Agreement; CMS - Convention on the Conservation of Migratory Species*.

***Y - wetland indicator species*.

BPA Priority Species

A list of BPA priority species that have been recorded on, or within approximately 4km of the AOI is contained in the following table.

Table 23: Priority species recorded on, or within 4km of the AOI

Species	Common name	Back on Track rank	Identified flora/fauna
Acacia legnota	None	None	FL
Asteromyrtus angustifolia	None	None	FL
Boronia alulata	None	None	FL
Carlia dogare	None	L	FA
Cherax cartalacoolah	None	H	FA
Cyclophyllum maritimum	None	None	FL
Denariusa australis	pennyfish	L	FA
Dianella pavopennacea	None	None	FL
Dodonaea polyandra	None	None	FL
Eriachne insularis	None	None	FL
Eriostemon banksii	None	None	FL
Eucalyptus brassiana	Cape York red gum	None	FL
Eucalyptus pellita	large-fruited red mahogany	None	FL
Hibbertia banksii	None	None	FL
Jasminum longipetalum	None	None	FL
Kuhlia rupestris	jungle perch	L	FA
Labichea buettneriana	None	L	FL
Leucopogon lavarackii	None	None	FL
Leucopogon yorkensis	None	None	FL
Macarthuria neocambrica	None	None	FL
Melaleuca arcana	None	None	FL
Melanotaenia maccullochi	McCulloch's rainbowfish	L	FA
Neofabricia myrtifolia	None	None	FL
Neoroepera banksii	None	None	FL
Neosilurus ater	black catfish	L	FA
Numenius phaeopus	whimbrel	L	FA
Oxyeleotris nullipora	poreless gudgeon	L	FA
Porochilus obbesi	Obbes' catfish	L	FA
Pseudomugil gertrudae	spotted blue eye	L	FA

NB. Please note that the list of priority species is based on those species identified in the BPAs, however records for these species may be more recent than the originals used. furthermore, the BPA priority species databases are updated from time to time. At each update, the taxonomic details for all species are amended as necessary to reflect current taxonomic name and/or status changes.

ACA Priority Species

A list of ACA priority species used in riverine and non-riverine ACAs that have been recorded on, or within approximately 4km of the AOI are contained in the following tables.

Table 24: Priority species recorded on, or within 4 km of the AOI - riverine

Species	Common name	Back on Track rank	Identified flora/fauna
Anguilla obscura	Pacific Shortfin Eel	Low	FA
Cherax cartalacoolah	None	High	FA

Species	Common name	Back on Track rank	Identified flora/fauna
Crocodylus porosus	Estuarine Crocodile	Low	FA
Denariusa australis	Pennyfish	Low	FA
Kuhlia rupestris	Jungle Perch	Low	FA
Melaleuca dealbata	swamp tea-tree	None	FL
Melaleuca leucadendra	broad-leaved tea-tree	None	FL
Melanotaenia maccullochi	McCulloch's Rainbowfish	Low	FA
Neosilurus ater	Black Catfish	Low	FA
Oxyeleotris nullipora	Poreless Gudgeon	Low	FA
Porochilus obbesi	Obbe's Catfish	Low	FA
Pseudomugil gertrudae	Spotted Blue Eye	Low	FA

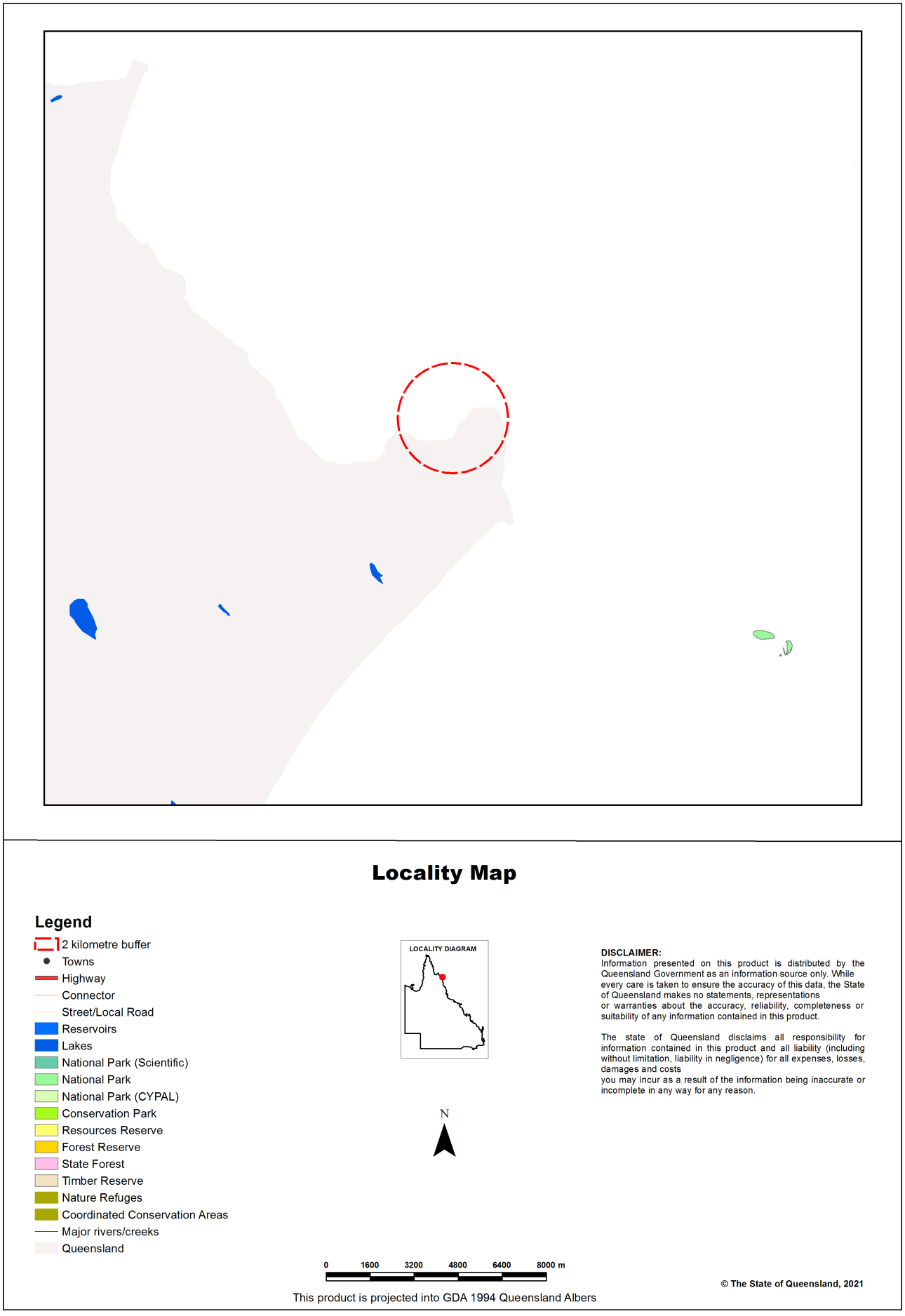
Table 25: Priority species recorded on, or within 4 km of the AOI - non-riverine

Species	Common name	Back on Track rank	Identified flora/fauna
Anguilla obscura	Pacific Shortfin Eel	Low	FA
Baumea rubiginosa	soft twigrush	None	FL
Cherax cartalacoolah	None	High	FA
Crocodylus porosus	Estuarine Crocodile	Low	FA
Denariusa australis	Pennyfish	Low	FA
Gahnia sieberiana	sword grass	None	FL
Melaleuca dealbata	swamp tea-tree	None	FL
Melaleuca leucadendra	broad-leaved tea-tree	None	FL
Melaleuca viridiflora	None	None	FL
Melanotaenia maccullochi	McCulloch's Rainbowfish	Low	FA
Neosilurus ater	Black Catfish	Low	FA
Oxyeleotris nullipora	Poreless Gudgeon	Low	FA
Pseudomugil gertrudae	Spotted Blue Eye	Low	FA

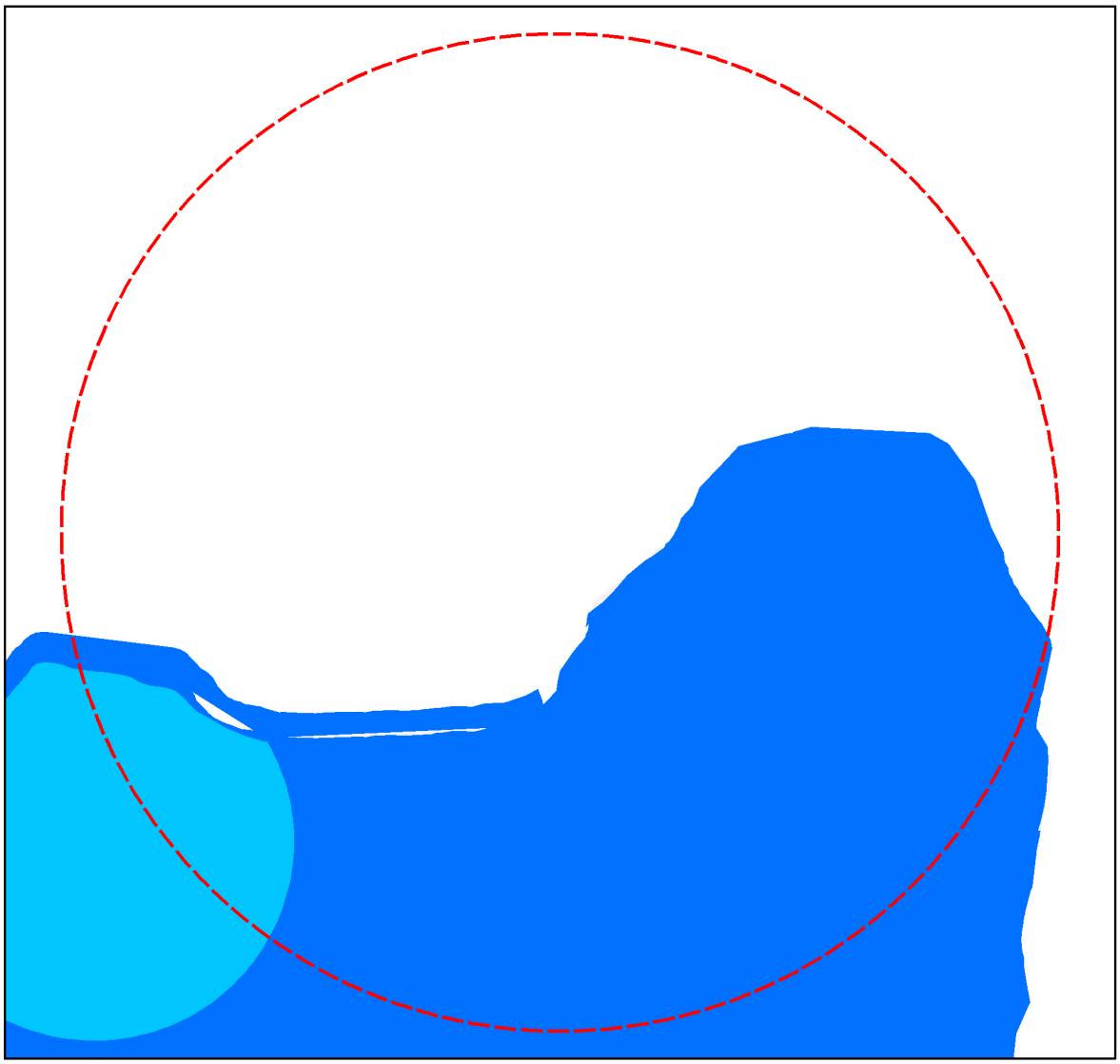
NB. Please note that the priority species records used in the above two tables are comprised of those adopted for the released individual ACAs. The ACA riverine and non-riverine priority species databases are updated from time to time to reflect new release of ACAs. At each update, the taxonomic details for all ACAs records are amended as necessary to reflect current taxonomic name and/or status changes.

