



Australia
Moreton Bay

Additional Material, Section 6.1.2

Expanded Version RIS Word form *December 2018*

The purpose of this form is to help in collecting data on a Ramsar Site for the completion of an online Ramsar Information Sheet (RIS) at <https://rsis.ramsar.org>. It can be circulated between the National Focal Point, RIS compilers and other national data collectors. However, it is not accepted by the Ramsar Secretariat for submission of a Site update or new Site designation. The data collected through this form must be transferred to the online form by the National Focal Point or an authorized online RIS compiler.

All fields marked with an asterisk (*) are required.

For more information on how to use this form, please refer to the document [How to use the offline RIS Word form.](#)

Summary

1.1 Summary description

Please provide a short descriptive text summarising the key characteristics and internationally important aspects of the site. You may prefer to complete the four following sections before returning to draft this summary.

Summary (This field is limited to 2500 characters)

The Moreton Bay Ramsar site (Ramsar site) is located in and around Moreton Bay, north-east, east and south-east of the city of Brisbane, in the state of Queensland, Australia. It is located approximately mid-way along the east coast of Australia at a latitude of between 27 and 28 degrees south.

The site is in a semi-enclosed basin, bounded on its eastern side by large sand islands and a deltaic coast on the western side, where large rivers discharge to the Bay from a combined catchment of approximately 22,000 km². The Bay is approximately 110 km long from north to south and 35 km at its widest east to west axis. It opens to the Pacific Ocean in five locations. The catchment for the site is a largely developed urban and peri urban area of over two million people, incorporating a major port, with agriculture and other land uses in the hinterland.

The site includes most of Moreton Island (Gnoorganbin), and parts of North and South Stradbroke Island (Minjerriba), Bribie Island, the southern Bay islands, as well as the waters and tributaries of the Pumicestone Passage. It incorporates some intertidal and subtidal areas of the western Bay, southern Bay, sandy channels and estuarine areas of the Broadwater region, marine areas and sand banks within the central and northern Bay, as well as some ocean beach habitats.

The site meets all nine criteria for the designation of wetlands of international importance. It is notable for its large size, diversity of wetland habitats, connectivity between wetland habitat types, as well as diverse flora and fauna. Wetlands within the site include seagrass, sandy and muddy tidal flats and subtidal areas, saltmarsh, mangroves and coral communities, freshwater wetlands, as well as ocean beaches and dunes.

The site contains one of the most extensive intertidal areas of seagrass, mangroves and saltmarsh communities on the eastern coast of Australia, and is valuable for supporting fisheries resources, waterbirds and marine megafauna of conservation significance. The seagrass meadows provide food and habitat for fish, crustaceans, the internationally vulnerable dugong (*Dugong dugon*), as well as marine turtles. The extensive mangrove and tidal flats provide important nursery conditions for fish and crustaceans, as well as habitat for waterbirds.

The site regularly supports more than 50,000 waterbirds representing at least 43 species of shorebirds and at least 28 migratory shorebird species listed under the Japan-Australia Migratory Bird Agreement (JAMBA), China-Australia Migratory Bird Agreement (CAMBA) and/or Republic of Korea-Australia Migratory Bird Agreement (RoKAMBA). The site is recognised as a network site under the East Asian-Australasian Flyway Partnership (site code EAAF013) and supports over 1% of the estimated flyway population of at least nine migratory shorebird species, including the critically endangered eastern curlew (*Numenius madagascariensis*) and curlew sandpiper (*Calidris ferruginea*). The connected network of low tide foraging areas and high tide roost sites is essential for sustaining shorebird populations in the region.

The site further supports a range of internationally, nationally, state and locally significant species including the Oxleyan pygmy perch (*Nannoperca oxleyana*) fish, four species of acid frogs, the water mouse (*Xeromys myoides*), Illidge's ant-blue butterfly (*Acrodipsas illidgei*), and several freshwater invertebrates.

In addition to its environmental values, the site provides important cultural, social, economic and recreational values. Aboriginal occupation dates back several millennia with present day activities, such as hunting and fishing, continuing to provide important spiritual and provisional value to Aboriginal people. The important fish, crustacean (crabs, prawns) and shellfish (such as oysters) nurseries and populations support commercial, cultural and recreational fisheries. These are of high regional economic and social significance, with commercial fishing in the Moreton Bay region previously estimated at \$24-30 million per annum and recreational fishing estimated at \$20 million per annum. The Ramsar site also supports major nature-based and indigenous cultural tourism opportunities with an estimated twelve million visits per annum to Moreton Bay.

Data & location

2.1 Formal data

2.1.1 Name and address of the compiler of this RIS

Name* (This field is mandatory)

Manager, Wetlands Team

Institution/agency* (This field is mandatory)

Department of Environment and Science, Queensland

Postal address (This field is limited to 254 characters)

GPO Box 2454, Brisbane, Queensland, 4001, Australia

E-mail* (The online RIS only accepts valid e-mail addresses, e.g. example@mail.com) (This field is mandatory)

info@des.qld.gov.au

Phone* (The online RIS only accepts valid phone numbers, e.g. +1 41 123 45 67) (This field is mandatory)

+61 13 74 68

Fax (The online RIS only accepts valid phone numbers, e.g. +1 41 123 45 67)

2.1.2 Period of collection of data and information used to compile the RIS

From year (The online RIS only accepts numeric values)

1999

To year (The online RIS only accepts numeric values)

2018

2.1.3 Name of the Ramsar Site

Official name (in English, French or Spanish)* (This field is mandatory)

Moreton Bay

Unofficial name (optional)

N/A

2.2 Site location

2.2.1 Defining the Site boundaries

The site boundaries must be clearly delineated on both: a) a GIS shapefile and b) a digital map/image:

-> To define the site boundaries please complete field 2.2.1 a1), 2.2.1 a2) and 2.2.1 b) via the online form.

Boundaries description (optional) (This field is limited to 2500 characters)

The Moreton Bay Ramsar site is located in and around Moreton Bay and near the city of Brisbane, in southeast Queensland. It extends approximately 110 km from Bribie Island in the north to the northern wall of the Gold Coast Seaway in the south, and is 35 km at its widest east to west axis.

The site includes one of the largest, hydrologically diverse estuarine bays in Australia and is semi-enclosed by large sand island barriers. The site includes most of Moreton Island, and parts of North and South Stradbroke Islands, Bribie Island, the southern Bay Islands, waters and tributaries of Pumicestone Passage, some intertidal and subtidal areas of the western Bay, southern Bay, estuarine and sandy channels of the Broadwater region, marine areas and sand banks within the central and northern Bay, and some ocean beach habitats.

Given the size and diversity of the Ramsar site, the site has been further delineated into four areas for the purposes of its boundary description:

- Area 1 – Bribie Island, Pumicestone Passage, Deception Bay and Caboolture River
- Area 2 – Western Bay (Redcliffe to Cleveland)
- Area 3 – Moreton Island and Eastern Banks
- Area 4 – Stradbroke Islands and Southern Bay

Refer to the 'Additional material' tab, Section 6.1.2 for a comprehensive boundary description for the site.

2.2.2 General location

a) In which large administrative region does the site lie?

The Moreton Bay Ramsar site is located in the south east of the state of Queensland, Australia. The following five administrative regions (local government areas) intersect the Ramsar site:

- Sunshine Coast Regional Council
- Moreton Bay Regional Council
- Brisbane City Council
- Redland City Council
- City of Gold Coast.

b) What is the nearest town or population centre?

The nearest major city is Brisbane, the capital city of Queensland, which has a population of approx. 2,055,000 based on the Australian Bureau of Statistics 2016 census.

2.2.3 For wetlands on national boundaries only

a) Does the wetland extend onto the territory of one or more other countries?

☐ Yes / ☒ No

b) Is the site adjacent to another designated Ramsar Site on the territory of another Contracting Party?

☐ Yes / ☒ No

c) Is the site part of a formal transboundary designation with another Contracting Party?

☐ Yes / ☒ No

d) Transboundary Ramsar Site name:

2.2.4 Area of the Site

If you have not established an official area by other means, you can copy the area calculated from the GIS boundaries into the 'official area' box.

Official area, in hectares (ha): *(The online RIS only accepts numeric values)*

120654

Area, in hectares (ha) as calculated from GIS boundaries

120654.44

2.2.5 Biogeography

Please provide the biogeographic region(s) encompassing the site and the biogeographic regionalization scheme applied:

Biogeographic regions

Regionalisation scheme(s) ¹	Biogeographic region	Reference (not included in RSIS)
Marine Ecoregions of the World (MEOW)	Temperate Australasia; East Central Australian Shelf (55), Tweed-Moreton (202)	(Spalding et al. 2007)
Udvardy's Biogeographical Provinces	6.1.1, Australian Realm, Queensland Coastal	(Udvardy 1975)
Bailey's Ecoregions	Province - Oceanic Mixed Constantly Humid Forests (44)	(UNEP-WCWC-Global 2011)
WWF Terrestrial Ecoregions (TEOW)	Temperate Broadleaf and Mixed Forests – Eastern Australian Temperate Forests (terrestrial) (code AA0402) (WWF)	(Olson et al. 2001)
Freshwater Ecoregions of the World (FEOW)	Eastern Coastal Australia (807) (FEOW)	(WWF and TNC 2015)

Other biogeographic regionalisation scheme (This field is limited to 2500 characters)

<ul style="list-style-type: none"> • Australian Drainage Division - North East Coast Drainage Division (NEC) (BOM 2012) • Interim Biogeographic Regionalisation for Australia version 7 (IBRA7) – Terrestrial: <ul style="list-style-type: none"> • South Eastern Queensland; Moreton Basin (SEQ02) biogeographic region • Commonwealth of Australia 2012- http://www.environment.gov.au/land/nrs/science/ibra • Interim Marine and Coastal Regionalisation for Australia (IMCRA version 4 June 2006) <ul style="list-style-type: none"> • Provincial-scale bioregion – Central Eastern • Meso-scale marine bioregion –Tweed-Moreton (Commonwealth of Australia 2006- http://www.environment.gov.au/resource/guide-integrated-marine-and-coastal-regionalisation-australia-version-40-june-2006-imcra) • Australian Hydrological Geospatial Fabric – Topographic Drainage Divisions and River Regions: <ul style="list-style-type: none"> • Maroochy River (41) • Pine River (42) • Brisbane River (43) • Stradbroke Island (44) • Logan–Albert Rivers (45) • South Coast (46) (BOM 2012 - http://www.bom.gov.au/water/about/riverBasinAuxNav.shtml)
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¹ Marine Ecoregions of the World (MEOW) | Udvardy's Biogeographical Provinces | Bailey's Ecoregions | WWF Terrestrial Ecoregions | EU biogeographic regionalization | Freshwater Ecoregions of the World (FEOW) | Other scheme (provide name below)
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Why is the Site important?

3.1 Ramsar Criteria and their justification

Tick the box against each criterion applied to the designation of the Ramsar Site. All criteria which apply should be ticked. Please explain why you selected a criterion by filling in the relevant fields on this page, on the three other pages of this section 'Criteria & justification' and on the 'Wetland types' page of the section 'What is the site like?'.

[✓] Criterion 1: Representative, rare or unique natural or near-natural wetland types

To justify this Criterion, please select at least one wetland type as representative, rare or unique in the section. What is the site like? > Wetland types and provide further details in at least one of the three boxes below.

Hydrological services provided (This field is limited to 3000 characters)

The Moreton Bay Ramsar site is representative of sub-tropical coastal wetland systems of the Moreton Basin biogeographic region of southeastern Queensland, and the Tweed-Moreton marine meso-scale bioregion of the Interim Marine and Coastal Regionalisation of Australia (IMCRA) (Commonwealth of Australia 2006). The subtropical climate is characterised by high summer rainfall that can result in large runoff events and floods. This seasonal, event-driven hydrology can lead to shifts between two distinct hydrological modes: wind, wave and tidally dominated; and freshwater inflow dominated (Gibbes et al. 2014).

The site is part of a functioning major coastal system and contains a diversity of wetland habitat types with a high degree of connectivity between many of these habitats. The wetlands are subject to sedimentation, accretion and erosion, and hydrodynamic controls such as tidal inundation, freshwater flows and groundwater interaction. These physical processes interact with chemical and biogeochemical processes, such as nutrient and carbon cycling that, in turn, influences biological processes, such as primary production, reproduction, recruitment and species interaction (BMT WBM 2008).

The site includes natural and near-natural freshwater wetlands, including those on Moreton and North Stradbroke Islands, and critical habitats, examples include peat swamps, clay pans, window water-table lakes, perched lakes, freshwater creeks and other groundwater dependent ecosystems (DES 2015). The hydrology of these wetlands is influenced by rainfall recharge, evaporation, sub-surface infiltration, groundwater flows and, for some creeks and lakes, the surface expression of groundwater (BMT WBM 2008). Significant variation among fish and crustacean species exists at small scales; for example, intraspecific genetic divergence has been identified in populations of freshwater fish and crustacea that have been long separated by a barrier to genetic exchange provided by the high central dunes of North Stradbroke Island (Page et al. 2012).

The site includes natural and near natural coastal heath referred to as 'wallum'. Habitats associated with wallum comprise permanent and ephemeral streams, lagoons and lakes and wet heath communities dominated by sedges and shrubs (Marshall et al. 2011). These are characterised by low nutrient siliceous sand soils, low pH and a supply of moisture from shallow groundwater sources (Leiper et al. 2008). These systems contain uncommon biota with highly restricted distributions that are adapted to acidic waters (Marshall et al. 2011).

Moreton Bay is subject to a large submarine groundwater discharge (SGD) rate estimated to be approximately 18 times greater than the average annual discharge of all the major river inputs into the Bay (Stewart et al. 2015). The SGD has been suggested as a major component of the hydrological and biogeochemical cycles of Moreton Bay and has a major influence on the export of alkalinity and dissolved carbon into the Bay. Hotspots have been identified in the western

embayments and near the Southern Bay Islands and mangroves (ibid); however, the source of the discharge is difficult to determine as the fresh and recirculated marine components are often well mixed (Sadat-Noori et al. 2016).

Other ecosystem services provided (*This field is limited to 3000 characters*)

Ecosystem services refer to the goods and services provided by ecosystems that benefit, sustain and support the environmental, social and economic wellbeing of people. These include provisioning services, such as food and water; regulating services, such as regulation of floods, drought, land degradation, and disease; supporting services, such as soil formation, provisioning of habitat and nutrient cycling; and cultural services, such as recreational, spiritual, religious, and other non-material benefits (Millennium Ecosystem Assessment 2005).

Moreton Bay provides numerous, valuable services to locals and visitors to southeast Queensland. Services provided by Moreton Bay include: tourism and recreational opportunities; fishery products; aesthetic benefits; health and wellbeing; cultural services; storm surge mitigation; climate regulation through carbon sequestration and local temperature moderation and treatment of pollutants (e.g. denitrification processes).

Moreton Bay mangroves and saltmarsh communities provide important primary production for a range of species including commercially valuable fish and crab species. The region supports one of the most productive fisheries in Queensland. Although the Bay only represents about 3% of Queensland's coastline, it produces just over 15% of the seafood for Queensland managed fisheries. The total value of commercial fishery production in the Bay is estimated to be \$24-30m (McPhee et al. 2008).

Moreton Bay's proximity to a major population centre makes it a very popular recreational fishing area. Estimates of the total expenditure by recreational fishers in Moreton Bay range from \$156m to \$194m per year (Pascoe et al. 2014).

In addition to fishing, Moreton Bay provides a range of recreational opportunities, including: sailing, motorboating, kayaking, swimming and kite surfing. A study from 1982 estimated the value of recreational boating to be \$1.7m per year (Rolfe et al. 2005). These recreational opportunities also provide significant health and wellbeing benefits to the broader community through the reduction in the cost of health care services.

While it is difficult to attribute an exact economic benefit from Moreton Bay specifically, it has been estimated that *"A decline in outdoor recreation participation rates of 10% would increase health costs by \$96 million to 2031"* and *"A modest decline of 2% in recreational activity (excluding fishing) by 2031 would result in a decline in expenditure of approximately \$200 million over the 2009 to 2031 period"* across South East Queensland (SEQC 2016).

Moreton Bay Marine Park is the most visited park in Queensland with an estimated 12.4 million visits per year by domestic tourists (SEQC 2016).

Cultural services identified as being significant in the context of the Ramsar site include the importance of the site to Traditional Owners. The site provides spiritual and aesthetic services, improving human wellbeing. The site is also used extensively for research and education.

Wetlands within the site assist in buffering against coastal erosion, storm surges and flooding, which helps build resilience to flood and cyclone events (Barbier 2016). They can help maintain or improve water quality by transforming and retaining nutrients and sediment from run-off.

Seagrass beds are important sites for fixing nitrogen via nitrogen-fixing bacteria, with 0.2 to 0.4knN/Ha/Day being fixed in Moreton Bay seagrass sediments (Clouston 2002). Mangrove

forests have also been shown to play an important role in nitrogen fixation and de-nitrification (Adame and Lovelock 2011). They also play a vital role in the carbon cycle by sequestering and storing carbon dioxide (Lovelock et al. 2014).

There are a range of natural and near-natural wetland types that provide supporting habitat for biodiversity within the Ramsar site. For instance, parts of the site provides critical seagrass meadows for sustaining the Moreton Bay dugong (*Dugong dugon*) population (Lanyon 2003; Sobotzick et al. 2015; Sobotzick et al. 2017), which feed predominately on seagrasses (Marsh et al. 2011 in Sobotzick et al. 2017), as well as the green turtle (*Chelonia mydas*), which consumes seagrass and macroalgae (Commonwealth of Australia 2017).

Coral reef communities support coral reef flora and fauna and the loggerhead turtle (*Caretta caretta*), a species known to exhibit strong fidelity to its foraging grounds (Thomson et al. 2012). Coral reef studies in the Bay show that coral reefs in marine reserves resisted the impact of the major flood event in 2011, unlike similar reefs that were not protected from fishing (Olds et al. 2014). The study determined that herbivorous fish species are critical for facilitating reef resilience to flood impacts, as their grazing activities reduce competition between macroalgae and coral, maintaining coral dominance (ibid).

Moreton Bay supports more than 50,000 waterbirds. At least 43 species of waterbirds occur, including 28 migratory species listed on international conservation agreements.

The estuarine wetlands contain intertidal flats, sandy and muddy substrates, and seagrass that support critical species such as dugong, turtles and the water mouse (*Xeromys myoides*). The water mouse inhabits the critical zone of connectivity between terrestrial and marine ecosystems where it constructs mud nests that act as an island at high tide (Kaluza et al. 2016). These islands are likely to provide an important ecosystem service for other animals inhabiting the intertidal zone (ibid).

The mangroves within this region are known to support *Crematogaster sp.* ants that form a mutually beneficial relationship with larvae of the endangered Illidge's ant-blue butterfly (*Acrodipsas illidgei*) (Sands and New 2002; Breidfuss and Dale 2004). Ant colonies form in stems of mangrove plant species, with adult ants feeding upon secretions released by the butterfly larvae and mature butterfly larvae feeding upon larval ants. This relationship is critical for the maintenance of populations of Illidge's ant-blue butterfly (Breidfuss and Dale 2004).

The freshwater wetlands of Moreton and North Stradbroke Islands sustain unique fauna often exhibiting high levels of genetic divergence. This includes the endangered freshwater fish, the Oxleyan pygmy perch (*Nannoperca oxleyana*), a restricted distribution crayfish *Cherax robustus*, and an undescribed species of false-spider crab (*Amarinus sp.*) and one-gilled swamp eel (*Ophisternon sp.*) (Dawkins et al. 2010; Marshall et al. 2011), as well as the only known population in Queensland of the rare heath shadeskink (*Saproscincus oriarus*) (Hines, Meyer and Hetherington 2015). There is also a range of significant and endangered wetland-dependent plants including the swamp daisy (*Olearia hygrophila*), spikerush (*Eleocharis difformis*), and the swamp orchids (*Phaius australis* and *P. bernaysii*) (Stephens and Sharp 2009).

Other reasons (This field is limited to 3000 characters)

Detailed mapping and classification of wetlands within the region has been undertaken using a combination of Queensland Wetland Mapping (Version 4) (EPA 2005) and Moreton Bay

broad-scale habitats 2008 and Regional ecosystem mapping (version 10). When compared to the Ramsar habitat classification, the Moreton Bay Ramsar site contains a wide diversity of Ramsar wetland types (with up to 23 types (one human-made)) including several that are considered rare within the bioregion. Refer Criterion 2: Rare species and threatened ecological communities; Criterion 3: Biological diversity (flora); section 3.2; section 3.4 and section 4.2 of this document.