Maps

Map 1 - Locality Map



Map 2 - Biodiversity Planning Assessment (BPA)



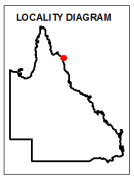
Biodiversity Planning Assessments

Legend

- 2 kilometre buffer
- Towns
- Roads
- Major rivers/creeks
- Queensland

Biodiversity Planning Assessment

- State Habitat for EVNT taxa
- State
- Regional
- Local or Other Values
- Non Bioregion Ecosystem



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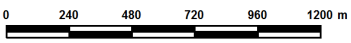
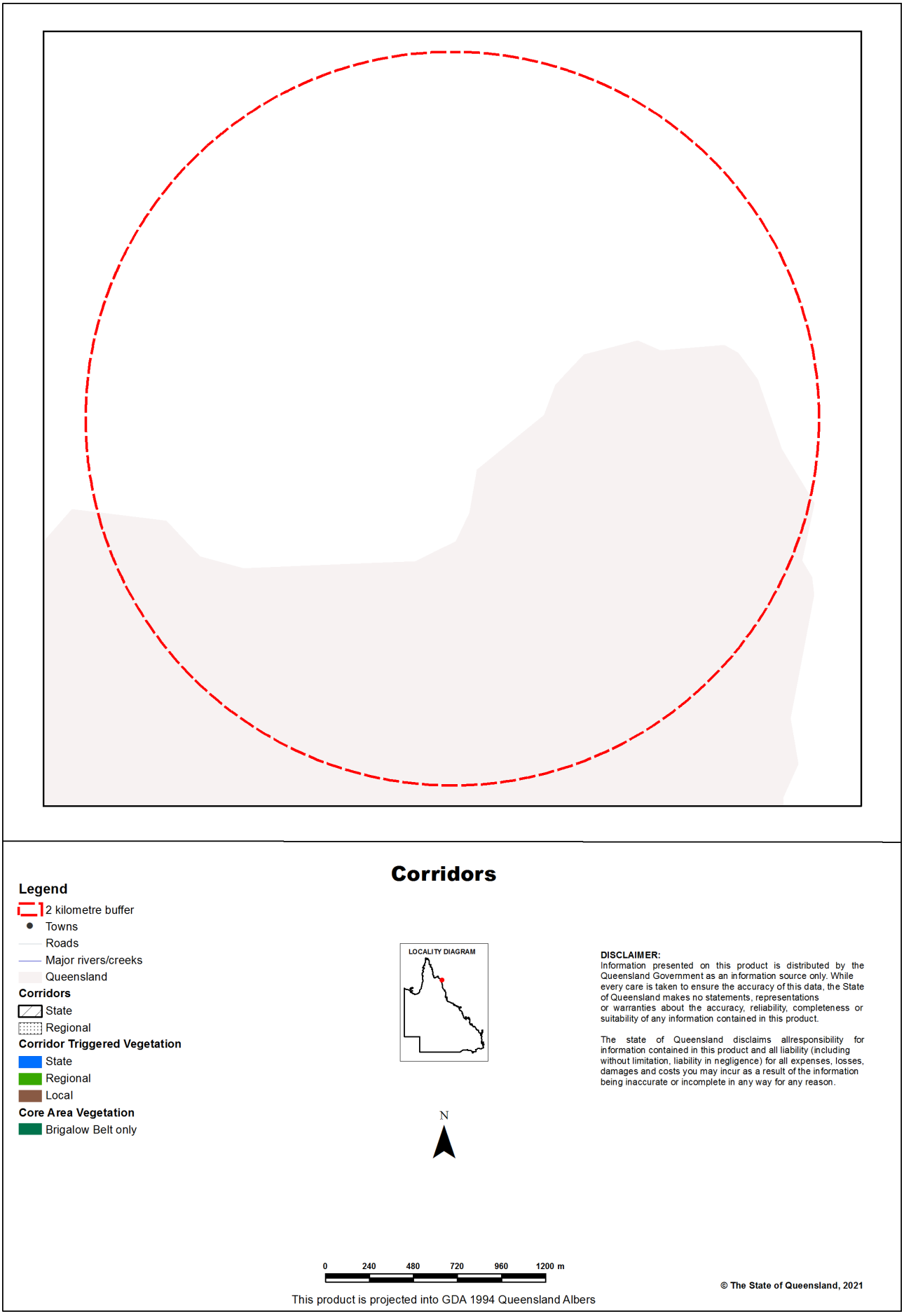
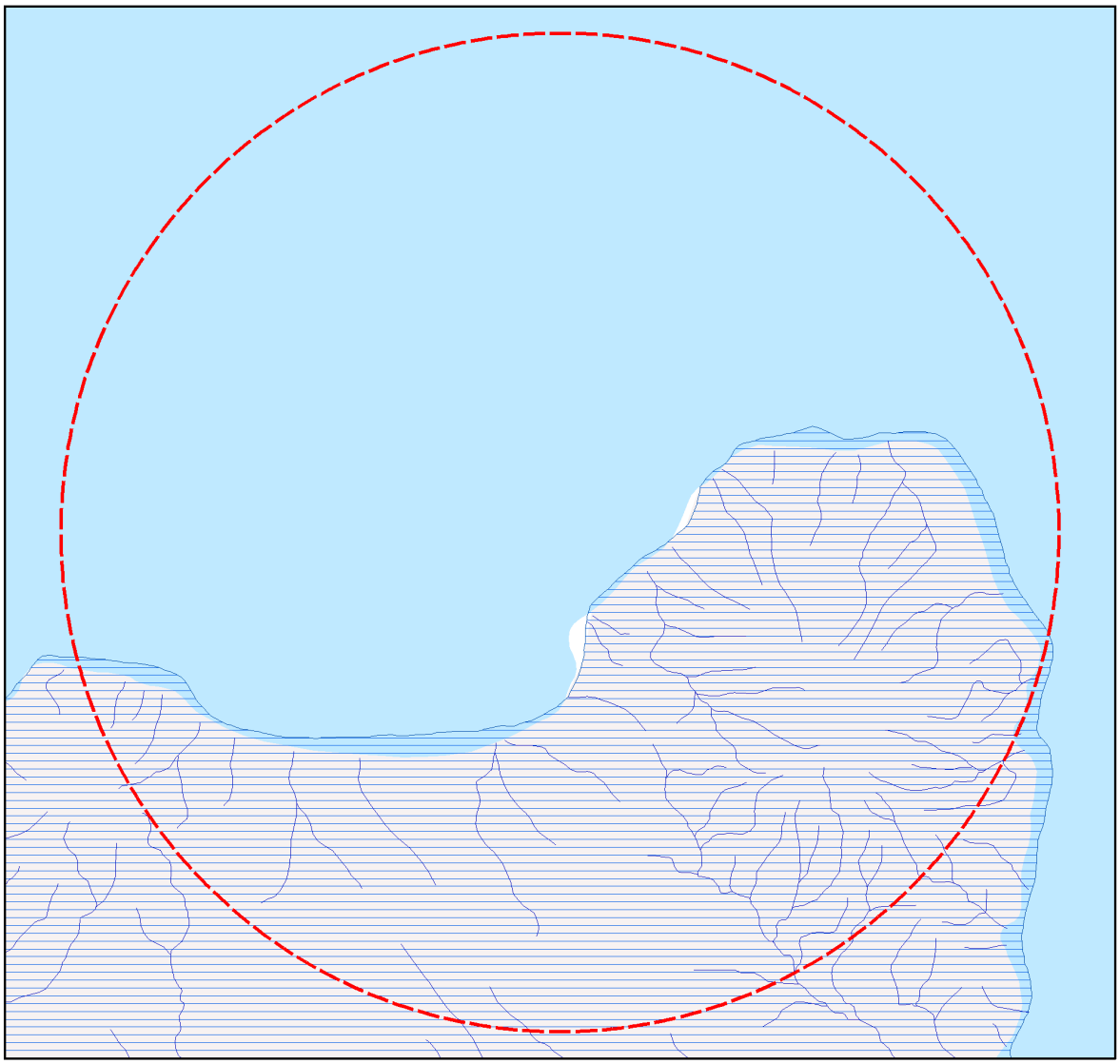


This product is projected into GDA 1994 Queensland Albers

Map 3 - Corridors



Map 4 - Wetlands and waterways



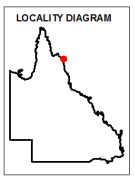
Wetlands and Waterways

Legend

- 2 kilometre buffer
- Towns
- Roads
- Springs
- Rivers/Creeks
- Directory of Important Wetlands
- Ramsar Sites - QLD
- Queensland

Wetland Type

- Marine Waterbodies
- Estuarine Waterbodies
- Riverine Waterbodies
- Lacustrine Waterbodies
- Palustrine Waterbodies
- Marine RE
- Estuarine RE
- Riverine RE
- Lacustrine RE
- Palustrine RE
- RE 51-80% wetland (mosaic units)
- RE 1-50% wetland (mosaic units)



N

0 240 480 720 960 1200 m

This product is projected into GDA 1994 Queensland Albers

DISCLAIMER:
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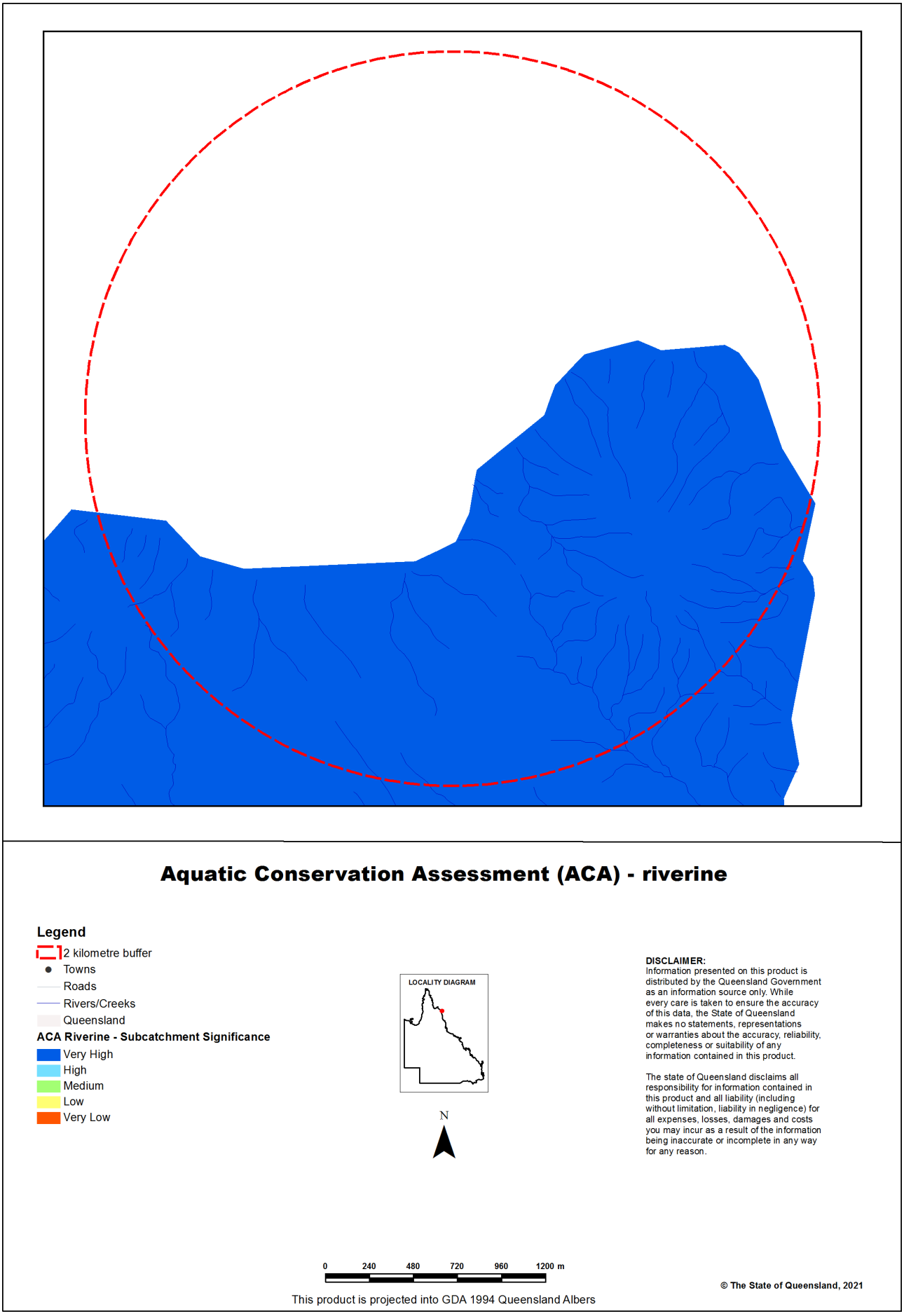
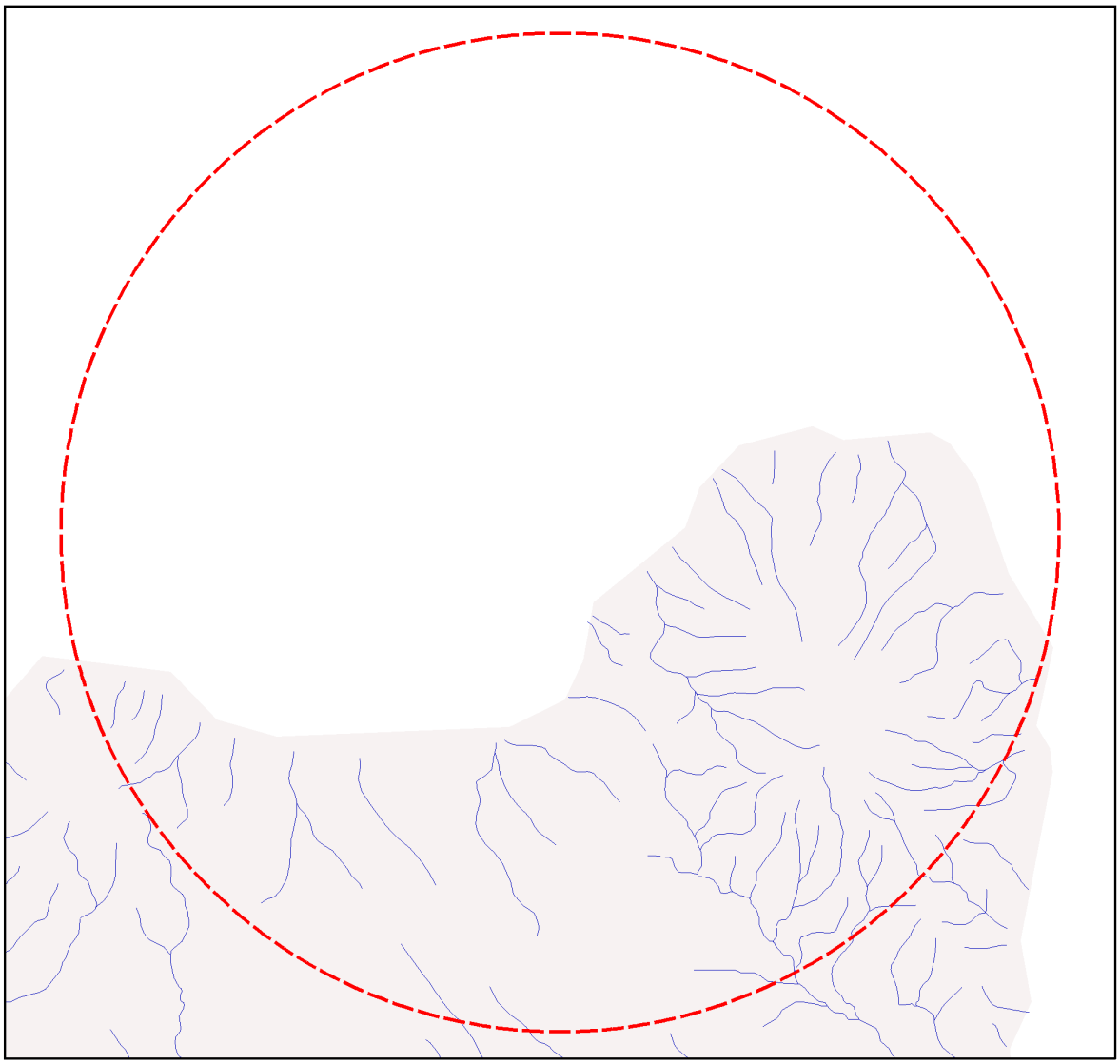
Map 5 - Aquatic Conservation Assessment (ACA) - riverine