[✓] Criterion 2: Rare species and threatened ecological communities

To justify this Criterion, please give details below on:

- *relevant plant species in the section Criteria & justification> Plant species (3.2)*
- *relevant animal species in the section Criteria & justification> Animal species (3.3)*
- *relevant ecological communities in the section Criteria & justification> Ecological communities (3.4)*

The Moreton Bay Ramsar site supports a high diversity of nationally and internationally threatened flora and fauna species, and ecological communities. At least four *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (nationally) listed plant species have been recorded including the endangered swamp daisy (*Olearia hygrophila*), and two endangered swamp orchid species (*Phaius australis* and *Phaius bernaysii*), which are frequently encountered on the bay islands but rarely on the mainland; as well as the vulnerable stinking cryptocarya (*Cryptocarya foetida*).

The Moreton Bay Ramsar site has a high diversity and abundance of waterbird species. This includes migratory shorebirds listed as threatened under the national Environment Protection and Biodiversity Conservation Act, such as the critically endangered eastern curlew (*Numenius madagascariensis*), curlew sandpiper (*Calidris ferruginea*) and great knot (*Calidris tenuirostris*), the endangered red knot (*Calidris canutus*) and lesser sand plover (*Charadrius mongolus*), as well as the vulnerable bar-tailed godwit (*Limosa lapponica*) and greater sand plover (*Charadrius leschenaultii*).

The site supports the *Environment Protection and Biodiversity Conservation Act 1999* listed marine turtles, including hawksbill (*Eretmochelys imbricata*), leatherback (*Dermochelys coriacea*), olive ridley (*Lepidochelys olivacea*), loggerhead (*Caretta caretta*), green (*Chelonia mydas*) and flatback (*Natator depressus*) (Limpus et al. 2006). It supports a number of iconic and nationally significant marine species, including the critically endangered grey nurse shark (*Carcharias taurus*) (east coast population), the endangered southern right whale (*Eubalaena australis*), the vulnerable great white shark (*Carcharodon carcharias*), manta ray (*Mobulia alfredi*) and humpback whale (*Megaptera novaeangliae*). It also marks the most southerly feeding and breeding grounds for dugongs (*Dugong dugon*) (Sobtzick et al. 2017). Moreton Bay features the most southerly resident population of the threatened Australian humpback dolphin (*Sousa sahalensis*) and an important population of Indo-Pacific bottlenose dolphins (*Tursiops aduncus*).

The wallum wetland habitats of Moreton Bay support nationally endangered fish species, the Oxleyan pygmy perch (*Nannoperca oxleyana*), as well as four acid frog species (*Crinia tinnula*, *Litoria olongburensis*, *Litoria cooloolensis* and *Litoria freycineti*). The site further supports the internationally vulnerable water mouse (*Xeromys myoides*), the endangered swamp crayfish (*Tenuibranchiurus glypticus*) and endangered Illidge's ant-blue butterfly (*Acrodipsas illidgei*).

The site contains the following threatened ecological communities:

- | |
|--|
| <ul style="list-style-type: none">• Subtropical and Temperate Coastal Saltmarsh- under national <i>Environment Protection and Biodiversity Conservation Act 1999</i> – Vulnerable• Lowland Rainforest of Subtropical Australia - <i>Environment Protection and Biodiversity Conservation Act 1999</i> – Critically endangered• Coastal Swamp Oak (<i>Casuarina glauca</i>) Forest of New South Wales and South East Queensland - <i>Environment Protection and Biodiversity Conservation Act 1999</i> – Endangered• Littoral Rainforest and Coastal Vine Thickets of Eastern Australia - <i>Environment Protection and Biodiversity Conservation Act 1999</i> – Critically endangered |
|--|

✓ Criterion 3: Biological diversity

To justify this Criterion, please give details in the box below. If you want to name any specific species, please give details on:

- relevant plant species in the section Criteria & justification> Plant species (3.2)
- relevant animal species in the section Criteria & justification> Animal species (3.3)

Justification (This field is limited to 3000 characters)

High levels of biodiversity are supported by the diversity and scale of habitat types found within the site, which encompass both nutrient-rich inshore components (made up of intertidal estuarine habitats) and more oligotrophic offshore components (made up of sandy beaches, channels, banks and bars), as well as a range of other habitats, including freshwater systems.

Fauna

Moreton Bay is a meeting point for tropical northern and temperate southern faunas which, combined with the diversity of habitats, has resulted in a high faunal diversity (Davie and Hooper 1998 in Tibbetts et al. 1998; Hines and Meyer 2011). Numerous species within vertebrate groups including frogs (19) (Hines and Meyer 2011), reptiles (82), birds (410) and mammals (72) (Queensland Government DES 2018) have been recorded within the Ramsar site. Shorebirds, whales, dolphins, marine turtles and fish are some of the wetland species that undertake migrations through, in or around the Ramsar site as part of their lifecycle. The Ramsar site supports over 33,000 migratory shorebirds. For these shorebirds, the site provides essential foraging and roosting habitat that is not only critical during the stationary non-breeding period (approx. Nov-Mar), but also during migration to and from northern hemisphere breeding grounds. During both seasons, shorebirds rely on a connected network of undisturbed roost sites and high quality feeding areas to fulfill their daily energy and rest requirements (Colwell 2010, Rogers et al. 2006, Zharikov & Milton 2009).

A high diversity of marine mammals occurs within Moreton Bay; a total of 14 species of marine mammals are resident or visitors to Moreton Bay, including eight species of dolphin (two resident), five species of whale and the dugong. These include the resident and vulnerable Australian humpback dolphin (*Sousa sahulensis*) (previously included in the taxon known as the Indo-Pacific humpback dolphin, *Sousa chinensis*), dugong (*Dugong dugon*) at the southern-most limit of their range, the Indo-Pacific bottlenose dolphin (*Tursiops aduncus*), short-beaked common dolphin (*Delphinus delphis*) and the southern right whale (*Eubalaena australis*). Moreton Bay temporarily hosts humpback whales (*Megaptera novaeangliae*), which pass through the region every year on their annual migration (Chilvers et al. 2005). The population is recovering strongly from past commercial whaling operations, and is estimated to be increasing at 11% annually (ibid). Female humpback whales with new season calves display a preference for shallow waters, such as those around North Stradbroke Island (Smultea 1994, Ersts and Rosenbaum 2003 and Craig et al. 2014 in Kavanagh et al. 2017).

All six marine turtle species known to occur in Australian waters have been recorded in Moreton Bay (Limpus et al. 2006). Field data and genetic analysis has identified discrete genetic stocks (Commonwealth of Australia 2017), with the loggerhead turtle (*Caretta caretta*) and the green turtle (*Chelonia mydas*) nesting in the site (O'Connor et al. 2017). These species as well as three others - olive ridley turtle (*Lepidochelys olivacea*), flatback turtle (*Natator depressus*), and hawksbill turtle (*Eretmochelys imbricata*), are considered residents (year round) within the Moreton Bay Ramsar site (DNPSR 2015). The extensive seagrass meadows in the site provide important foraging habitat that sustains some of these species.

Over 3,000 species of marine invertebrates and approximately 750 fish species have been recorded in the Bay (Davie and Hooper 1998 in Tibbetts et al. 1998; Johnson 1999).

Some freshwater crayfish, such as *Tenuibranchiurus glypticus*, and fish species, including Oxleyan pygmy perch (*Nannoperca oxleyana*), are coastal wetland habitat specialists and are often geographically isolated, leading to high levels of genetic divergence (Dawkins et al. 2010).

Sixty-four scleractinian coral species from 26 genera and 13 families have been recorded in the inner Bay area and 125 species from 35 genera in the outer Bay area (Wallace et al. 2009). The coral habitats within the Ramsar site are mainly distributed in shallow waters with fringing coral reefs occurring around many of the central bay islands and in the eastern Bay including Peel-, Goat-, Green-, Mud-, King- and Macleay- Island, as well as Lazaret Gutter and Myora Reef (Roelfsema et al. 2016a). There are also mapped coral reef areas on the ocean side of the Bay directly adjacent to the Ramsar boundary (Roelfsema et al. 2016b; Roelfsema et al. 2017). The coral communities are of very high conservation significance because they occur within a transitional area where tropical, subtropical and temperate species co-exist (Beger et al. 2014).

The heath shadecink (*Saproscincus oriarus*) occurs within the Ramsar site, it is known in Queensland only from North Stradbroke Island (Hines, Meyer and Hethrington 2015) and from another six locations in NSW. It is associated with lowland coastal heath and paperbark (*Melaleuca*) swamps.

Flora

The Moreton Bay Ramsar site supports diverse flora. For example, the Queensland Herbarium (2005) have recorded 824 native plant species at North Stradbroke Island alone, illustrating the high level of biodiversity in a regional context. Some flora species are thought to be restricted to the site and, therefore, contribute significantly to the bioregional biodiversity.

The site includes ten regional ecosystems that have a state-based biodiversity status of 'endangered', covering over 363 hectares within the site. It also includes 15 regional ecosystems that have an 'of concern' status covering over 13,126 hectares. The biodiversity status of these ecosystems reflects their condition and clearing at a bioregional scale. The regional ecosystems that contribute to the international importance listing for the site are listed in section 3.4, with more information about Queensland's regional ecosystem classification and mapping available at <http://www.qld.gov.au/environment/plants-animals/plants/ecosystems/about>.

Extensive loss of paperbark (*Melaleuca* spp.) swamps has occurred within southeast Queensland due to development and the paperbark communities within the Ramsar site are an important representation of this wetland type within the bioregion.

Similarly, few areas of extensive and intact heathlands remain within the bioregion. Wallum heathland is particularly important due to the diversity of flora species, as well as the unique fauna species that inhabit it and the Ramsar site provides an important refuge for these habitats.

As a whole, Moreton Bay supports approximately 275 species of macroalgae, which represents approximately 40% of the macroalgae species reported in Queensland (Phillips 1998 in Tibbetts et al. 1998). A large proportion of these species occur in the Ramsar site, although this figure includes the reef areas outside the boundaries of the site. Overall, tropical/subtropical species predominate (approximately 64% of species), and several of these have their southernmost distribution limit in the Bay (ibid).

Several other flora communities within the Moreton Bay Ramsar site are particularly noteworthy. These include saltmarsh, seagrass and mangrove ecosystems that provide habitat to a range of

species at various stages in their life cycles, including commercially and recreationally significant fish species and crustacea. Saltmarsh communities are important for a range of ecosystem services including providing habitat for species, carbon capture and storage and water quality filtration. Saltmarsh within Moreton Bay has declined by 36%, a net loss of 5,700 ha, over the period 1955 – 2012 (Accad et al. 2016). It is subject to a range of threats including reclamation for development, damage from recreational and industrial traffic, stormwater quality impacts, weed infestations, and mangrove incursion. Indeed, mangrove incursion is the major recent driver of loss of this community with 47% converted to mangrove communities (Accad et al. 2016; Wegscheidl et al. 2015).