Map 6 - Aquatic Conservation Assessment (ACA) - non-riverine



Aquatic Conservation Assessment (ACA) - nonriverine

Legend

- 2 kilometre buffer
- Towns
- Roads
- Rivers/Creeks
- Queensland

ACA Non-riverine

- Very High
- High
- Medium
- Low
- Very Low

LOCALITY DIAGRAM

N

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0 240 480 720 960 1200 m

This product is projected into GDA 1994 Queensland Albers

References

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Sattler, P.S. and Williams, R.D. (eds) (1999). *The Conservation Status of Queensland's Bioregional Ecosystems*. Environmental Protection Agency, Brisbane.

Appendices

Appendix 1 - Source Data

Theme	Datasets
Aquatic Conservation Assessments Non-riverine*	Combination of the following datasets: Cape York Peninsula Non-riverine v1.1 Eastern Gulf of Carpentaria v1.1 Great Barrier Reef Catchment Non-riverine v1.3 Lake Eyre and Bulloo Basins v1.1 QMDB Non-riverine ACA v1.4 Southeast Queensland ACA v1.1 WBB Non-riverine ACA v1.1 Southern Gulf Catchments Non-riverine ACA v1.1
Aquatic Conservation Assessments Riverine*	Combination of the following datasets: Cape York Peninsula Riverine v1.1 Eastern Gulf of Carpentaria v1.1 Great Barrier Reef Catchment Riverine v1.1 Lake Eyre and Bulloo Basins v1.1 QMDB Riverine ACA v1.4 Southeast Queensland ACA v1.1 WBB Riverine ACA v1.1 Southern Gulf Catchments Riverine ACA v1.1
Biodiversity Planning Assessments*	Combination of the following datasets: Brigalow Belt BPA v2.1 Cape York Peninsula BPA v1.1 Central Queensland Coast BPA v1.3 Channel Country BPA v1.1 Desert Uplands BPA v1.3 Einasleigh Uplands BPA v1.1 Gulf Plains BPA v1.1 Mitchell Grass Downs BPA v1.1 Mulga Lands BPA v1.4 New England Tableland v2.3 Northwest Highlands v1.1 Southeast Queensland v4.1 Wet Tropics v1.1
Statewide BPA Corridors*	Statewide corridors v1.6
Threatened Species	An internal DES database compiled from Wildnet, Herbrecs, Corveg, the QLD Museum, as well as other incidental sources.
BPA Priority Species	An internal DES database compiled from Wildnet, Herbrecs, Corveg, the QLD Museum, as well as other incidental sources.
ACA Priority Species	An internal DES database compiled from Wildnet, Herbrecs, Corveg, the QLD Museum, as well as other incidental sources.

***These datasets are available at:**

http://dds.information.qld.gov.au/DDS

Appendix 2 - Acronyms and Abbreviations

AOI	- Area of Interest
ACA	- Aquatic Conservation Assessment
AQUABAMM	- Aquatic Biodiversity Assessment and Mapping Methodology
BAMM	- Biodiversity Assessment and Mapping Methodology
BoT	- Back on Track
BPA	- Biodiversity Planning Assessment
CAMBA	- China-Australia Migratory Bird Agreement
DES	- Department of Environment and Science
EPBC	- *Environment Protection and Biodiversity Conservation Act 1999*
EVNT	- Endangered, Vulnerable, Near Threatened
GDA94	- Geocentric Datum of Australia 1994
GIS	- Geographic Information System
JAMBA	- Japan-Australia Migratory Bird Agreement
NCA	- *Nature Conservation Act 1992*
RE	- Regional Ecosystem
REDD	- Regional Ecosystem Description Database
ROKAMBA	- Republic of Korea-Australia Migratory Bird Agreement

WildNet Records
Weed List

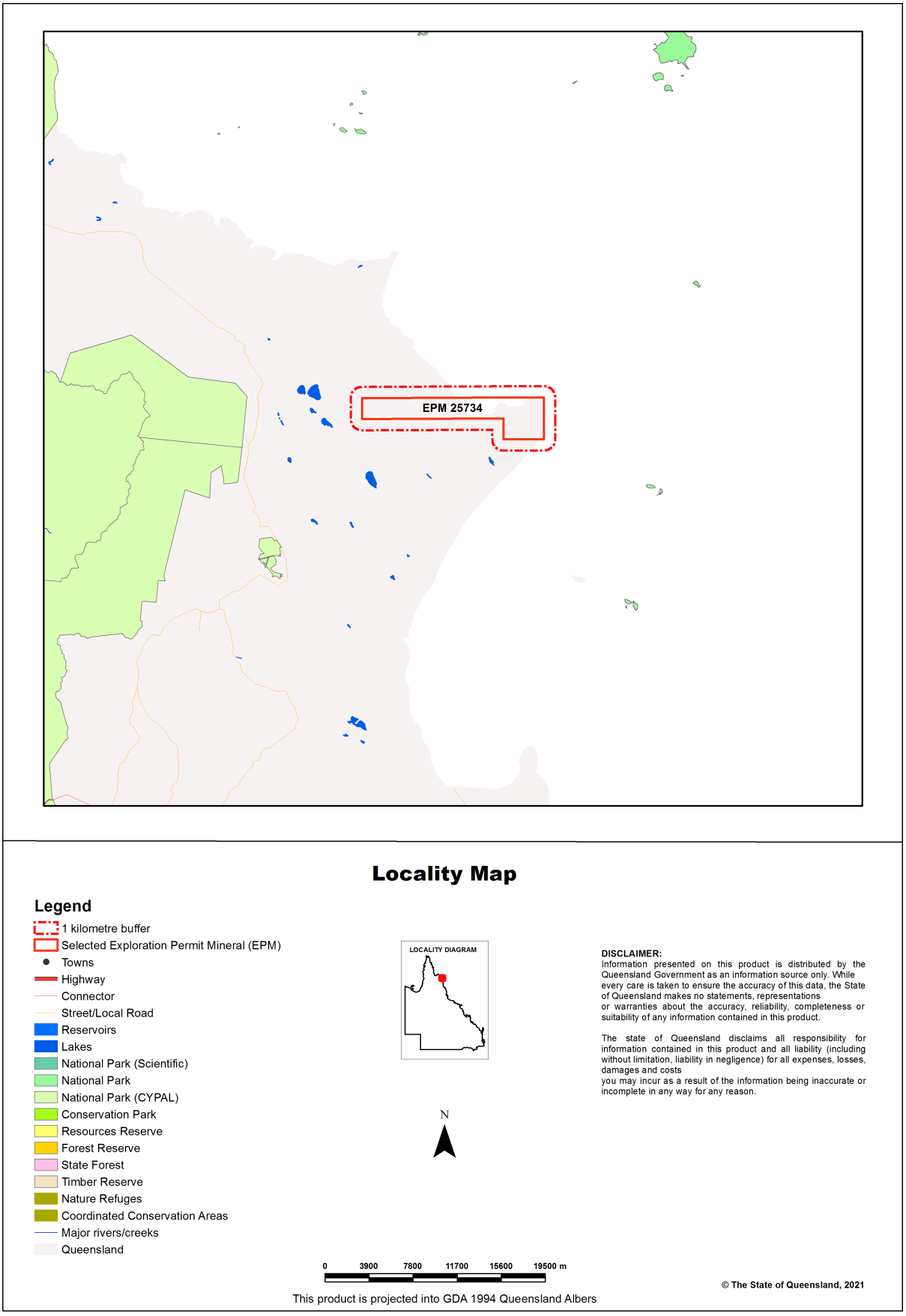
For the selected area of interest 3636.81ha epm: 25734

Current as at 13/08/2021

WildNetWeedList

Queensland Government

Map 1. Locality Map



Summary Information

The following table provides an overview of the area of interest epm: 25734.

Table 1. Area of interest details

Size (ha)	3,636.81
Local Government(s)	Cook Shire, Hope Vale Aboriginal Shire
Bioregion(s)	Cape York Peninsula
Subregion(s)	Starke Coastal Lowlands
Catchment(s)	Jeannie

Protected Area(s)

No estates or reserves are located within the area of interest.

World Heritage Area(s)

The following World Heritage Areas are located in the area of interest:

Great Barrier Reef

Ramsar Area(s)

No Ramsar Areas are located within the area of interest.

Weed List

Introduction

This report is derived from a spatial layer generated from the WildNet database managed by the Department of Environment and Science. The layer which is generated weekly contains the WildNet wildlife records that are not classed as erroneous or duplicate, that have a location precision equal to or less than 10000 metres and do not have a count of zero.

The WildNet dataset is constantly being enhanced and the taxonomic and status information revised. If a species is not listed in this report, it does not mean it doesn't occur there and listed species may also no longer inhabit the area. It is recommended that you also access other internal and external data sources for species information in your area of interest (Refer Links and Support).

Species Data

Contextual location information is presented in Map 1.

A summary of the weeds recorded within the area of interest and its one kilometre buffer is presented in Table 2.

Table 2. Weeds recorded within the area of interest and its one kilometre buffer

Taxon Id	Family	Scientific Name	Common Name	Specimens	Records	Last record	Endemicity
15400	Asteraceae	*Emilia sonchifolia var. sonchifolia*	None	1	1	15/04/1975	IU
16530	Passifloraceae	*Passiflora foetida*	None	1	1	15/04/1975	IU
15552	Poaceae	*Chloris inflata*	purpletop chloris	1	1	11/12/2008	IU

Species table headings and codes

Taxon Id: Unique identifier of the taxon from the WildNet database.

Specimens: The number of specimen-backed records of the taxon.

Records: The total number of records of the taxon.

Last record: Date of latest record of the taxon.

Endemicity: The endemicity code for the taxon (Introduced (Intranational) (IA), Introduced (International) (II), Introduced (Unknown), Exotic (Intranational) (XA), Exotic (International) (XI) and Exotic (Unknown) (XU)).

Links and Support

Other sites that deliver species information from the WildNet database include:

- Species profile search - access species information approved for publication including species names, statuses, notes, images, distribution maps and records
- Species lists - generate species lists for Queensland protected areas, forestry areas, local governments and areas defined using coordinates
- Biomaps - view biodiversity information, including WildNet records approved for publication, and generate reports
- Queensland Globe - view spatial information, including WildNet records approved for publication
- Qld wildlife data API - access WildNet species information approved for publication such as notes, images and records etc.
- Wetland*Maps* - view species records, survey locations etc. approved for publication
- Wetland*Summary* - view wildlife statistics, species lists for a range of area types, and access WildNet species profiles
- WildNet wildlife records - published - Queensland - spatial layer of WildNet records approved for publication generated weekly
- Generalised distribution and densities of Queensland wildlife - Queensland species distributions and densities generalised to a 10 km grid resolution
- Conservation status of Queensland wildlife - access current lists of priority species for Queensland including nomenclature and status information
- Queensland Confidential Species - the list of species flagged as confidential in the WildNet database.