Seven species of seagrass occur in the site, which is considered a large number compared to most estuaries of the same bioregion that typically host one to three species (Abal et al. 1998 in Tibbetts et al. 1998; Roelfsema et al. 2009). Previous studies have estimated that seagrass meadows cover approximately 190 km² of Moreton Bay with *Zostera muelleri* being the dominant species in the intertidal and shallow areas (Roelfsema et al. 2013; Digby et al. 1998 in Gibbes et al. 2014).

Seven to eight species of mangrove occur in the site (Dowling and Stephens 2001; Duke 2006). Fourteen distinct mangrove communities have been mapped by the Queensland Herbarium covering an area of approximately 15,231 ha of the Bay (Dowling and Stephens 2001; Accad et al. 2016). The site represents the southernmost distribution limit of *Ceriops australis* and *Lumnitzera racemosa*. The area of mangrove community distribution in Moreton Bay has increased by 6.4% since 1955, due mainly to the encroachment of mangroves into saltmarsh and swamp she-oak (*Casuarina glauca*) communities, and the colonisation and expansion of mangrove areas along the coastline where sediment from the catchment has been deposited (Accad et al. 2016).

Criterion 4: Support during critical life cycle stage or in adverse conditions

To justify this Criterion, please give details below on:

- relevant plant species in the section *Criteria & justification*> *Plant species* (3.2)

- relevant animal species in the section *Criteria & justification*> *Animal species* (3.3)

and explain the life cycle stage or nature of adverse conditions in the accompanying 'justification' box.

The Moreton Bay Ramsar site supports habitats that are important at critical stages in the life cycles of numerous wetland-dependent species, including at least 28 migratory shorebirds of the East Asian-Australasian Flyway. Each summer, more than 33,000 migratory shorebirds spend the non-breeding season (approx. Nov-Mar), and parts of their northward and southward migratory journeys in Moreton Bay. In addition, a subset of the non-breeding population, typically sub-adult birds not yet ready to reproduce, will remain in Moreton Bay year-round before making their first northward migration to breed, this includes nationally critically endangered species such as the eastern curlew. Moreton Bay is one of the premier sites in Queensland for this species.

While in Moreton Bay, shorebirds feed twice daily on benthic invertebrates in exposed intertidal habitats. At high tide, when intertidal foraging areas are submerged, shorebirds congregate in high densities ('roosts') in supratidal habitats in or along the periphery of the Ramsar site, including claypans, sandy and rocky foreshores, and mangroves (coastal and islands) (Zharikov and Milton 2009). Shorebirds move within these areas depending on a number of factors including the time of day, availability of resources, levels of disturbance and environmental conditions. Some habitats are important refuges during extreme high tides or

when weather conditions prohibit occupancy of more commonly used habitats. In particular, undisturbed roosting and foraging sites are important to a number of species, such as threatened eastern curlew and bar-tailed godwit, which show high site fidelity, very high energy demands and sensitivity to human approach (Weston et al. 2012).

Due to its internationally recognised importance for migratory waterbirds, Moreton Bay is listed as a Flyway network site of the East Asian Australasian Flyway Partnership (site code EAAF013). In addition to migratory shorebirds, the site supports a range of other waterbird species (QWSG 2017). The site provides important breeding habitat for the resident Australian pied oystercatcher (*Haematopus longirostris*), beach stone-curlew (*Esacus magnirostris*) and Little tern (*Sterna albifrons*), as well as raptors, such as the eastern osprey (*Pandion haliaetus*) and white bellied sea eagle (*Haliaeetus leucogaster*).

The site also provides important nursery grounds for a range of marine fish, prawns and crabs as well as supporting the entire life cycle of acid frog species, the water mouse (*Xeromys myoides*), Illidge's ant blue butterfly (*Acrodipsas illidgei*) and the Oxleyan pygmy perch (*Nannoperca oxleyana*), a freshwater fish.

The site is also an important feeding area for green (*Chelonia mydas*) and loggerhead (*Caretta caretta*) turtles, and provides some areas suitable for nesting for both species (O'Connor et al. 2017). The site is an important feeding and breeding area for a population of dugongs (Lanyon 2003; Seddon et al. 2014; Sobotzick et al. 2015; Sobotzick et al. 2017) and provides habitat features for migratory species including the grey nurse shark (*Carcharias taurus*) and zebra shark (*Stegostoma fasciatum*). Both these species use mating sites in large aggregations during the warmer summer months near to the site (Dudgeon et al. 2013; Smith et al. 2015).

Moreton Bay provides critical habitat for dugongs. Some studies have suggested that some dugongs may have moved into Moreton Bay from the Hervey Bay population following the effects of extreme weather events, i.e., loss of seagrass (Preen and Marsh 1995, Sobotzick et al. 2012), however, there is little evidence genetically for this immigration (Seddon et al. 2014).

The overall dugong population of Moreton Bay appears to have been largely unaffected by significant floods (Sobotzick et al. 2012). Following local flood events and the loss of inshore seagrasses from coastal intertidal areas within Moreton Bay such as Deception and Bramble Bays, there may have been movement of dugongs within the Bay to the seagrass meadows of the Eastern Banks (ibid). The major dugong habitat of the Eastern Banks is flushed with oceanic water on a daily basis and is probably less prone to impacts from major flood events and anthropogenic pollution than the western meadows (Sobotzick et al. 2015).

✓ Criterion 5: >20,000 waterbirds

To justify this Criterion, please give details below on: the total number of waterbirds and the period of data collection - relevant waterbird species, and if possible their population size, in the section Criteria & justification> Animal species (3.3)

Overall waterbird numbers* (This field is mandatory)

Despite significant declines of several migratory shorebird species in Moreton Bay (Wilson et al. 2011), the area is estimated to continue to support more than 33,000 individuals (Hansen et al. 2016). Migratory shorebirds are a subset of 'waterbirds', which also includes other wetland bird species such as ducks, pelicans, cormorants, darters, herons, bitterns, storks, ibises and spoonbills. Monthly counts of migratory and non-migratory shorebirds, as well as other waterbirds, at no fewer than 40 high tide roost sites have been undertaken by the Queensland Wader Study Group (QWSG) since 1992 (further detail can be found in Wilson et al. 2011). A species list for the 28 migratory shorebird species that occupy the site is in Attachment 1.

Category	Species	Estimated population (2013-2017)
Migratory shorebirds	28	33,929
Non migratory shorebirds	15	3,758
Other waterbirds	59	28,653

Start year* (This field is mandatory)

2013

End year* (This field is mandatory)

2017

Source of data:

QWSG 2017; Hansen et al. 2016

✓ Criterion 6: >1% waterbird population

To justify this Criterion, please give details on relevant waterbird species and their population size in the section Criteria & justification> Animal species (3.3)

Based on the Hansen et al. 2016 revised East Asian-Australasian Flyway population estimates, the site provides habitat for >1% of the estimated East Asian-Australasian Flyway population of the following species:

- bar-tailed godwit (*Limosa lapponica*)
- curlew sandpiper (*Calidris ferruginea*)
- eastern curlew (*Numenius madagascariensis*)
- grey-tailed tattler (*Heteroscelus brevipes*)
- red-necked stint (*Calidris ruficollis*)
- Australian pied oystercatcher (*Haematopus longirostris*)¹
- whimbrel (*Numenius phaeopus*)
- sharp-tailed sandpiper (*Calidris acuminata*)
- lesser sand plover (*Charadrius mongolus*)
- double-banded plover (*Charadrius bicinctus*)

¹As Australian pied oystercatcher (*Haematopus longirostris*) is not a migratory shorebird, there is no Hansen et al. 2016 population estimates for the species. Instead, the Waterbird Population Estimates (WPE) (wpe.wetlands.org) has been used to determine the 1% threshold for this species.

Bar-tailed godwit (*Limosa lapponica*), curlew sandpiper (*Calidris ferruginea*), eastern curlew (*Numenius madagascariensis*) and lesser sand plover (*Charadrius mongolus*) have been undergoing significant declines, which is reflected in their national conservation status of vulnerable for bar-tailed godwit, critically endangered for eastern curlew and curlew sandpiper, and endangered for the lesser sand plover.

The QWSG surveys (refer Criterion 5 above) include counts at high tide at the Port of Brisbane located adjacent to the Ramsar site. These shorebird species are likely foraging in the surrounding area including the Ramsar site. Red-necked stint (*Calidris ruficollis*) are one species that might forage within the Port of Brisbane in higher numbers, meaning estimates may be inflated for this species when considering the extent of the Ramsar site.

[✓] Criterion 7: Significant and representative fish

To justify this Criterion, please give information in the box below and details of relevant fish species in the section Criteria & justification> Animal species (3.3)

Justification (This field is limited to 3000 characters)

The Moreton Bay Ramsar site supports diverse fish fauna due to the wide variety of habitats within and adjacent to it, including mangroves, saltmarsh, seagrass, sand and mud flats, offshore channels, reef environments, estuarine creeks, freshwater lakes and streams (Laegdsgaard and Johnson 1995; Davie and Hooper 1998 in Tibbetts et al. 1998; Pusey et al. 2004; Johnson 2010; Olds et al. 2012).

For fish in the waters of Moreton Bay, two interacting zones of diversity exist; an inshore estuarine-dominated system and an eastern marine- dominated system (Davie and Hooper 1998 in Tibbetts et al. 1998). Moreton Bay is also a meeting point for tropical northern and temperate southern faunas which, combined with the diversity of habitats, has resulted the high faunal diversity with approximately 750 fish species recorded in the Bay (Johnson 1999; Johnson 2010). Species at their southern range extent include Australian weasel shark (*Hemigaleus australiensis*) and the Australian sharpnose shark (*Rhizoprionodon taylori*) (Taylor et al. 2016), both of which display regional differences in reproductive characteristics, the result of latitudinal variation in environmental conditions (ibid). In addition, there are at least 27 species of fish that are only known to occur in Moreton Bay (Davie and Hooper 1998 in Tibbetts et al. 1998).

The diverse fish fauna of the Bay has cultural, social, and economic value (Johnson 2010). The estimated gross value of production for commercial fisheries in the Bay are in the range of AUD\$24m-\$30m (McPhee et al. 2008) and the recreational fisheries are valued at AUD\$20m per year (Pascoe et al. 2014). The major fish species targeted for commercial fisheries include yellowfin bream (*Acanthopagrus australis*) and sea mullet (*Mugil cephalus*) (van de Geer et al. 2013; Gilby et al. 2017a) as well as (but not limited to), other species of mullet, bream, whiting, tailor, spinefoot (rabbitfish), garfish, baitfish, flathead, dart, snapper and trevally (QFish 2018). Popular species for recreational fisheries include, amongst others, sand whiting (*Sillago ciliata*) and dusky flathead (*Platycephalus fuscus*) (Vargas-Fonseca et al. 2016; Henderson et al. 2017).

Over 3,000 species of marine invertebrates have been recorded in the bay (Davie and Hooper 1998 in Tibbetts et al. 1998; Johnson 1999), with many species contributing to the high value fisheries (e.g. banana (*Fenneropenaeus* spp.), king (*Melicertus* spp.), endeavour (*Metapenaeus* spp.), tiger (*Penaeus* spp.), school (*Metapenaeus* spp.) and greasy-back (*Metapenaeus* spp.) prawns; mud (*Scylla serrata*, blue swimmer (*Portunus armatus*) and spanner (*Ranina ranina*) crabs (QFish 2018). Other species of commercial significance include Onuphidae bait worms, squid (*Photololigo* *Sepioteuthis* *Nototodar* spp.), cuttlefish (*Sepia* spp.), rock oysters

(*Saccostrea glomerata*) and beche-de-mer/ sea cucumber (*Holothuria fuscogilva*, *Actinopyga spinea* and *Stichopus spp.*) (BMT WBM 2008; QFish 2018).

Freshwater fish fauna of the Moreton Bay Ramsar site are relatively well known but there are still taxonomic problems within some groups with potentially new taxa yet to be described (Davie and Hooper 1998 in Tibbetts et al. 1998; Pusey et al. 2004). Within Moreton Bay, 30 freshwater fish species have been recorded (Pusey et al. 2004) and 66 aquatic macroinvertebrate taxa have been recorded on North Stradbroke Island alone (Marshall et al. 2011).

The wallum wetland habitats of Moreton Bay support nationally threatened fish species including the Oxleyan pygmy perch (*Nannoperca oxleyana*) known to be present at the Ramsar site. This species, along with other freshwater species recorded within the site such as ornate rainbowfish (*Rhadinocentrus ornatus*) and the IUCN red listed endangered crayfish *Tenuibranchiurus glypticus*, are coastal wetland habitat specialists and are often geographically isolated from one another leading to high levels of genetic divergence (Dawkins et al. 2010; Hughes et al. 1999; Page et al. 2004; 2012; Mather et al. 2015). This could lead to increased vulnerability to changes in their habitat.

☒ **Criterion 8: Fish spawning grounds, etc.**

To justify this Criterion, please give information in the box below. Completion of details on relevant fish species in the section Criteria & justification> Animal species (3.3) is optional.

Justification (This field is limited to 3000 characters)

Moreton Bay provides important habitats, feeding areas, dispersal and migratory pathways for approximately 750 marine and estuarine fish species (Johnson 1999; Johnson 2010). Some of these fish and shellfish species have important fisheries resource values both within and external to the site.

Documented fish feeding habitats in Moreton Bay include saltmarshes, mangroves, intertidal flats, seagrasses as well as coral and rocky reefs (Laegdsgaard and Johnson 2001; Hollingsworth and Connolly 2006; Gilby et al. 2011; Ebrahim et al. 2014; Pearson and Stevens 2015; Yabsley et al. 2016; Gilby et al. 2017b). This includes tidal marshes feeding habitats for commercially important species including whiting, mullet and the giant mud crab (Thomas and Connolly 2001, McPhee et al. 2015; Meynecke and Richards 2014). Moreton Bay mangroves and seagrasses also provide refuge from predators (Laegdsgaard and Johnson 2001) and; together with saltmarshes, function as nursery habitats for juvenile fish (Blaber and Blaber 1980; Morton et al. 1987; Laegdsgaard and Johnson 1995).

Mangroves play an indirect role in supporting coral reef food webs by providing important refuge for some juvenile reef fish species, while seagrass beds in close proximity to reefs can also contribute to inshore reef fish diets (Kieckbusch et al. 2004 in Davis et al. 2014). A range of fish species move into mangroves to feed, indicating this habitat's importance to foraging reef species (Olds et al. 2012; Martin et al. 2015).

Intertidal habitats, particularly soft sediment tide pools, act as essential habitat for small fishes and nurseries for juvenile fish species (Krück et al. 2009; Chargulaf et al. 2011). Many of these species also spawn in inshore waters, particularly near the surf zone and in sandy channels within the boundaries of the Ramsar site (Chargulaf et al. 2011).

Spawning aggregations of yellowfin bream, *Acanthopagrus australis* have been observed in the Bay (Pollock 1982) and breeding aggregations of the double-ended pipefish, *Syngnathoides biaculeatus* have been reported from seagrass meadows (Takahashi and Connolly 2003).

Migration of some fish species also appear to occur in Moreton Bay, either for movement to spawn over surf bars or to migrate from shallower habitats as juveniles into offshore waters as adults (Pollock 1982; Davis et al. 2015). Studies have also shown that the variety of habitats, including the central reefs in Moreton Bay, may serve as stepping stones for some species of fish during their migrations (Olds et al. 2012).

✓ **Criterion 9: >1% non-avian population**

To justify this Criterion, please give details on relevant non-avian species and their population size in the section Criteria & justification> Animal species (3.3)

Justification (This field is limited to 3000 characters)

The site provides or is likely to provide habitat for >1% of the population of the following wetland dependent non-avian species:

- Wallum froglet (*Crinia tinnula*)
- Cooloola sedgefrog (*Litoria cooloolensis*)
- Wallum sedgefrog (*Litoria olongburensis*)
- Wallum rocketfrog (*Litoria freycineti*)
- Dugong (*Dugong dugon*)
- Oxleyan pygmy perch (*Nannoperca oxleyana*)
- Water mouse (*Xeromys myoides*)
- Illidge's ant blue butterfly (*Acrodipsas illidgei*)
- Loggerhead turtle (*Caretta caretta*)
- Green turtle (*Chelonia mydas*)

Acid frogs – Wallum froglet (*Crinia tinnula*), Cooloola sedgefrog (*Litoria cooloolensis*), wallum sedgefrog (*L. olongburensis*) and wallum rocketfrog (*L. freycineti*)

“Acid frogs” is a term used to describe a group of frogs that are uniquely adapted to breeding in low-pH low-nutrient waters and are typically found in coastal and sub-coastal Melaleuca swamps, wet heath, sedgeland and lakes in southeast Queensland and northern New South Wales. Their populations have declined due to habitat loss; competition; predation; and fragmentation and degradation due to changes in hydrological regimes (Ingram and Corben 1975; Gillespie and Hero 1999; Lowe et al. 2015; Meyer et al. 2006; Hines and Meyer 2011).

Based on limited studies of relative abundance, surveys of the extent of occurrence and area of occupancy, knowledge of habitat requirements and expert opinion, at least 1% of the Australian population of these 4 species occur in the Moreton Bay Ramsar area. Hines and Meyer (2011) recorded wallum sedgefrog from numerous sites on Bribie Island with densities as high as 181 individuals per 100m².

The national recovery plan for acid frogs (Meyer et al. 2006) lacks species population estimates; however, it lists the geographic locations of important wallum frog populations. Four locations are listed within Queensland, three of which are within the Ramsar site; Bribie Island National Park; Moreton Island National Park; and North Stradbroke Island National Park (ibid). Hines and Meyer (2011) (and Hines, H pers.comm 2018) show wallum sedgefrog and wallum froglet to be widespread and abundant in suitable habitat on Moreton, Bribie and North Stradbroke Islands. Their data show that the wallum rocketfrog has a much more limited distribution, although significant populations occur on these three islands. The Cooloola sedgefrog occurs at high density in sedgeland and lakes of North Stradbroke Island, with the two other populations of this species occurring in the Cooloola and Fraser Island areas (Selles 2004).

The IUCN Red List (2004) lists the four acid frog species as decreasing. The federal Species Profile and Threats Database (SPRAT) entry for wallum sedgefrog states that sizeable populations of the frog persist in nine protected areas of Queensland including Naree Budjong Djara National Park on North Stradbroke Island, Moreton Island National Park and Bribie Island National Park that are within the Ramsar site (DEE 2017).

Dugong (*Dugong dugon*)

The resident dugong population in Moreton Bay is a distinct sub-population of the Australian east coast population, with genetic studies indicating significant genetic differentiation of dugong populations over relatively small distances in southern Queensland (Seddon et al. 2014).

Dugongs do not appear to undertake regular large-scale migrations (Seddon et al. 2014). While pedigree links between the Moreton Bay population and the Hervey Bay-Great Sandy Straits region population, located approximately 300 km to the north have been established, the migration rate of these are estimated to 2-3% (Cope et al. 2015), and is not considered sufficient to disrupt the long-term existence of these distinct breeding populations (Seddon et al. 2014).

The most recent aerial survey of dugong in Moreton Bay in 2016, estimated relative dugong abundance at 601 with a standard error of 80 (Sobtzick et al. 2017). The winter survey of 2013 estimated a population size of 759 ± 181 (Sobtzick et al. 2015). The previous estimate in the summer of 2011 was 883 ± 68 , with the change in dugong abundance estimates between these years being largely attributable to the seasonal difference between the different surveys (Sobtzick et al. 2012). Comparing these results against aerial surveys from the mid-1990s (Lanyon 2003) and Capture-Mark-Recapture estimates in 2007 (Lanyon et al. 2007) suggests a relatively stable population of 850–1,000 dugongs (Seddon et al. 2014).

The eastern Amity Banks, Moreton Banks (i.e., Eastern Banks) and adjacent areas to these sandbanks are considered the most important seagrass habitats for dugong in the Bay (Lanyon 2003; Marsh et al. 2011; Sobtzick et al. 2017). Rous Channel and east of South Passage (up to 10 m offshore from Moreton Island) are also important in cooler months (Lanyon et al. 2005). Pumicestone Passage's tidal flats and estuarine wetland assemblages supporting intertidal flats, shoals and seagrass, are critical to smaller numbers of dugongs (Lanyon et al. 2005).

The evidence of the Moreton Bay dugongs as a resident and genetically distinct subpopulation coupled with their major shallow water seagrass habitats being within the Moreton Bay Ramsar site provisions for meeting the 1% threshold of criterion 9.

Oxleyan pygmy perch (*Nannoperca oxleyana*)

The Oxleyan pygmy perch is a small-bodied percichthyid fish found only in dystrophic, acidic, freshwater systems in wallum habitat from Fraser Island to Wooli in northern New South Wales (NSW) (Knight et al. 2009).