Please direct queries about this report to the WildNet Team.

Other useful sites for accessing Queensland biodiversity data include:

- Useful wildlife resources
- Queensland Government Data
- Atlas of Living Australia (ALA)
- Online Zoological Collections of Australian Museums (OZCAM)
- Australia's Virtual Herbarium (AVH)
- Protected Matters Search Tool

Disclaimer

WildNet Records
Species List

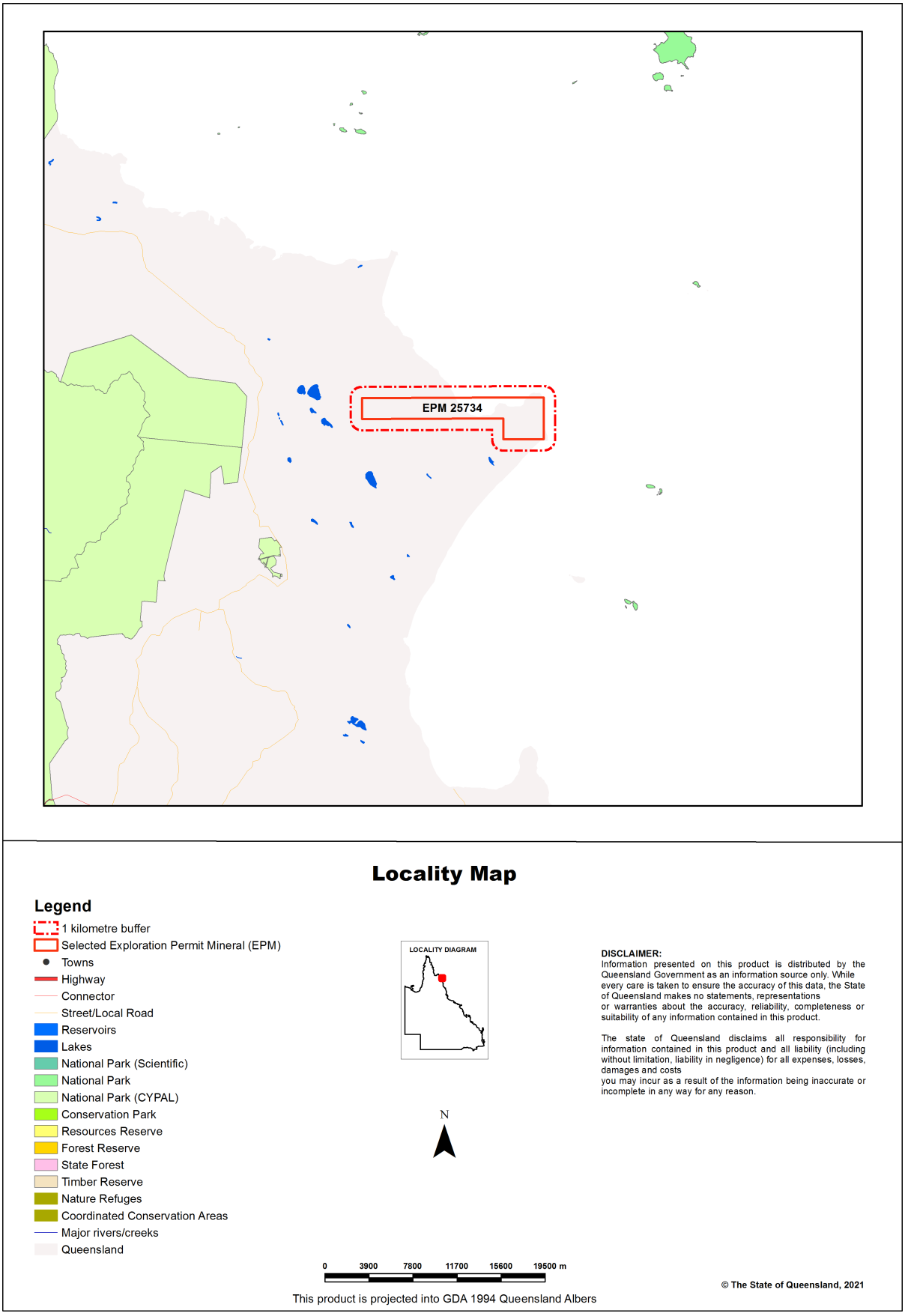
For the selected area of interest 3636.81ha epm: 25734

Current as at 13/08/2021

WildNetSpeciesList

Queensland Government

Map 1. Locality Map



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Species List

Introduction
This report is derived from a spatial layer generated from the WildNet database managed by the Department of Environment and Science. The layer which is generated weekly contains the WildNet wildlife records that are not classed as erroneous or duplicate, that have a location precision equal to or less than 10000 metres and do not have a count of zero.

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Table 2 lists the animals recorded within the area of interest and its one kilometre buffer.

Table 3 lists the plants recorded within the area of interest and its one kilometre buffer.

Table 4 lists the fungi recorded within the area of interest and its one kilometre buffer.

Table 5 lists the protists recorded within the area of interest and its one kilometre buffer.

Table 2. Animals recorded within the area of interest and its one kilometre buffer

Taxon Id	Class	Family	Scientific Name	Common Name	NCA	EPBC	Specimens	Records	Last record
604	Amphibia	Hylidae	*Litoria nasuta*	striped rocketfrog	C	None	0	1	01/09/1986
677	Amphibia	Limnodynastidae	*Limnodynastes convexiusculus*	marbled frog	C	None	0	1	07/03/1995
697	Amphibia	Myobatrachidae	*Crinia remota*	northern froglet	C	None	0	1	07/03/1995
1937	Aves	Charadriidae	*Charadrius ruficapillus*	red-capped plover	C	None	0	2	20/07/2003
1572	Aves	Hirundinidae	*Hirundo neoxena*	welcome swallow	C	None	0	1	20/07/2003
1912	Aves	Laridae	*Chroicocephalus novaehollandiae*	silver gull	C	None	0	1	31/07/1993

Taxon Id	Class	Family	Scientific Name	Common Name	NCA	EPBC	Specimens	Records	Last record
1505	Aves	Meliphagidae	*Meliphaga notata*	yellow-spotted honeyeater	C	None	0	1	20/07/2003
1476	Aves	Meliphagidae	*Trichodere cockerelli*	white-streaked honeyeater	C	None	0	1	20/07/2003
1451	Aves	Nectariniidae	*Cinnyris jugularis*	olive-backed sunbird	C	None	0	1	20/07/2003
1611	Aves	Nectariniidae	*Dicaeum hirundinaceum*	mistletoebird	C	None	0	1	20/07/2003
1125	Aves	Psittacidae	*Trichoglossus moluccanus*	rainbow lorikeet	C	None	0	2	20/07/2003
772	Mammalia	Muridae	*Melomys burtoni*	grassland melomys	C	None	2	3	26/05/2004
759	Mammalia	Muridae	*Melomys cervinipes*	fawn-footed melomys	C	None	2	3	31/12/1998
734	Mammalia	Muridae	*Rattus tunneyi*	pale field-rat	C	None	1	1	27/09/1995
584	Reptilia	Crocodylidae	*Crocodylus porosus*	estuarine crocodile	V	None	0	1	31/05/1988
361	Reptilia	Elapidae	*Hydrophis elegans*	elegant sea snake	C	None	1	1	18/09/1970
291	Reptilia	Scincidae	*Carlia dogare*	sandy rainbow-skink	C	None	0	1	31/12/1982
32835	Reptilia	Scincidae	*Carlia longipes*	closed-litter rainbow-skink	C	None	0	1	08/09/1986
232	Reptilia	Scincidae	*Ctenotus rawlinsoni*	Cape heath ctenotus	V	None	0	1	31/12/1982
168	Reptilia	Scincidae	*Lerista ingrami*	Ingram's lerista	V	None	0	1	31/12/2003

Table 3. Plants recorded within the area of interest and its one kilometre buffer

Taxon Id	Class	Family	Scientific Name	Common Name	NCA	EPBC	Specimens	Records	Last record
6799	Equisetopsida	Acanthaceae	*Avicennia marina subsp. eucalyptifolia*	None	C	None	1	1	15/04/1975
16258	Equisetopsida	Acanthaceae	*Rostellularia adscendens var. hispida*	None	C	None	1	1	20/06/1975
16260	Equisetopsida	Acanthaceae	*Rostellularia adscendens var. latifolia*	None	C	None	1	1	08/02/1976
17979	Equisetopsida	Apocynaceae	*Alyxia spicata*	None	C	None	1	1	15/04/1975
16922	Equisetopsida	Apocynaceae	*Hoya australis subsp. australis*	None	C	None	2	2	01/04/2009
41672	Equisetopsida	Apocynaceae	*Leichhardtia viridiflora subsp. tropica*	None	C	None	1	1	07/11/2000
16527	Equisetopsida	Apocynaceae	*Parsonsia velutina*	hairy silkpod	C	None	1	1	06/05/1990
15400	Equisetopsida	Asteraceae	*Emilia sonchifolia var. sonchifolia*	None	None	None	1	1	15/04/1975
35019	Equisetopsida	Asteraceae	*Sphaeromorphaea harrisii*	None	C	None	1	1	15/04/1975
35063	Equisetopsida	Asteraceae	*Wollastonia uniflora*	None	C	None	1	1	15/04/1975
15266	Equisetopsida	Caesalpiniaceae	*Labichea buettneriana*	None	C	None	2	2	20/06/1975

Taxon Id	Class	Family	Scientific Name	Common Name	NCA	EPBC	Specimens	Records	Last record
7530	Equisetopsida	Casuarinaceae	*Allocasuarina sp. (Shaw Island G.N.Batianoff+ 3360)*	None	C	None	1	1	27/02/2021
11098	Equisetopsida	Centrolepidaceae	*Centrolepis banksii*	None	C	None	1	1	26/08/1986
13872	Equisetopsida	Combretaceae	*Lumnitzera racemosa*	None	C	None	1	1	15/04/1975
16025	Equisetopsida	Combretaceae	*Terminalia muelleri*	None	C	None	1	1	15/04/1975
16861	Equisetopsida	Convolvulaceae	*Ipomoea pes-caprae subsp. brasiliensis*	goatsfoot	C	None	1	1	15/04/1975
33902	Equisetopsida	Cucurbitaceae	*Cucumis althaeoides*	None	C	None	1	1	15/04/1975
41373	Equisetopsida	Cyperaceae	*Anthelepis clarksonii*	None	C	None	2	2	20/06/1975
14812	Equisetopsida	Cyperaceae	*Arthrostylis aphylla*	None	C	None	2	2	20/06/1975
17780	Equisetopsida	Cyperaceae	*Bulbostylis barbata*	None	C	None	1	1	15/04/1975
17529	Equisetopsida	Cyperaceae	*Cyperus pedunculatus*	None	C	None	1	1	15/04/1975
17481	Equisetopsida	Cyperaceae	*Cyperus stoloniferus*	None	C	None	1	1	15/04/1975
17341	Equisetopsida	Cyperaceae	*Eleocharis geniculata*	None	C	None	1	1	22/07/1949
11959	Equisetopsida	Cyperaceae	*Eleocharis ochrostachys*	None	C	None	1	1	10/05/1988
17113	Equisetopsida	Cyperaceae	*Fimbristylis*	None	None	None	1	1	09/09/1986
11041	Equisetopsida	Cyperaceae	*Fimbristylis recta*	None	C	None	2	2	08/02/1976
17130	Equisetopsida	Cyperaceae	*Fuirena ciliaris*	None	C	None	3	3	20/06/1975
17079	Equisetopsida	Cyperaceae	*Gahnia sieberiana*	sword grass	C	None	1	1	20/06/1975
41293	Equisetopsida	Cyperaceae	*Machaerina rubiginosa*	None	C	None	1	1	05/08/1978
10973	Equisetopsida	Cyperaceae	*Rhynchospora heterochaeta*	None	C	None	1	1	20/06/1975
16212	Equisetopsida	Cyperaceae	*Schoenus calostachyus*	None	C	None	2	2	20/06/1975
14225	Equisetopsida	Cyperaceae	*Schoenus sparteus*	None	C	None	2	2	20/06/1975
11913	Equisetopsida	Cyperaceae	*Scleria rugosa*	None	C	None	1	1	20/06/1975
16007	Equisetopsida	Cyperaceae	*Trachystylis stradbrokensis*	None	C	None	2	2	20/06/1975
8877	Equisetopsida	Dilleniaceae	*Hibbertia banksii forma banksii*	None	C	None	2	2	08/02/1976
35066	Equisetopsida	Droseraceae	*Drosera serpens*	None	C	None	1	1	20/06/1975
41525	Equisetopsida	Ericaceae	*Styphelia lavarackii*	None	C	None	1	1	12/02/2009
41536	Equisetopsida	Ericaceae	*Styphelia ruscifolia*	None	C	None	2	2	20/06/1975
41521	Equisetopsida	Ericaceae	*Styphelia yorkensis*	None	C	None	1	1	26/02/2021
30690	Equisetopsida	Euphorbiaceae	*Shonia tristigma subsp. borealis*	None	C	None	1	1	08/02/1976
15844	Equisetopsida	Fabaceae	*Canavalia rosea*	coastal jack bean	C	None	1	1	15/04/1975
15357	Equisetopsida	Fabaceae	*Glycine tomentella*	woolly glycine	C	None	1	1	15/04/1975
15262	Equisetopsida	Fabaceae	*Jacksonia thesioides*	None	C	None	3	3	31/05/2009
14946	Equisetopsida	Fabaceae	*Vandasina retusa*	None	C	None	1	1	15/04/1975
14953	Equisetopsida	Fabaceae	*Vigna marina*	dune bean	C	None	1	1	15/04/1975
14920	Equisetopsida	Fabaceae	*Zornia maritima*	None	C	None	1	1	15/04/1975
9188	Equisetopsida	Goodeniaceae	*Scaevola taccada*	Cardwell cabbage	C	None	1	1	15/04/1975