Genetic studies have revealed highly significant population subdivisions between Queensland and NSW localities (Knight et al. 2009). Populations in coastal and island catchments appear isolated and genetically distinct, most probably as a result of the loss of dispersal pathways by rising sea levels following the last glacial period approximately 8,000 years BP (ibid).

Within Queensland, Oxleyan pygmy perch is known to inhabit water bodies with small populations on six mainland drainages and the rest on Fraser, Moreton and North Stradbroke Islands (Knight and Arthington 2008). Comprehensive sampling efforts of the Oxleyan pygmy

perch indicate this species has a significant proportion of their population at Moreton and North Stradbroke Islands (Knight et al. 2009).

The estimated population of Oxleyan pygmy perch within the Ramsar site would satisfy the 1% threshold of criterion 9 (Arthington, A pers. comm. 2017).

Water mouse (*Xeromys myoides*)

The water mouse is a small native rodent that can be found in coastal saltmarsh including samphire shrublands, saline reed-beds, saline grasslands, mangroves and coastal freshwater wetlands (DERM 2010b). In Queensland, the water mouse has been recorded on the mainland in the Proserpine region and in southeast Queensland between Hervey Bay and the Coomera River (50 km south east of Brisbane). High density populations occur within the Pumicestone Passage and Southern Moreton Bay including the western shores of North and South Stradbroke Island (ibid).

The total population in Australia is estimated to only 10,000 mature individuals (Woinarski et al. 2014). Despite significant impacts to mainland populations of water mouse (DERM 2010b), the western shorelines of North Stradbroke, South Stradbroke and Bribie islands are considered stronghold populations, and support populations that meet the 1% threshold of criterion 9 (Kaluza, N and Gynther, I pers. comm. 2017).

Illidge's ant blue butterfly (*Acrodipsas illidgei*)

Populations of Illidge's ant blue butterfly are restricted to a small number of coastal mangrove localities from the Mary River Heads, south eastern Queensland to Brunswick Heads, northern New South Wales (Sands and New 2002). The Moreton Bay Region is one of only six confirmed areas for the species, all of which are associated with intertidal mangrove systems and the presence of *Crematogaster* ants. In particular, the Southern Bay supports known populations of Illidge's ant-blue butterfly (Sands and New 2002). At Coomera Island in the Southern Bay, Illidge's ant-blue was identified from mature grey mangrove (*Avicennia marina*) supporting *Crematogaster* ants, adjacent salt marsh (Breitfuss and Dale 2004).

Green turtle (*Chelonia mydas*)

Australia has seven widely separated genetic stocks (management units) of green turtles, with Moreton Bay being part of the southern Great Barrier Reef (GBR) stock (Limpus 2008). The main nesting areas for the southern GBR region are within the islands of the Capricorn-Bunker Groups (Limpus 2008). Some nesting has been recorded within the Moreton Bay Ramsar Site, for example, supervised community groups have recorded 11 green turtle nests on the ocean beaches of North Stradbroke Island for the 2017/18 season, representing 3 individual females (Truman, J pers. comm. 2018).

Moreton Bay is an important green turtle feeding ground and one of three primary index foraging areas for monitoring population dynamics of the southern GBR green turtle management unit (Limpus et al. 2013). Monitoring of green turtles in Moreton Bay has been undertaken under the Department of Environment and Science (Queensland Government). Observations have found the green turtle population of the eastern banks in Moreton Bay has tripled over the past 25 years and now equates to an estimated 10,000 individuals (Dr Limpus, C pers. comm. 2018). Sobtzick et al. (2017) estimated from aerial surveys conducted in October-November 2016 that there were 26,229 (+/-4946) large juvenile and adult marine turtles (male and female) of all species in Moreton Bay, suggesting green turtles may constitute a large proportion of marine turtles observed in the Bay. Based on an estimated total population of green turtles of 700,000 (Dr Limpus, C pers. comm. 2018), the 1% population threshold is fulfilled for green turtles.

Loggerhead turtle (*Caretta caretta*)

Australia's eastern coast population of nesting loggerhead turtles belong to the southwest Pacific Ocean genetic stock, a genetically distinct breeding stock considered as a separate management unit (FitzSimmons and Limpus 2014). The eastern Australia loggerhead turtle sub-population currently comprises an estimated 700-800 nesting females (Dr Limpus, C pers. comm. 2018).

Community groups have monitored the nesting loggerhead turtles on the sand barrier islands located within the Ramsar site over a number of years and found approximately 6-8 nests per season on the northern end of Bribie Island, possibly equating to two nesting females per season (Hofmeister, K pers. comm. 2017), and approximately 22 nests on southern Bribie Island in 2017, possibly equating to six nesting females per season (Environmental Protection Association- Oxenford, D pers. comm. 2017). Monitoring of loggerhead turtle nesting have also been undertaken on North Stradbroke Island, where 17 loggerhead turtle nests were recorded on the ocean beaches for the 2017/18 season, representing 5 to 6 individual females (Truman, J pers. comm. 2018). Further, on Moreton Island approximately 5-10 females nest per year (Dr Limpus, C pers. comm. 2018). Based on these observations of nesting turtles alone (not accounting for the total population in Moreton Bay), the 1% population threshold is met. As for green turtles, Moreton Bay is also an important foraging site for loggerhead turtles, and one of two primary index sites for monitoring inwater population dynamics for this species in eastern Australia (Limpus et al. 2013b).

3.2 Plant species whose presence relates to the international importance of the site

Scientific name*	Common name	Criterion 2	Criterion 3	Criterion 4	IUCN Red List ²	CITES App I	Other status*	Justification
<i>Cryptocarya foetida</i>	stinking cryptocarya	[x]	[x]				National (EPBC Act)– vulnerable; QLD (<i>Nature Conservation Act 1992</i>) – VU	Only recorded on mainland between Gympie and Ballina (NSW) as well as North Stradbroke and St Helena islands in Moreton Bay
<i>Olearia hygrophila</i>	swamp daisy	[x]	[x]				National (EPBC Act) – endangered; QLD (<i>Nature Conservation Act 1992</i>) – EN	Endemic to North Stradbroke Island, wetland dependent
<i>Phaius australis</i>	lesser swamp-orchid	[x]	[x]				National (EPBC Act) – endangered; QLD (<i>Nature Conservation Act 1992</i>) – EN	Found frequently on the bay islands, however rarely on the mainland
<i>Phaius bernaysii</i>	yellow swamp-orchid	[x]	[x]				National (EPBC Act) – endangered; QLD (<i>Nature Conservation Act 1992</i>) – EN	Found frequently on the bay islands, however rarely on the mainland

*Note the *Nature Conservation Act 1992* is the Queensland state legislation pertaining to native flora and fauna species, including state level conservation status. It is referenced throughout this document.

Optional text box to provide further information on plant species of international importance:

(This field is limited to 2500 characters)

Threatened ecological communities in the Ramsar site include:

- Subtropical and Temperate Coastal Saltmarsh- *Environment Protection and Biodiversity Conservation Act 1999* – Vulnerable
- Lowland Rainforest of Subtropical Australia - *Environment Protection and Biodiversity Conservation Act 1999* – Critically endangered
- Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland - *Environment Protection and Biodiversity Conservation Act 1999* – Endangered
- Littoral Rainforest and Coastal Vine Thickets of Eastern Australia - *Environment Protection and Biodiversity Conservation Act 1999* – Critically endangered

² | LC | NT | VU | EN | CR | EW | EX

3.3 Animal species whose presence relates to the international importance of the site

Phylum	Scientific name*	Common name	Species qualifies under criterion				Species contributes under criterion				Est Pop size at site	Period of pop est.	1% occur	IUCN red list	CITES Apx 1	CMS Apx 1	other status	justification
			2	4	6	9	3	5	7	8								
Chordata/ actinopterygii	<i>Carcharias taurus</i>	Greynurse shark	[x]				[x]		[x]					VU			National (EPBC Act) – critically endangered; QLD (<i>Nature Conservation Act 1992</i>) – EN	Iconic species
Chordata/ actinopterygii	<i>Carcharodon carcharias</i>	Great white shark	[x]				[x]		[x]					VU		✓	National (EPBC Act) – vulnerable, migratory (CMS)	Iconic species
Choradata/elasmo branchi	<i>Hemitrygon fluviorum</i>	Estuary stingray	[x]											VU				
Chordata/ actinopterygii	<i>Isurus oxyrinchus</i>	Shortfin mako	[x]				[x]		[x]					VU			National (EPBC Act) – migratory (CMS)	
Chordata/ actinopterygii	<i>Manta alfredi</i> “ <i>Manta birostris</i> ”	Manta ray	[x]				[x]		[x]					VU		✓	National (EPBC Act) – migratory (CMS)	
Chordata/ actinopterygii	<i>Mobula japanica</i>	Japanese devilray	[x]				[x]		[x]					NT		✓	National (EPBC Act) – migratory (CMS)	
Chordata/ actinopterygii	<i>Nannoperca oxleyana</i>	Oxleyan pygmy perch	[x]	[x]		[x]	[x]		[x]	[x]		2009	>1%	EN			National (EPBC Act) – endangered; QLD (<i>Nature Conservation Act 1992</i>) – VU	Comprehensive sampling efforts indicate this species has a significant proportion of their population at Moreton and North Stradbroke Islands (Knight et al. 2009).
Chordata/ actinopterygii	<i>Sphyrna lewini</i>	Scalloped hammerhead	[x]				[x]		[x]					EN			National (EPBC Act) – conservation dependent	
Chordata/ actinopterygii	<i>Sphyrna mokarran</i>	Great hammerhead	[x]				[x]		[x]					EN				
Chordata/ actinopterygii	<i>Syngnathoides biaculeatus</i>	Double-ended pipefish					[x]		[x]	[x]				LC			National (EPBC Act) – marine	
Chordata/ amphibia	<i>Crinia tinnula</i>	Wallum froglet	[x]	[x]		[x]	[x]				10 000s to 100 000s	2018	>1%	VU			QLD (<i>Nature Conservation Act 1992</i>) – VU	Acid wetland dependant. Population size and percentage estimate based on expert opinion (Hines, H pers. comm. 2018).
Chordata/ amphibia	<i>Litoria cooloolensis</i>	Cooloola sedgefrog	[x]	[x]		[x]	[x]				1 000s to 10 000s	2018	>1%	EN			QLD (<i>Nature Conservation Act 1992</i>) – NT	Acid wetland dependant. Population size and percentage estimate based on expert opinion (Hines, H pers. comm. 2018).
Chordata/ amphibia	<i>Litoria freycineti</i>	Wallum rocketfrog	[x]	[x]		[x]	[x]				1 000s	2018	>1%	VU			QLD (<i>Nature Conservation Act 1992</i>) – VU	Acid wetland dependant, highly fragmented distribution, generally at low abundance. Population size and percentage estimate based on expert opinion (Hines, H pers. comm. 2018).
Chordata/ amphibia	<i>Litoria olongburensis</i>	Wallum sedgefrog	[x]	[x]		[x]	[x]				10 000s to 100 000s	2018	>1%	VU			National (EPBC Act) – vulnerable; QLD (<i>Nature Conservation Act 1992</i>)– VU	Acid wetland dependant, restricted to North Stradbroke Island and Great Sandy sandmasses. Population size and percentage estimate based on expert opinion (Hines, H pers. comm. 2018).
Chordata/ aves	<i>Actitis hypoleucos</i>	Common sandpiper	[x]	[x]			[x]	[x]						LC			National (EPBC Act) – marine, migratory (CMS, CAMBA, JAMBA, ROKAMBA)	
Chordata/ aves	<i>Apus pacificus</i>	Fork-tailed swift	[x]	[x]			[x]	[x]						LC			National (EPBC Act) – marine, migratory (CAMBA, JAMBA, ROKAMBA)	
Chordata/ aves	<i>Ardenna carneipes</i> (<i>Puffinus carneipes</i>)	Flesh-footed shearwater	[x]	[x]			[x]	[x]						NT			National (EPBC Act) – marine, migratory (JAMBA, ROKAMBA)	
Chordata/ aves	<i>Ardenna grisea</i> (<i>Puffinus griseus</i>)	Sooty shearwater	[x]	[x]			[x]	[x]						NT			National (EPBC Act) – marine, migratory (JAMBA)	
Chordata/ aves	<i>Ardenna pacifica</i> (<i>Puffinus pacificus</i>)	Wedge-tailed shearwater	[x]	[x]			[x]	[x]						LC			National (EPBC Act) – marine, migratory (JAMBA); QLD (<i>Nature Conservation Act 1992</i>) – VU	
Chordata/ aves	<i>Ardenna tenuirostris</i> (<i>Puffinus tenuirostris</i>)	Short-tailed shearwater	[x]	[x]			[x]	[x]						LC			National (EPBC Act) – marine, migratory (CAMBA, JAMBA, ROKAMBA)	
Chordata/ aves	<i>Arenaria interpres</i>	Ruddy turnstone	[x]	[x]			[x]	[x]						LC			National (EPBC Act) – marine, migratory (CMS, CAMBA, JAMBA, ROKAMBA)	