Taxon Id	Class	Family	Scientific Name	Common Name	NCA	EPBC	Specimens	Records	Last record
17467	Equisetopsida	Hemerocallidaceae	*Dianella longifolia var. longifolia*	None	C	None	1	1	07/05/1990
14647	Equisetopsida	Hemerocallidaceae	*Dianella pavopennacea var. pavopennacea*	None	C	None	1	1	20/06/1975
15972	Equisetopsida	Johnsoniaceae	*Tricoryne anceps subsp. anceps*	None	C	None	1	1	31/03/2009
15973	Equisetopsida	Johnsoniaceae	*Tricoryne anceps subsp. pterocaulon*	None	C	None	1	1	08/02/1976
15549	Equisetopsida	Lamiaceae	*Chloanthes parviflora*	None	C	None	1	1	20/06/1975
15965	Equisetopsida	Lamiaceae	*Vitex rotundifolia*	None	C	None	1	1	15/04/1975
16769	Equisetopsida	Laxmanniaceae	*Lomandra banksii*	None	C	None	1	1	15/04/1975
36450	Equisetopsida	Laxmanniaceae	*Lomandra decomposita*	None	C	None	1	1	31/05/2009
15940	Equisetopsida	Lentibulariaceae	*Utricularia chrysantha*	None	C	None	1	1	20/06/1975
24602	Equisetopsida	Leucobryaceae	*Campylopus*	None	None	None	1	1	31/12/1983
13236	Equisetopsida	Loranthaceae	*Dendrophthoe glabrescens*	None	C	None	1	1	20/06/1975
13937	Equisetopsida	Loranthaceae	*Diplatia furcata*	None	C	None	1	1	15/04/1975
16130	Equisetopsida	Lythraceae	*Sonneratia alba*	None	C	None	1	1	15/04/1975
16727	Equisetopsida	Macarthuriaceae	*Macarthuria neocambrica*	None	C	None	1	1	07/05/1990
16957	Equisetopsida	Malvaceae	*Hibiscus meraukensis*	Merauke hibiscus	C	None	1	1	15/04/1975
16961	Equisetopsida	Malvaceae	*Hibiscus tiliaceus*	cotton tree	C	None	1	1	15/04/1975
16897	Equisetopsida	Menispermaceae	*Hypserpa decumbens*	None	C	None	2	2	30/08/1986
15794	Equisetopsida	Mimosaceae	*Acacia crassicarpa*	None	C	None	1	1	15/04/1975
15756	Equisetopsida	Mimosaceae	*Acacia humifusa*	None	C	None	1	1	15/04/1975
14863	Equisetopsida	Mimosaceae	*Acacia leptoloba*	None	C	None	1	1	15/04/1975
15743	Equisetopsida	Mimosaceae	*Acacia pubirhachis*	None	C	None	1	1	27/02/2021
15688	Equisetopsida	Mimosaceae	*Acacia racospermoides*	None	C	None	1	1	20/06/1975
3362	Equisetopsida	Mimosaceae	*Acacia solenota*	None	V	None	3	3	27/03/2021
17947	Equisetopsida	Myrtaceae	*Asteromyrtus angustifolia*	None	C	None	2	2	15/04/1975
17949	Equisetopsida	Myrtaceae	*Asteromyrtus lysicephala*	None	C	None	2	2	15/04/1975
17950	Equisetopsida	Myrtaceae	*Asteromyrtus symphyocarpa*	None	C	None	1	1	31/05/2009
17245	Equisetopsida	Myrtaceae	*Eucalyptus brassiana*	Cape York red gum	C	None	1	1	15/04/1975
17252	Equisetopsida	Myrtaceae	*Eucalyptus crebra*	narrow-leaved red ironbark	C	None	1	1	06/05/1990
14441	Equisetopsida	Myrtaceae	*Leptospermum polygalifolium*	tantoon	C	None	2	2	20/06/1975
21826	Equisetopsida	Myrtaceae	*Lithomyrtus obtusa*	None	C	None	2	2	11/12/2008
16730	Equisetopsida	Myrtaceae	*Lophostemon suaveolens*	swamp box	C	None	1	1	15/04/1975
16682	Equisetopsida	Myrtaceae	*Melaleuca arcana*	None	C	None	3	3	30/11/1990

Taxon Id	Class	Family	Scientific Name	Common Name	NCA	EPBC	Specimens	Records	Last record
16689	Equisetopsida	Myrtaceae	*Melaleuca leucadendra*	broad-leaved tea-tree	C	None	1	1	15/04/1975
16617	Equisetopsida	Myrtaceae	*Neofabricia myrtifolia*	None	C	None	4	4	20/06/1975
16554	Equisetopsida	Myrtaceae	*Osbornia octodonta*	myrtle mangrove	C	None	1	1	15/04/1975
16053	Equisetopsida	Myrtaceae	*Syzygium suborbiculare*	None	C	None	1	1	15/04/1975
16530	Equisetopsida	Passifloraceae	*Passiflora foetida*	None	None	None	1	1	15/04/1975
17808	Equisetopsida	Phyllanthaceae	*Breynia oblongifolia*	None	C	None	1	1	15/04/1975
16621	Equisetopsida	Picrodendraceae	*Neoroepera banksii*	None	C	None	3	3	03/03/2009
15552	Equisetopsida	Poaceae	*Chloris inflata*	purpletop chloris	None	None	1	1	11/12/2008
15482	Equisetopsida	Poaceae	*Cymbopogon ambiguus*	lemon grass	C	None	1	1	07/05/1990
14598	Equisetopsida	Poaceae	*Digitaria leucostachya*	None	C	None	2	2	11/12/2008
15440	Equisetopsida	Poaceae	*Ectrosia leporina*	None	C	None	3	3	11/12/2008
15363	Equisetopsida	Poaceae	*Eragrostis interrupta*	None	C	None	1	1	11/12/2008
14587	Equisetopsida	Poaceae	*Eragrostis pubescens*	None	C	None	1	1	15/04/1975
15380	Equisetopsida	Poaceae	*Eremochloa bimaculata*	poverty grass	C	None	2	2	07/05/1990
14592	Equisetopsida	Poaceae	*Eriachne insularis*	None	C	None	1	1	11/12/2008
10731	Equisetopsida	Poaceae	*Eriachne pallescens var. pallescens*	None	C	None	1	1	06/05/1990
10734	Equisetopsida	Poaceae	*Eriachne stipacea*	None	C	None	1	1	06/05/1990
10885	Equisetopsida	Poaceae	*Eriachne triodioides*	None	C	None	1	1	11/12/2008
10735	Equisetopsida	Poaceae	*Eriachne triseta*	None	C	None	1	1	06/05/1990
15250	Equisetopsida	Poaceae	*Ischaemum muticum*	None	C	None	1	1	15/04/1975
15218	Equisetopsida	Poaceae	*Lepturus repens*	stalky grass	C	None	1	1	05/05/1990
10652	Equisetopsida	Poaceae	*Panicum seminudum var. cairnsianum*	None	C	None	1	1	06/05/1990
18424	Equisetopsida	Poaceae	*Panicum simile*	None	C	None	1	1	07/05/1990
9830	Equisetopsida	Poaceae	*Paspalidium spartellum*	None	C	None	2	2	07/05/1990
15136	Equisetopsida	Poaceae	*Paspalum scrobiculatum*	ditch millet	C	None	1	1	11/12/2008
15032	Equisetopsida	Poaceae	*Setaria surgens*	None	C	None	1	1	15/04/1975
15003	Equisetopsida	Poaceae	*Sporobolus virginicus*	sand couch	C	None	1	1	15/04/1975
14974	Equisetopsida	Poaceae	*Themeda triandra*	kangaroo grass	C	None	1	1	08/02/1976
14975	Equisetopsida	Poaceae	*Thuarea involuta*	tropical beachgrass	C	None	1	1	15/04/1975
10112	Equisetopsida	Poaceae	*Triodia microstachya*	None	C	None	1	1	15/04/1975
10126	Equisetopsida	Poaceae	*Whiteochloa airoides*	None	C	None	1	1	08/02/1976
8925	Equisetopsida	Portulacaceae	*Calandrinia arenicola*	None	C	None	1	1	15/04/1975
17896	Equisetopsida	Proteaceae	*Banksia dentata*	None	C	None	1	1	15/04/1975
17031	Equisetopsida	Proteaceae	*Grevillea glauca*	bushy's clothes peg	C	None	1	1	15/04/1975
17040	Equisetopsida	Proteaceae	*Grevillea pteridifolia*	golden parrot tree	C	None	1	1	20/06/1975
17678	Equisetopsida	Pteridaceae	*Cheilanthes contigua*	None	C	None	1	1	07/05/1990

Taxon Id	Class	Family	Scientific Name	Common Name	NCA	EPBC	Specimens	Records	Last record
21908	Equisetopsida	Restionaceae	*Baloskion tetraphyllum subsp. meiostachyum*	None	C	None	1	1	20/06/1975
21909	Equisetopsida	Restionaceae	*Dapsilanthus ramosus*	None	C	None	2	2	09/05/1988
9659	Equisetopsida	Rhamnaceae	*Alphitonia excelsa*	soap tree	C	None	1	1	31/03/2009
17815	Equisetopsida	Rhizophoraceae	*Bruguiera gymnorhiza*	large-fruited orange mangrove	C	None	1	1	15/04/1975
16282	Equisetopsida	Rhizophoraceae	*Rhizophora apiculata*	None	C	None	1	1	15/04/1975
16284	Equisetopsida	Rhizophoraceae	*Rhizophora stylosa*	spotted mangrove	C	None	1	1	15/04/1975
22156	Equisetopsida	Rubiaceae	*Atractocarpus sessilis*	None	C	None	1	1	31/05/2009
27442	Equisetopsida	Rubiaceae	*Cyclophyllum maritimum*	None	C	None	1	1	06/05/1990
29833	Equisetopsida	Rubiaceae	*Psydrax banksii*	None	C	None	1	1	15/04/1975
14215	Equisetopsida	Rubiaceae	*Spermacoce marginata*	None	C	None	1	1	15/04/1975
17829	Equisetopsida	Rutaceae	*Boronia alulata*	None	C	None	2	2	20/06/1975
6236	Equisetopsida	Rutaceae	*Eriostemon banksii*	None	C	None	3	3	03/02/1984
17181	Equisetopsida	Santalaceae	*Exocarpos latifolius*	None	C	None	1	1	01/04/2009
17376	Equisetopsida	Sapindaceae	*Dodonaea lanceolata var. subsessilifolia*	None	C	None	1	1	07/05/1991
17380	Equisetopsida	Sapindaceae	*Dodonaea polyandra*	None	C	None	1	1	20/06/1975
16996	Equisetopsida	Sapindaceae	*Guioa acutifolia*	northern guioa	C	None	1	1	11/12/2008
16721	Equisetopsida	Sapotaceae	*Manilkara kauki*	None	C	None	1	1	28/02/2021
13519	Equisetopsida	Smilacaceae	*Smilax calophylla*	None	C	None	1	1	06/05/1990
15982	Equisetopsida	Sparrmanniaceae	*Triumfetta repens*	None	C	None	1	1	15/04/1975
21883	Equisetopsida	Stylidiaceae	*Stylidium tenerum*	None	C	None	2	2	22/07/1949
41612	Equisetopsida	Violaceae	*Pigea enneasperma*	None	C	None	1	1	15/04/1975
13083	Equisetopsida	Zygophyllaceae	*Tribulopis solandri*	None	C	None	1	1	15/04/1975

Table 4. Fungi recorded within the area of interest and its one kilometre buffer

Taxon Id	Class	Family	Scientific Name	Common Name	NCA	EPBC	Specimens	Records	Last record
26700	Agaricomycetes	Corticiaceae	*Corticium*	None	C	None	1	1	31/12/1983
23533	Lecanoromycetes	Caliciaceae	*Pyxine cocoes*	None	C	None	1	1	20/08/1983
23030	Lecanoromycetes	Cladoniaceae	*Cladonia macilenta*	None	C	None	1	1	31/12/1983
23067	Lecanoromycetes	Collemataceae	*Collema rugosum*	None	C	None	2	2	31/12/1983
23263	Lecanoromycetes	Collemataceae	*Leptogium*	None	None	None	1	1	20/08/1983
23258	Lecanoromycetes	Collemataceae	*Leptogium cyanescens*	None	C	None	1	1	31/12/1983
24214	Lecanoromycetes	Collemataceae	*Leptogium fallax*	None	C	None	2	2	31/12/1983

Taxon Id	Class	Family	Scientific Name	Common Name	NCA	EPBC	Specimens	Records	Last record
24486	Lecanoromycetes	Collemataceae	*Leptogium propaguliferum*	None	C	None	1	1	31/12/1983
32871	Lecanoromycetes	Graphidaceae	*Myriotrema subconforme*	None	C	None	1	1	31/12/1983
27407	Lecanoromycetes	Pannariaceae	*Pannaria dissecta*	None	C	None	4	4	31/12/1983
24479	Lecanoromycetes	Pannariaceae	*Parmeliella mariana*	None	C	None	1	1	20/08/1983
25324	Lecanoromycetes	Pannariaceae	*Physma ahtianum*	None	C	None	1	1	20/08/1983
24288	Lecanoromycetes	Parmeliaceae	*Parmotrema judithae*	None	C	None	1	1	20/08/1983
23379	Lecanoromycetes	Parmeliaceae	*Parmotrema robustum*	None	C	None	1	1	20/08/1983
23576	Lecanoromycetes	Parmeliaceae	*Relicina sublanea*	None	C	None	1	1	31/08/1983
25241	Lecanoromycetes	Pertusariaceae	*Pertusaria clarkeana*	None	C	None	1	1	31/12/1983

Table 5. Protists recorded within the area of interest and its one kilometre buffer

No species found within the area of interest and its one kilometre buffer.

Species table headings and codes

Taxon Id: Unique identifier of the taxon from the WildNet database.

NCA: Queensland conservation status of the taxon under the *Nature Conservation Act 1992* (Least Concern (C), Critically Endangered (CR), Endangered (E), Extinct (EX), Near Threatened (NT), Extinct in the Wild (PE), Special Least Concern (SL), and Vulnerable (V)).

EPBC: Australian conservation status of the taxon under the *Environment Protection and Biodiversity Conservation Act 1999* (Conservation Dependent (CD), Critically Endangered (CE), Endangered (E), Extinct (EX), Vulnerable (V), and Extinct in the Wild (XW)).

Specimens: The number of specimen-backed records of the taxon.

Records: The total number of records of the taxon.

Last record: Date of latest record of the taxon.

Links and Support

Other sites that deliver species information from the WildNet database include:

- Species profile search - access species information approved for publication including species names, statuses, notes, images, distribution maps and records
- Species lists - generate species lists for Queensland protected areas, forestry areas, local governments and areas defined using coordinates
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- Qld wildlife data API - access WildNet species information approved for publication such as notes, images and records etc.
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- Generalised distribution and densities of Queensland wildlife - Queensland species distributions and densities generalised to a 10 km grid resolution
- Conservation status of Queensland wildlife - access current lists of priority species for Queensland including nomenclature and status information
- Queensland Confidential Species - the list of species flagged as confidential in the WildNet database.

Please direct queries about this report to the WildNet Team.

Other useful sites for accessing Queensland biodiversity data include:

- Useful wildlife resources
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- Atlas of Living Australia (ALA)
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Disclaimer

WildNet Records
Pest List

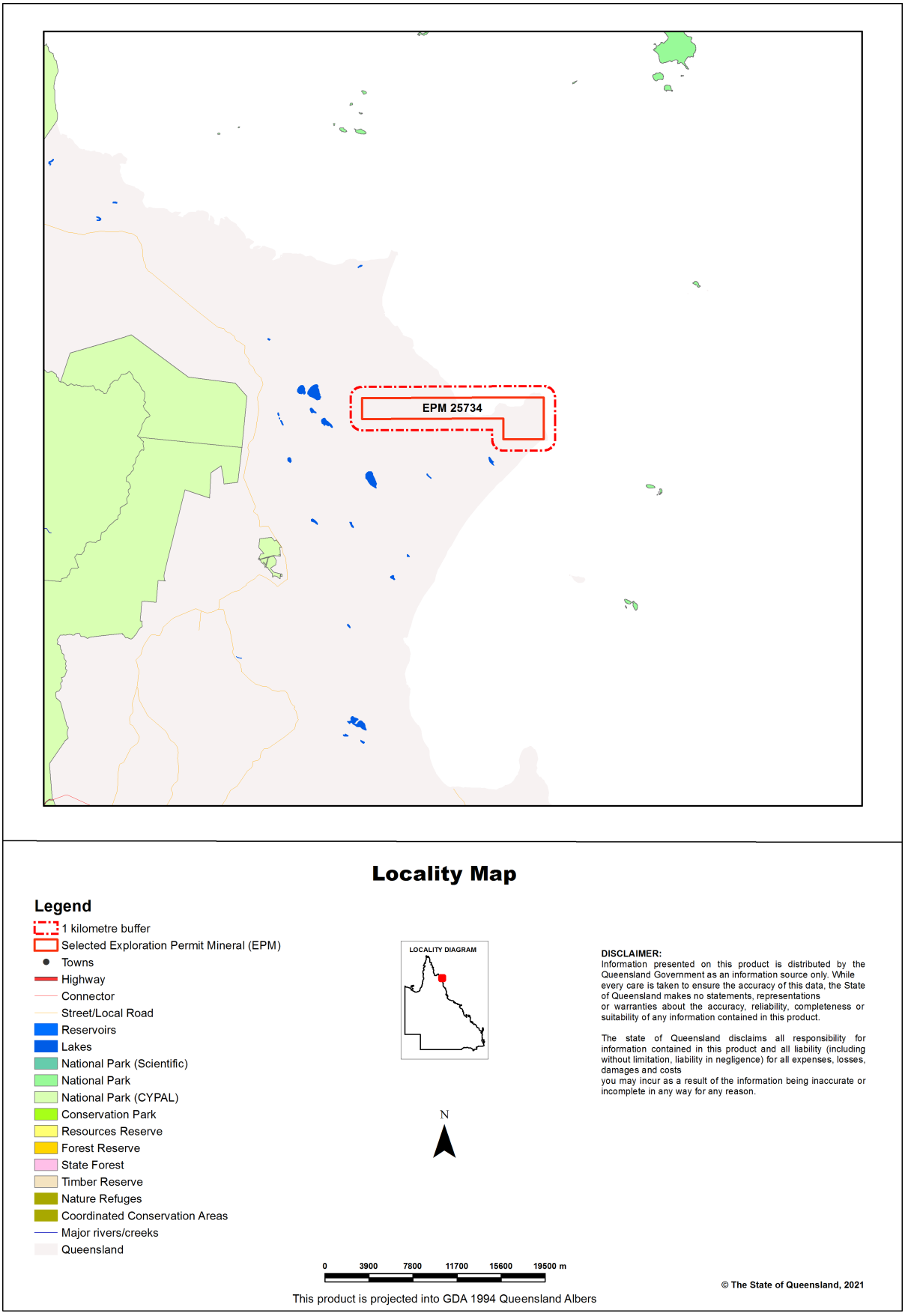
For the selected area of interest 3636.81ha epm: 25734

Current as at 13/08/2021

WildNetPestList

Queensland Government

Map 1. Locality Map



Summary Information

The following table provides an overview of the area of interest epm: 25734.

Table 1. Area of interest details

Size (ha)	3,636.81
Local Government(s)	Cook Shire, Hope Vale Aboriginal Shire
Bioregion(s)	Cape York Peninsula
Subregion(s)	Starke Coastal Lowlands
Catchment(s)	Jeannie

Protected Area(s)

No estates or reserves are located within the area of interest.

World Heritage Area(s)

The following World Heritage Areas are located in the area of interest:

Great Barrier Reef

Ramsar Area(s)

No Ramsar Areas are located within the area of interest.

Pest List

Introduction

This report is derived from a spatial layer generated from the WildNet database managed by the Department of Environment and Science. The layer which is generated weekly contains the WildNet wildlife records that are not classed as erroneous or duplicate, that have a location precision equal to or less than 10000 metres and do not have a count of zero.

The WildNet dataset is constantly being enhanced and the taxonomic and status information revised. If a species is not listed in this report, it does not mean it doesn't occur there and listed species may also no longer inhabit the area. It is recommended that you also access other internal and external data sources for species information in your area of interest (Refer Links and Support).

Species Data

Contextual location information is presented in Map 1.

A summary of the pests recorded within the area of interest and its one kilometre buffer is presented in Table 2.

Table 2. Pests recorded within the area of interest and its one kilometre buffer

Taxon Id	Kingdom	Class	Family	Scientific Name	Common Name	Specimens	Records	Last record	Endemicity
15400	Plantae	Equisetopsida	Asteraceae	*Emilia sonchifolia var. sonchifolia*	None	1	1	15/04/1975	IU
16530	Plantae	Equisetopsida	Passifloraceae	*Passiflora foetida*	None	1	1	15/04/1975	IU
15552	Plantae	Equisetopsida	Poaceae	*Chloris inflata*	purpletop chloris	1	1	11/12/2008	IU

Species table headings and codes

Taxon Id: Unique identifier of the taxon from the WildNet database.

Specimens: The number of specimen-backed records of the taxon.

Records: The total number of records of the taxon.

Last record: Date of latest record of the taxon.

Endemicity: The endemicity code for the taxon (Introduced (Intranational) (IA), Introduced (International) (II), Introduced (Unknown), Exotic (Intranational) (XA), Exotic (International) (XI) and Exotic (Unknown) (XU)).

Links and Support

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Disclaimer

WildNet Records
Conservation Significant Species List

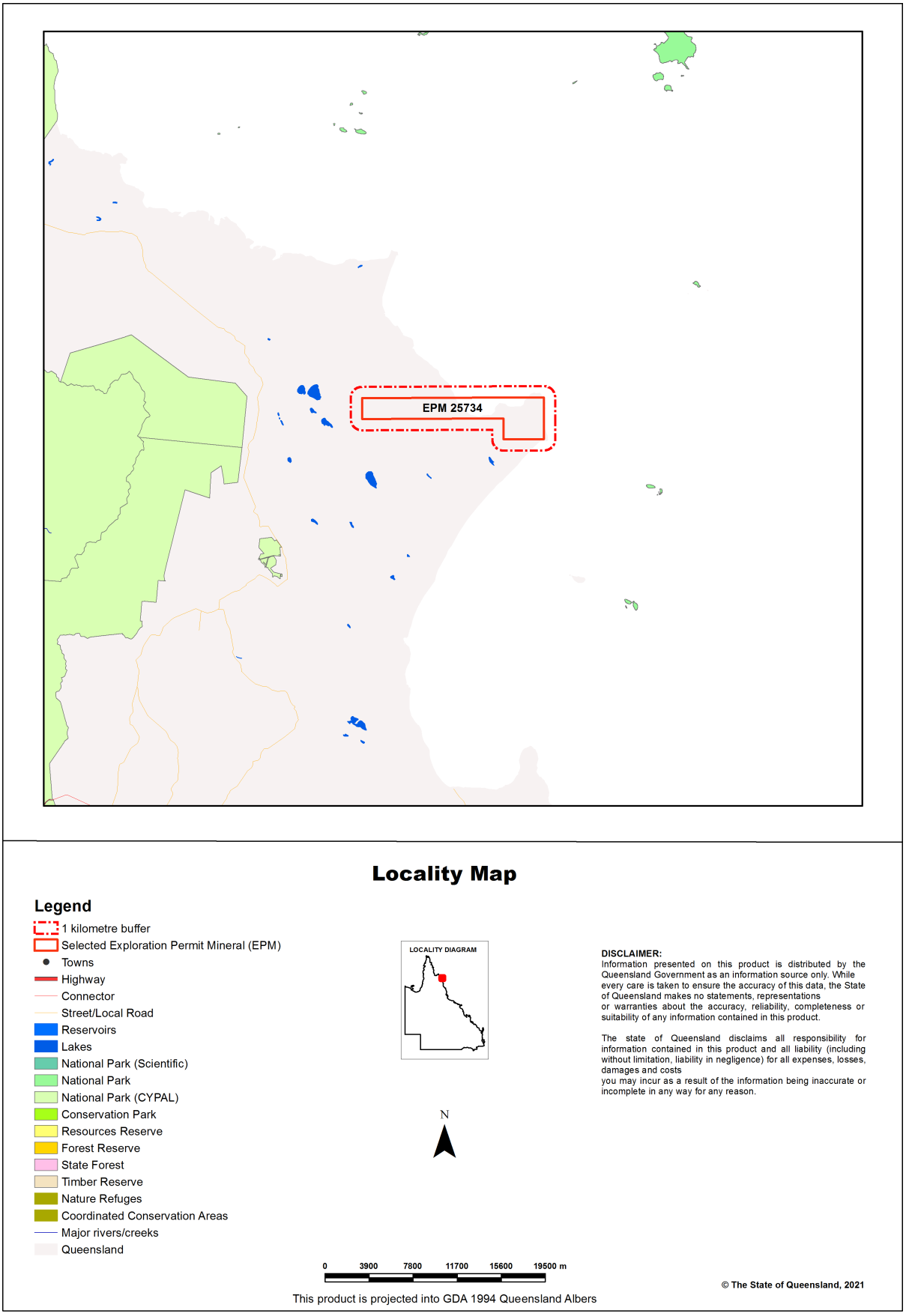
For the selected area of interest 3636.81ha epm: 25734

Current as at 13/08/2021

WildNetCSSpeciesList

Queensland Government

Map 1. Locality Map



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No estates or reserves are located within the area of interest.