Phylum	Scientific name*	Common name	Species qualifies under criterion				Species contributes under criterion				Est Pop size at site	Period of pop est.	1% occur	IUCN red list	CITES Apx 1	CMS Apx 1	other status	justification
			2	4	6	9	3	5	7	8								
Chordata/ aves	<i>Botaurus poiciloptilus</i>	Australasian bittern	[x]				[x]	[x]						EN			National (EPBC Act) – endangered; QLD (<i>Nature Conservation Act 1992</i>)– LC	Wetland dependent
Chordata/ aves	<i>Calidris acuminata</i>	Sharp-tailed sandpiper	[x]	[x]	[x]		[x]	[x]			1,550	2013-2017	1.82% (850)	LC			National (EPBC Act) – marine, migratory (CMS, CAMBA, JAMBA, ROKAMBA); QLD (<i>Nature Conservation Act 1992</i>) – SL	Regularly exceeds 1% Hansen et al. 2016 population threshold
Chordata/ aves	<i>Calidris alba</i>	Sanderling	[x]	[x]			[x]	[x]						LC			National (EPBC Act) – marine, migratory (CMS, CAMBA, JAMBA, ROKAMBA)	
Chordata/ aves	<i>Calidris canutus</i>	Red knot	[x]	[x]			[x]	[x]						NT	✓		National (EPBC Act) – endangered, marine, migratory (CMS CAMBA, JAMBA, ROKAMBA); QLD (<i>Nature Conservation Act 1992</i>) – EN	
Chordata/ aves	<i>Calidris ferruginea</i>	Curlew sandpiper	[x]	[x]	[x]		[x]	[x]			2,126	2013-2017	2.36% (900)	NT			National (EPBC Act) – critically endangered, marine, migratory (CMS, CAMBA, JAMBA, ROKAMBA); QLD (<i>Nature Conservation Act 1992</i>) – EN	Regularly exceeds 1% Hansen et al. 2016 population threshold
Chordata/ aves	<i>Calidris melanotos</i>	Pectoral sandpiper	[x]	[x]			[x]	[x]						LC			National (EPBC Act) – marine, migratory (CMS, JAMBA, ROKAMBA)	
Chordata/ aves	<i>Calidris ruficollis</i>	Red-necked stint	[x]	[x]	[x]		[x]	[x]			4,919	2013-2017	1.04% (4,750)	NT			National (EPBC Act) – marine, migratory (CMS, CAMBA, JAMBA, ROKAMBA); QLD (<i>Nature Conservation Act 1992</i>) – SL	Regularly exceeds 1% Hansen et al. 2016 population threshold
Chordata/ aves	<i>Calidris tenuirostris</i>	Great knot	[x]	[x]			[x]	[x]						EN		✓	National (EPBC Act) – critically endangered, marine, migratory (CMS, CAMBA, JAMBA, ROKAMBA); QLD (<i>Nature Conservation Act 1992</i>) – EN	
Chordata/ aves	<i>Calonectris leucomelas</i>	Streaked shearwater	[x]	[x]			[x]	[x]						NT			National (EPBC Act) – marine, migratory (CAMBA, JAMBA, ROKAMBA)	
Chordata/ aves	<i>Charadrius bicinctus</i>	Double-banded plover	[x]	[x]	[x]		[x]	[x]			248	2013-2017	1.31% (190)	LC			National (EPBC Act) – marine, migratory (CMS)	Regularly exceeds 1% Hansen et al. 2016 population threshold
Chordata/ aves	<i>Charadrius leschenaultii</i>	Greater sand plover	[x]	[x]			[x]	[x]						LC			National (EPBC Act) – vulnerable, marine, migratory (CMS, CAMBA, JAMBA, ROKAMBA); QLD (<i>Nature Conservation Act 1992</i>) – VU	
Chordata/ aves	<i>Charadrius mongolus</i>	Lesser sand plover	[x]	[x]	[x]		[x]	[x]			1,949	2013-2017	1.08% (1,800)	LC			National (EPBC Act) – endangered, marine, migratory (CMS, CAMBA, JAMBA, ROKAMBA); QLD (<i>Nature Conservation Act 1992</i>) – EN	Regularly exceeds 1% Hansen et al. 2016 population threshold
Chordata/ aves	<i>Charadrius veredus</i>	Oriental plover	[x]	[x]			[x]	[x]									National (EPBC Act) – marine, migratory (CMS, CAMBA, JAMBA, ROKAMBA)	
Chordata/ aves	<i>Chlidonias leucopterus</i>	White-winged black tern	[x]	[x]			[x]	[x]						LC			National (EPBC Act) – marine. migratory (CAMBA, JAMBA, ROKAMBA)	
Chordata/ aves	<i>Cuculus optatus</i>	Oriental cuckoo	[x]	[x]			[x]							not assessed			National (EPBC Act) – migratory (CAMBA)	
Chordata/ aves	<i>Diomedea exulans</i>	Wandering albatross	[x]	[x]			[x]	[x]						VU			National (EPBC Act) – vulnerable, marine, migratory (CMS); QLD (<i>Nature Conservation Act 1992</i>) – VU	
Chordata/ aves	<i>Esacus magnirostris</i> (<i>Esacus giganteus</i>)	Beach stone-curlew	[x]	[x]			[x]							NT			National (EPBC Act) - marine; QLD (<i>Nature Conservation Act 1992</i>) – VU	Breeding recorded at site
Chordata/ aves	<i>Fregata ariel</i>	Lesser frigatebird	[x]	[x]			[x]	[x]						LC			National (EPBC Act) – marine, migratory (CAMBA, JAMBA, ROKAMBA)	
Chordata/ aves	<i>Fregata minor</i>	Great frigatebird	[x]	[x]			[x]	[x]						LC			National (EPBC Act) – marine, migratory (CAMBA, JAMBA)	
Chordata/ aves	<i>Fregetta grallaria</i>	White-bellied storm-petrel	[x]				[x]	[x]						LC			National (EPBC Act) – vulnerable; QLD (<i>Nature Conservation Act 1992</i>) – LC	
Chordata/ aves	<i>Gallinago hardwickii</i>	Latham's snipe	[x]	[x]			[x]	[x]						LC			National (EPBC Act) – marine, migratory (CMS, JAMBA, ROKAMBA)	
Chordata/ aves	<i>Gelochelidon nilotica</i>	Gull-billed tern	[x]	[x]			[x]	[x]						LC			National (EPBC Act) – marine, migratory (CAMBA)	
Chordata/ aves	<i>Haematopus longirostris</i>	Australian pied oystercatcher		[x]	[x]		[x]	[x]			648 586 486	2013 2014 2015	5.09% (110)	LC			QLD (<i>Nature Conservation Act 1992</i>) – LC	Regularly exceeds 1% WPE5 population threshold, based on QWSG database population estimate