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The following World Heritage Areas are located in the area of interest:

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Ramsar Area(s)
No Ramsar Areas are located within the area of interest.

Conservation Significant Species List

Introduction
This report is derived from a spatial layer generated from the WildNet database managed by the Department of Environment and Science. The layer which is generated weekly contains the WildNet wildlife records that are not classed as erroneous or duplicate, that have a location precision equal to or less than 10000 metres and do not have a count of zero.

Conservation significant species are species listed:

- as threatened or near threatened under the Nature Conservation Act 1992;
- as threatened under the *Environment Protection and Biodiversity Conservation Act 1999* or
- migratory species protected under the following international agreements:
  - Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)
  - China-Australia Migratory Bird Agreement
  - Japan-Australia Migratory Bird Agreement
  - Republic of Korea-Australia Migratory Bird Agreement

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Table 2 lists the species recorded within the area of interest and its one kilometre buffer.

Table 2. Conservation significant species recorded within the area of interest and its one kilometre buffer

Taxon Id	Kingdom	Class	Family	Scientific Name	Common Name	NCA	EPBC	Specimens	Records	Last record
584	Animalia	Reptilia	Crocodylidae	*Crocodylus porosus*	estuarine crocodile	V	None	0	1	31/05/1988
232	Animalia	Reptilia	Scincidae	*Ctenotus rawlinsoni*	Cape heath ctenotus	V	None	0	1	31/12/1982
168	Animalia	Reptilia	Scincidae	*Lerista ingrami*	Ingram's lerista	V	None	0	1	31/12/2003

Taxon Id	Kingdom	Class	Family	Scientific Name	Common Name	NCA	EPBC	Specimens	Records	Last record
3362	Plantae	Equisetopsida	Mimosaceae	*Acacia solenota*	None	V	None	3	3	27/03/2021

Taxon Id: Unique identifier of the taxon from the WildNet database.

NCA: Queensland conservation status of the taxon under the *Nature Conservation Act 1992* (Least Concern (C), Critically Endangered (CR), Endangered (E), Extinct (EX), Near Threatened (NT), Extinct in the Wild (PE), Special Least Concern (SL), and Vulnerable (V)).

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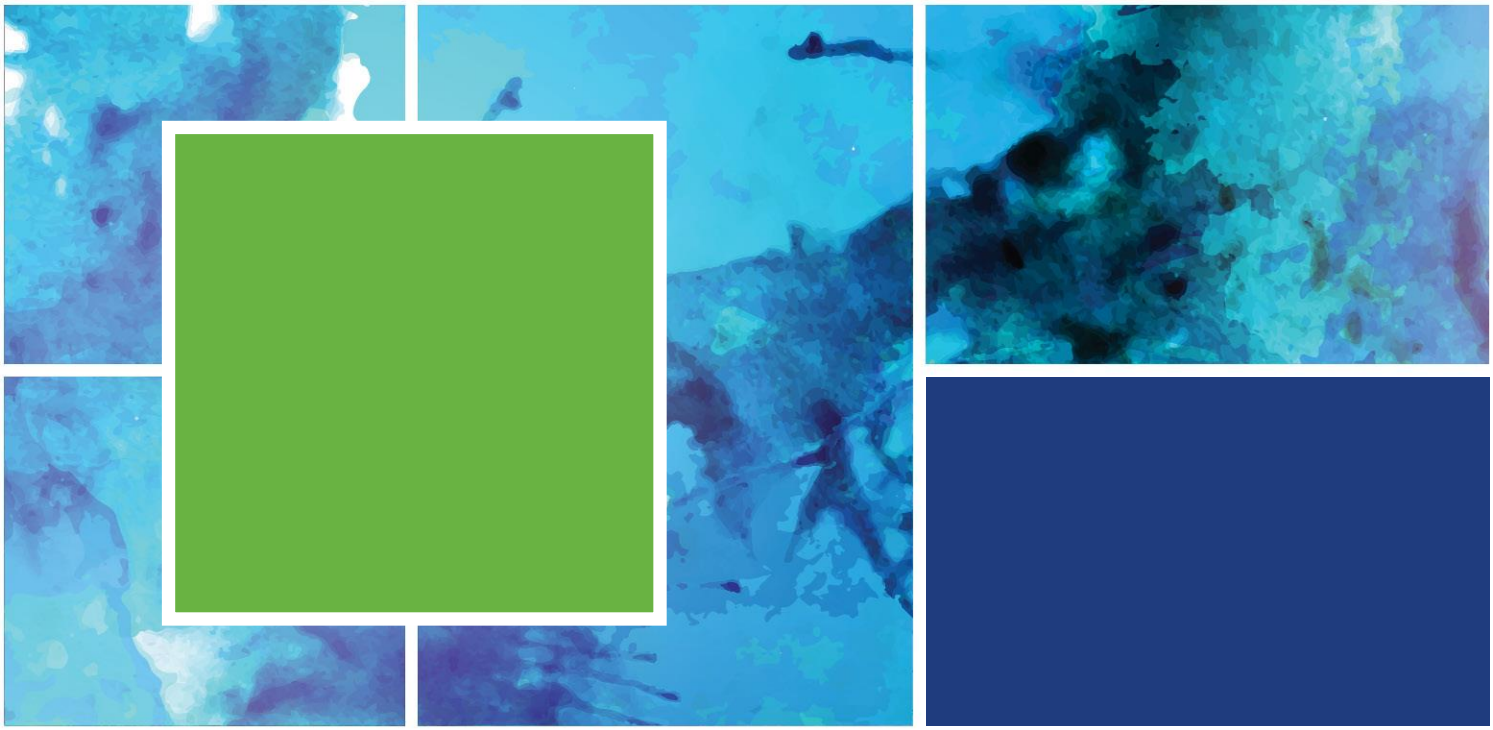
APPENDIX C. METHODS



MARINE HABITATS CLASSIFICATION

Marine habitats within the Study area were captured and classified via a combination of methods which included the following:

- ROV transects;
- UAV transects;
- On-foot transects; and
- Side scan transects.

ROV SURVEYS

DATA COLLECTION

ROV transects were undertaken using a Chasing M2 underwater ROV fitted with a 4K UHD Camera and GoPRO Hero Series 8. The ROV was deployed through a combination of both inshore (shoreline deployed) and offshore (boat deployed) methods which included eight transects of approximately 200m in length.

The ROV travelled directly above the seabed with the mounted GoPRO directed at the seabed to capture all habitat features within each transect. GPS points were marked at the start and end of each transect.

DATA ANALYSIS

Both GoPRO and fitted camera video footage were reviewed in conjunction with sidescan and UAV surveys to define marine habitats within the Study area.

UAV SURVEYS

DATA COLLECTION

A DJI Phantom IV multispectral drone was flown during low tide at a height of 60m across the intertidal zone of the Study area.

DATA ANALYSIS

Data Processing Artificial intelligence powered drone data processing service, DJI Terra provided by DJI was used to create a mosaic of drone imagery of the Study area. The aerial imagery was then used in conjunction with ROV, on-foot, and sidescan surveys to define habitats within the Study area.

ON-FOOT

DATA COLLECTION

Onfoot surveys were undertaken across the shoreline of the Study area, during the survey photographs and general descriptions of the habitats within the area were captured.

DATA ANALYSIS

The qualitative assessment of habitat within the area through photos and field observations in conjunction with UAV surveys were used to define habitats within the Study area.

SIDE SCAN

DATA COLLECTION

A Humminbird Helix-12 Fishfinder was mounted to the side of a small watercraft to provide high-resolution side-scan sonar imaging with combined GPS, side-scan, down-imaging and down-beam data sources. The down-beam data were collected at 200 khz to enable bottom hardness, bottom roughness and depth information to be obtained. Side-scan and down-imaging data were collected at 1200 kHz

which provided high-resolution imagery suitable for visual interpretation of bottom habitat types and geomorphic bed forms. The transducer was located on the rear port side of the survey vessel and 20 centimetres below the water line when the vessel was loaded.

DATA ANALYSIS

The underwater habitat transect at each site was imported to Reefmaster 2.0 software where the sonar viewer capabilities were used to generate bathymetric maps and imagery of the seafloor. The transect was visually inspected for habitat features. This data, alongside UAV and ROV data was used to define habitats within the Study area.

SEAGRASS ANALYSIS

Data captured by the various aforementioned methods was used to define seagrass species composition and coverage throughout the Study area. Seagrass coverage was measured approximately using the Seagrass-watch "Manual for Mapping and Monitoring of Seagrass" (McKenzie et al., 2003) and the "Guidelines for the rapid assessment and mapping of tropical seagrass habitats (QFS, NFC, Cairns)" (McKenzie, 2003).

CORAL REEF ANALYSIS

Data captured by the ROV was used to define an approximate coverage of the coral reef systems within the Study area. ROV footage was divided into still images and processed through The CPCe (Coral Point Count with Excel extensions) program.

Three of the eight ROV transects included reef habitat which were processed with a generated number of points randomly overlayed across each image still. A selection of CPCe categories and codes of reef features were then imputed into the analysis. The feature present on each of the randomly positioned points was then defined on eat image still. This information was then used by the program to calculate %compostion of the reef features.

MARINE FAUNA

Marine fauna surveys were undertaken through the use of three methods, these included incidental spotting, BRUVs, and ROV capture.

BRUV

DATA COLLECTION

A total of eight BRUVs deployments were undertaken across eight sites within the Study area. The BRUVs were baited with tuna placed within a net at the end of a pole within view of a horizontally facing GoPRO Hero Series 8.

During each deployment the BRUV unit was baited and lowered to the bottom of the seabed within the Study area. The BRUV was deployed for approximately 60 minutes of recording time and retrieved at the end of this period.

DATA ANALYSIS

Video recordings from each BRUV deployment were analysed from start to finish and any identifiable species were noted. Several individuals were unable to be identified due to poor water quality conditions during video capture.

ROV

DATA COLLECTION

ROV transects were undertaken using a Chasing M2 underwater ROV fitted with a 4K UHD Camera and GoPRO Hero Series 8. The ROV was deployed through a combination of both inshore (shoreline

deployed) and offshore (boat deployed) methods which included eight transects of approximately 200m in length.

The ROV travelled directly above the seabed with the mounted GoPRO directed at the seabed to capture all habitat features within each transect. GPS points were marked at the start and end of each transect. While the ROV survey purpose was to capture habitat features, recordings also incidentally captured several species of Marine Fauna which were incorporated into the species count.

DATA ANALYSIS

Both GoPRO and fitted camera video footage were reviewed to identify footage of incidental marine fauna.

EDNA

DATA COLLECTION

At a subset of sites, approximately 6 L of water was collected from the marine environment. Four to six separate filters were needed per site (depending on the amount of particulates) to process 6 L of site water. Each filter paper was stored and transported in individual 7 mL vials with 99% ethanol. This particular capture, storage and preservation technique has been identified by Hinlo et al., (2017) as one of the more successful techniques in terms of cost and efficiency for DNA recovery

Fish DNA extraction, purification and quantification are detailed below. Laboratory analysis was undertaken at enviroDNA laboratories.

DNA was extracted from the filters using a DNeasy Blood and Tissue Kit (Qiagen), including an extraction negative. Biodiversity assessments were performed with a universal Fish assay targeting a small region of the 12S mitochondrial DNA (McColl-Gausden et al. 2020). Library construction involved two rounds of PCR whereby the first round employed gene-specific primers to amplify the target region and the second round incorporated sequencing adapters and unique barcodes for each sample-amplicon combination included in the library. Negative controls were also included during library construction. Negative controls consisted of the extraction negative as well as PCR negatives where nuclease-free water was used in place of DNA during both rounds of PCR. Sequencing was carried out on an Illumina MiSeq machine.

Following quality control filtering to remove primer sequences, truncated reads and lowfrequency reads, DNA sequences were clustered into Operational Taxonomic Units (OTUs) on the basis of sequence similarity. Taxonomic assignment was performed with VSEARCH. software (Rognes et al. 2016) whereby each OTU cluster was assigned a species identity using a threshold of 95% by comparing against a reference sequence database. Where a species could not be assigned (i.e. reference database was deficient and/or taxa were poorly-characterised), taxonomic assignments were manually vetted by first obtaining a list of possible species through BLASTN searches against the public repository Genbank (www.ncbi.nlm.nih.gov), then eliminating species on the basis of their geographic distribution using information from the Atlas of Living Australia (ALA). In cases where an OTU could not be adequately resolved to a single species (due to shared haplotypes for instance), either a list of multiple species was included, or it was assigned to the lowest taxonomic rank without further classification

MARINE MACROINVERTEBRATES

DATA COLLECTION

Marine macroinvertebrate data collection was split by both offshore and tidal habitat methods. Offshore involved the use of a petite ponar lowered to the seafloor to capture seafloor materials, on contrast to tidal which involved the use of a trowel to capture intertidal samples within the zone.

A total of 2 triplicate grab samples were captured offshore and 3 triplicate tidal samples, less offshore samples were captured due to an equipment malfunction. Collected samples were jarred, preserved in ethanol (70%) and returned to the laboratory for picking, identification and enumeration. Taxonomic

identification was to Family level, with the exception of lower Phyla (Porifera, Nematoda, Nemertea), Oligochaeta (freshwater worms) and Acarina (mites). Chironomids were identified to sub-family level.

Specific QA/QC procedures implemented during macroinvertebrate identification included:

- All sampling and macroinvertebrate enumeration and identification were undertaken by accredited taxonomists; and
- 10% of all samples were cross checked to assess the accuracy of identification and enumeration of the samples collected. Compliance was within the 90% similarity level for all checked samples.

DATA ANALYSIS

Simple univariate analysis was undertaken to define taxonomic richness, abundance and % species contribution.

MARINE TURTLE NESTING SURVEYS

DATA COLLECTION

Coastal shoreline sea turtle nesting surveys were undertaken through the use on-foot ground truthing and UAV surveys over the extent of the shorelines within and surrounding the Study area. Surveys were undertaken using the methods stipulated in the "Queensland Marine Turtle Field Guide" https://environment.des.qld.gov.au/__data/assets/pdf_file/0031/86674/marine-turtle-field-guide.pdf.

WATER QUALITY

DATA COLLECTION

At each site, physicochemical parameters were measured in-situ with a calibrated YSI DSS Pro water quality meter. The following parameters were assessed:

- Temperature (°C);
- Electrical conductivity @ 25°C (µS/cm);
- pH (pH unit);
- Turbidity (NTU); and
- Dissolved oxygen (% saturation and mg/L).

Physicochemical measurements were collected via depth profiling from the waters surface to the seafloor in 1m increments. Results were compared with the trigger limits determined in basin specific WQOs (DSITI, 2017).

CONSERVATION SIGNIFICANT SPECIES

At each site habitat assessments were undertaken for conservation significant (State and/or Federally listed endangered, vulnerable, near threatened, and MNES species identified during the desktop assessment which included the classification of the likelihood of any one species occurring at each site. Assessments were undertaken for three sawfish species, an aquatic reptile and a goby. The likelihood of species occurring was considered under four categories; (i) unlikely; (ii) possible; (iii) likely; and (iv) Known. The criterion used to define each category is provided in Table A2.

Table A2. Criteria used for assigning likelihood of occurrences relevant to EVNT and special least concern species.

Likelihood of occurrence category	Criteria
Unlikely	• No suitable habitat present.

Likelihood of occurrence category	Criteria
Possible	• Suitable species habitat present.
Likely	• Suitable species habitat present and; • A record occurs nearby (10 km) in similar habitat.
Known	• Species recorded during field surveys (including past records).

IMPACT ASSESSMENT

IDENTIFYING THE IMPACT

Each identified impact was categorised, and the significance of the impact determined using the methodology set out below.

CATEGORISING THE IMPACT

PHASE

Impacts will be categorised into either or both of the following phases.

- Construction
- Operation

Where an impact exists in both construction and operation phases, it will be included in both categories (i.e. twice)

DIRECTION

The impact will be identified as positive or negative

RATING THE IMPACT

Impacts will be assessed using a standardised method, which is based on a set of criteria as set out in Table A3. The assessment matrix presented as Table A4 demonstrates how the impact rating is derived.

Table A3 Impact categorisation

Aspect	Magnitude	Duration/Reversibility	Likelihood/frequency
Environment-biological	• Negligible- Little noticeable impact to the environment, impacts consistent with existing activities taking place in the area • Minor- Limited impacts, may affect some common species within a local context but unlikely to change ecological dynamics • Moderate- Impacts to multiple species or communities requiring complex mitigation or management, widespread impacts • Major- Impacts to multiple species of communities, possibly including significant impacts to threatened species or critical biological systems, affects may be felt outside of the region	• Short term- effects will be occur over a period of weeks or months; are easily reversible • Long Term – effects will occur for years • Permanent- values will never return to pre-existing state	• Rare- may occur in exceptional circumstances • Possible- may occur on this project, has occurred occasionally or intermittently on similar projects or actions in the past • Likely – could be expected to occur, has occurred on similar projects or actions in the past. Intermittent affects have occurred frequently in the past. • Almost certain- Is expected to occur, has occurred recently on similar projects or actions and is very likely to occur again
Environment-physical	• Negligible- Little measurable impact to physical environmental features, no additional surface disturbance above that normally created by existing activities • Minor- Limited physical disturbance or minimal changes which are within the normal range of variability, impacts limited to an immediate area of disturbance • Moderate- Measurable changes to physical environment which are outside of the range of normal variability, impacts which extend beyond the immediate disturbance area • Major- Serious physical disturbance or changes which pose a significant risk to physical environment, extensive physical changes well beyond the project area	• Short term- effects will be occur over a period of weeks or months. • Long Term – effects will occur for years • Permanent- values will never return to pre-existing state	• Rare- may occur in exceptional circumstances • Possible- may occur on this project, has occurred occasionally or intermittently on similar projects or actions in the past • Likely – could be expected to occur, has occurred on similar projects or actions in the past. Intermittent affects have occurred frequently in the past. • Almost certain- Is expected to occur, has occurred recently on similar projects or actions and is very likely to occur again

Table A4 Impact rating matrix

Magnitude	Duration	Likelihood	Impact Significance
Negligible	Short Term	Rare	Insignificant
		Possible	Insignificant
		Likely	Insignificant
		Almost Certain	Insignificant
	Long Term	Rare	Insignificant
		Possible	Insignificant
		Likely	Insignificant
		Almost Certain	Insignificant
	Permanent	Rare	Insignificant
		Possible	Insignificant
		Likely	Insignificant
		Almost Certain	Insignificant
Minor	Short Term	Rare	Insignificant
		Possible	Insignificant
		Likely	Low
		Almost Certain	Low
	Long Term	Rare	Low
		Possible	Low
		Likely	Medium
		Almost Certain	Medium
	Permanent	Rare	Low
		Possible	Medium
		Likely	Medium
		Almost Certain	Medium
Moderate	Short Term	Rare	Low
		Possible	Low
		Likely	Medium

Magnitude	Duration	Likelihood	Impact Significance
		Almost Certain	Medium
	Long Term	Rare	Low
		Possible	Low
		Likely	Medium
		Almost Certain	High
	Permanent	Rare	Low
		Possible	Medium
		Likely	High
		Almost Certain	High
Major	Short Term	Rare	Low
		Possible	Medium
		Likely	Medium
		Almost Certain	High
	Long Term	Rare	Low
		Possible	Medium
		Likely	High
		Almost Certain	High
	Permanent	Rare	Medium
		Possible	High
		Likely	High
		Almost Certain	High

SENSITIVITY/IMPORTANCE

The intrinsic sensitivity or importance of the environmental or social was assessed by the subject expert. The rating was derived depending on the type of value, and each subject expert provided definition within the subject chapter to demonstrate how the relative sensitivity/importance has been derived.

Sensitivity/Importance encompassed the intrinsic worth of the value, and related to legal protection e.g. red listed species, or was defined by individual or community perception of social or cultural worth. Rarity or uniqueness was considered to increase the importance of a value. In this way a moderate impact on an irreplaceable value was considered alongside a high impact on a value that is replicated many times in the local area to determine the relative significance of the impact.

Values were rated as low, moderate, high or extreme sensitivity/importance.

IMPACT SIGNIFICANCE

The significance of the impact was derived based on the matrix below. Positive impacts have been excluded from the matrix but were reported in the impact assessment.

Table A5 Impact significance matrix

		Sensitivity/Importance			
		Low sensitivity	Moderately sensitive	Highly sensitive	Extremely sensitive
Impact rating	Insignificant	Minor	Minor	Minor	Minor
	Low	Minor	Minor	Moderate	Moderate
	Medium	Minor	Moderate	Moderate	Major
	High	Moderate	Moderate	Major	Major

The impact significance categories were defined as follows:

Minor: Impact is acceptable on the value; impact is consistent with accepted good practice. Monitoring may be required to assess whether impacts remain acceptable.

Moderate: Impact is acceptable although not ideal. Mitigation can be expected to be required to minimise impacts on the values. Impact is likely to require monitoring if there are opportunities to further reduce impact level.

Major: Impact on the value is unacceptable, is likely to exceed accepted or legislated thresholds, is not in compliance with good practice outcomes. Mitigation is required to reduce the impact. Impacts at this level should not be permitted unless all practicable mitigation measures have been considered.

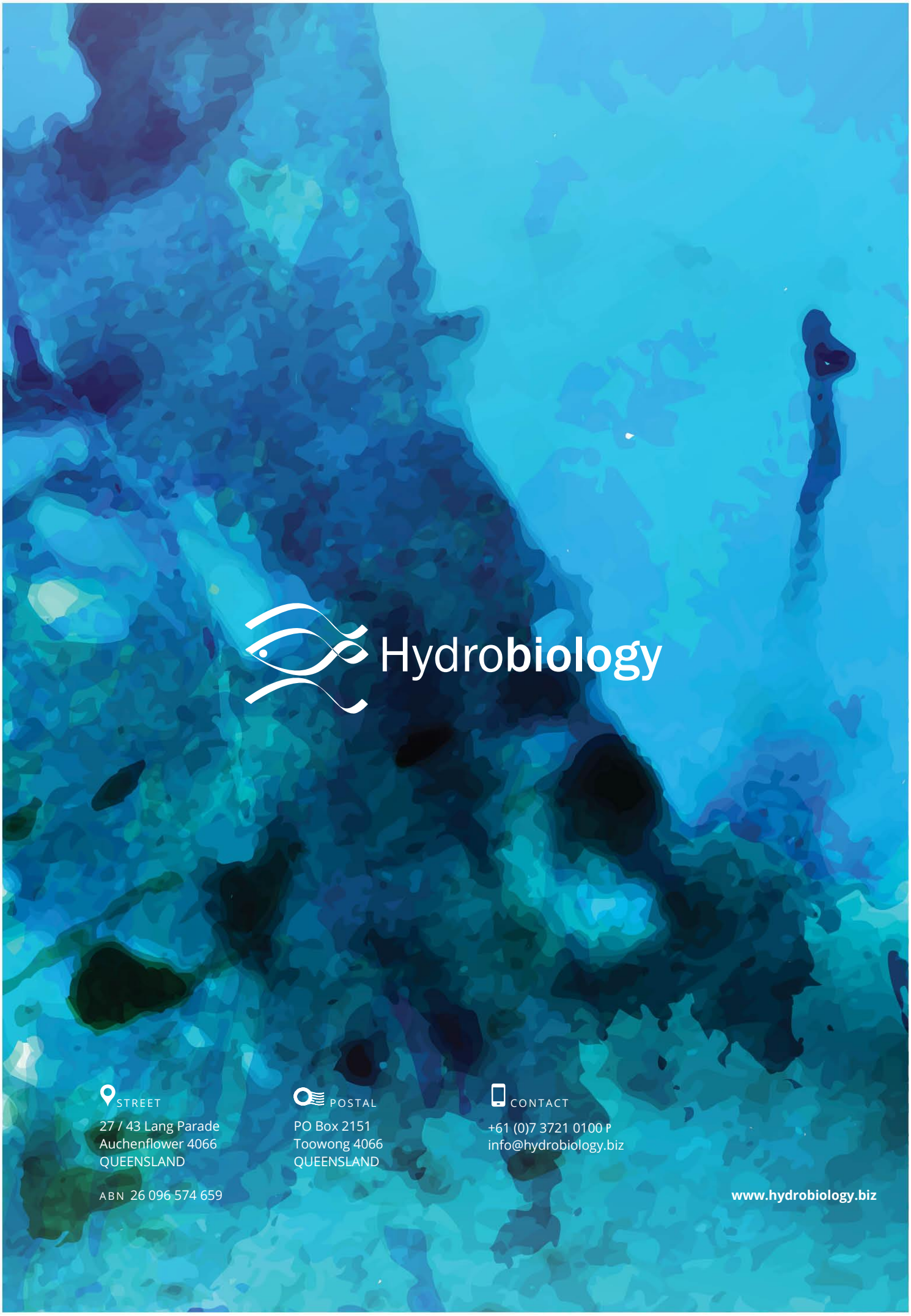
MITIGATION

Mitigation measures were nominated by the subject expert for each impact. Mitigation options were generally considered in the following order of preference:

1. Avoidance of impacts altogether;
2. Reduction of impacts where unavoidable;
3. Restoration of the environmental or social or cultural value following the impact; and
4. Offset or enhancements delivered elsewhere.

RESIDUAL IMPACT RATING

Following the nomination of appropriate mitigation measures, the impact significant assessment process was repeated, considering the proposed mitigation measure, and a residual impact classification was derived using the same matrix presented above. The objective of mitigation was to reduce the impact significance to as low as reasonably practicable



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