Phylum	Scientific name*	Common name	Species qualifies under criterion				Species contributes under criterion				Est Pop size at site	Period of pop est.	1% occur	IUCN red list	CITES Apx 1	CMS Apx 1	other status	justification
			2	4	6	9	3	5	7	8								
											335 747 560	2016 2017 Mean						
Chordata/ aves	<i>Halobaena caerulea</i>	Blue petrel	[x]				[x]	[x]						LC			National (EPBC Act) – vulnerable, marine; QLD (<i>Nature Conservation Act 1992</i>) – LC	
Chordata/ aves	<i>Hirundapus caudacutus</i>	White-throated needletail	[x]	[x]			[x]	[x]						LC			National (EPBC Act) – marine, migratory (CAMBA, JAMBA, ROKAMBA)	
Chordata/ aves	<i>Hydroprogne caspia</i>	Caspian tern	[x]	[x]			[x]	[x]						LC			National (EPBC Act) – marine, migratory (JAMBA)	
Chordata/ aves	<i>Lathamus discolor</i>	Swift parrot	[x]				[x]							CE			National (EPBC Act) – critically endangered, marine; QLD (<i>Nature Conservation Act 1992</i>) – EN	
Chordata/ aves	<i>Limicola falcinellus</i>	Broad-billed sandpiper	[x]	[x]			[x]	[x]						LC			National (EPBC Act) – marine, migratory (CMS, CAMBA, JAMBA, ROKAMBA)	
Chordata/ aves	<i>Limnodromus semipalmatus</i>	Asian dowitcher	[x]	[x]			[x]	[x]						NT			National (EPBC Act) – marine, migratory (CMS, CAMBA, JAMBA, ROKAMBA)	
Chordata/ aves	<i>Limosa lapponica</i>	Bar-tailed godwit	[x]	[x]	[x]		[x]	[x]			11,650	2013-2017	3.58% (3,250)	NT			National (EPBC Act) – vulnerable, marine, migratory (CMS, CAMBA, JAMBA, ROKAMBA); QLD (<i>Nature Conservation Act 1992</i>) – VU	Regularly exceeds 1% Hansen et al. 2016 population threshold
Chordata/ aves	<i>Limosa limosa</i>	Black-tailed godwit	[x]	[x]			[x]	[x]						NT			National (EPBC Act) – marine, migratory (CMS, CAMBA, JAMBA, ROKAMBA)	
Chordata/ aves	<i>Macronectes giganteus</i>	Southern giant-petrel	[x]	[x]			[x]	[x]						LC			National (EPBC Act) – endangered, marine, migratory (CMS); QLD (<i>Nature Conservation Act 1992</i>) – EN	
Chordata/ aves	<i>Macronectes halli</i>	Northern giant-petrel	[x]	[x]			[x]	[x]						LC			National (EPBC Act) – vulnerable, marine, migratory (CMS); QLD (<i>Nature Conservation Act 1992</i>) – VU	
Chordata/ aves	<i>Monarcha melanopsis</i>	Black-faced monarch	[x]	[x]			[x]							LC			National (EPBC Act) – marine, migratory (CMS)	
Chordata/ aves	<i>Motacilla 'flava' sp.</i>	Yellow wagtail sp.	[x]	[x]			[x]							LC			National (EPBC Act) – marine, migratory (CAMBA, JAMBA, ROKAMBA)	
Chordata/ aves	<i>Myiagra cyanoleuca</i>	Satin flycatcher	[x]	[x]			[x]							LC			National (EPBC Act) – marine, migratory (CMS)	
Chordata/ aves	<i>Numenius madagascariensis</i>	Eastern curlew	[x]	[x]	[x]		[x]	[x]			3,158	2013-2017	9.02% (350)	EN		✓	National (EPBC Act) – critically endangered, marine, migratory (CMS, CAMBA, JAMBA, ROKAMBA); QLD (<i>Nature Conservation Act 1992</i>) – EN	Regularly exceeds 1% Hansen et al. 2016 population threshold
Chordata/ aves	<i>Numenius minutus</i>	Little curlew	[x]	[x]			[x]	[x]						LC			National (EPBC Act) – marine, migratory (CMS, CAMBA, JAMBA, ROKAMBA)	
Chordata/ aves	<i>Numenius phaeopus</i>	Whimbrel	[x]	[x]	[x]		[x]	[x]			1,140	2013-2017	1.75% (650)	LC			National (EPBC Act) - marine, migratory (CMS, CAMBA, JAMBA, ROKAMBA); QLD (<i>Nature Conservation Act 1992</i>) – SL	Regularly exceeds 1% Hansen et al. 2016 population threshold
Chordata/ aves	<i>Oceanites oceanicus</i>	Wilson's storm-petrel	[x]	[x]			[x]	[x]						LC			National (EPBC Act)– marine, migratory (JAMBA)	
Chordata/ aves	<i>Onychoprion anaethetus</i>	Bridled tern	[x]	[x]			[x]	[x]						LC			National (EPBC Act) – marine, migratory (CAMBA, JAMBA)	
Chordata/ aves	<i>Pandion cristatus</i>	Eastern osprey	[x]	[x]			[x]							not assessed			National (EPBC Act) – marine, migratory (CMS)	
Chordata/ aves	<i>Phaethon rubricauda</i>	Red-tailed tropicbird	[x]	[x]			[x]	[x]						LC			National (EPBC Act) – marine, migratory (CAMBA, JAMBA); QLD (<i>Nature Conservation Act 1992</i>) – VU	
Chordata/ aves	<i>Phoebastria palpebrata</i>	Light-mantled sooty albatross	[x]	[x]			[x]	[x]						NT			National (EPBC Act) – marine, migratory (CMS)	
Chordata/ aves	<i>Plegadis falcinellus</i>	Glossy ibis	[x]	[x]			[x]	[x]						LC			National (EPBC Act) – marine, migratory (CMS)	
Chordata/ aves	<i>Pluvialis fulva</i>	Pacific golden plover	[x]	[x]			[x]	[x]						LC			National (EPBC Act) – marine, migratory (CMS, CAMBA, JAMBA, ROKAMBA)	
Chordata/ aves	<i>Pluvialis squatarola</i>	Grey plover	[x]	[x]			[x]	[x]						LC			National (EPBC Act) – marine, migratory (CMS, CAMBA, JAMBA, ROKAMBA)	
Chordata/ aves	<i>Rostratula australis</i>	Australian Painted Snipe	[x]				[x]	[x]						EN			National (EPBC Act) – endangered, marine; QLD (<i>Nature Conservation Act 1992</i>) – VU	

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			2	4	6	9	3	5	7	8								
Chordata/ aves	<i>Stercorarius longicaudus</i>	Long-tailed jaeger	[x]	[x]			[x]	[x]						LC			National (EPBC Act) – marine, migratory (CAMBA, JAMBA)	
Chordata/ aves	<i>Stercorarius parasiticus</i>	Arctic jaeger	[x]	[x]			[x]	[x]						LC			National (EPBC Act) – marine, migratory (CAMBA, JAMBA, ROKAMBA)	
Chordata/ aves	<i>Stercorarius pomarinus</i>	Pomarine jaeger	[x]	[x]			[x]	[x]						LC			National (EPBC Act) – marine, migratory (CAMBA, JAMBA)	
Chordata/ aves	<i>Sterna dougallii</i>	Roseate tern	[x]	[x]			[x]	[x]						LC			National (EPBC Act) – marine, migratory (CAMBA, JAMBA)	
Chordata/ aves	<i>Sterna hirundo</i>	Common tern	[x]	[x]			[x]	[x]						LC			National (EPBC Act) – marine, migratory (CAMBA, JAMBA, ROKAMBA)	
Chordata/ aves	<i>Sterna paradisaea</i>	Arctic tern	[x]	[x]			[x]	[x]						LC			National (EPBC Act) – marine, migratory (CMS)	
Chordata/ aves	<i>Sterna sumatrana</i>	Black-naped tern	[x]	[x]			[x]	[x]						LC			National (EPBC Act) – marine, migratory (CAMBA, JAMBA)	
Chordata/ aves	<i>Sternula albifrons</i>	Little tern	[x]	[x]			[x]	[x]						LC			National (EPBC Act) – marine, migratory (CMS, JAMBA, CAMBA, ROKAMBA); QLD (<i>Nature Conservation Act 1992</i>) – SL	Breeding recorded
Chordata/ aves	<i>Sula dactylatra</i>	Masked booby	[x]	[x]			[x]	[x]						LC			National (EPBC Act) – marine, migratory (JAMBA, ROKAMBA)	
Chordata/ aves	<i>Sula leucogaster</i>	Brown booby	[x]	[x]			[x]	[x]						LC			National (EPBC Act) – marine, migratory (CAMBA, JAMBA, ROKAMBA)	
Chordata/ aves	<i>Thalassarche bulleri</i>	Buller's albatross	[x]	[x]			[x]	[x]						NT			National (EPBC Act) –vulnerable, marine, migratory (CMS); QLD (<i>Nature Conservation Act 1992</i>) – VU	
Chordata/ aves	<i>Thalassarche carteri</i>	Indian yellow-nosed albatross	[x]				[x]	[x]						EN			National (EPBC Act) –vulnerable, marine, migratory (CMS); QLD (<i>Nature Conservation Act 1992</i>) – VU	
Chordata/ aves	<i>Thalassarche cauta</i>	Shy albatross	[x]	[x]			[x]	[x]						NT			National (EPBC Act) –vulnerable, marine, migratory (CMS); QLD (<i>Nature Conservation Act 1992</i>) – VU	
Chordata/ aves	<i>Thalassarche chrysostoma</i>	Grey-headed albatross	[x]	[x]			[x]	[x]						EN			National (EPBC Act) –endangered, marine, migratory (CMS); QLD (<i>Nature Conservation Act 1992</i>) – VU	
Chordata/ aves	<i>Thalassarche melanophris</i>	Black-browed albatross	[x]	[x]			[x]	[x]						NT			National (EPBC Act) –vulnerable, marine, migratory (CMS); QLD (<i>Nature Conservation Act 1992</i>) – SL	
Chordata/ aves	<i>Tringa brevipes</i>	Grey-tailed tattler	[x]	[x]	[x]		[x]	[x]			2,430	2013-2017	3.47% (700)	NT			National (EPBC Act) – marine, migratory (CMS, CAMBA, JAMBA, ROKAMBA); QLD (<i>Nature Conservation Act 1992</i>) – SL	Regularly exceeds 1% Hansen et al. 2016 population threshold
Chordata/ aves	<i>Tringa glareola</i>	Wood sandpiper	[x]	[x]			[x]	[x]						LC			National (EPBC Act) – marine, migratory (CMS, CAMBA, JAMBA, ROKAMBA)	
Chordata/ aves	<i>Tringa incana</i>	Wandering tattler	[x]	[x]			[x]	[x]						LC			National (EPBC Act) – marine, migratory (CMS, JAMBA)	
Chordata/ aves	<i>Tringa nebularia</i>	Common greenshank	[x]	[x]			[x]	[x]						LC			National (EPBC Act) – marine, migratory (CMS, CAMBA, JAMBA, ROKAMBA)	
Chordata/ aves	<i>Tringa stagnatilis</i>	Marsh sandpiper	[x]	[x]			[x]	[x]						LC			National (EPBC Act) – marine, migratory (CMS, CAMBA, JAMBA, ROKAMBA)	
Chordata/ aves	<i>Tringa totanus</i>	Common redshank	[x]	[x]			[x]	[x]						LC			National (EPBC Act) – marine, migratory (CMS, CAMBA, JAMBA, ROKAMBA)	
Chordata/ aves	<i>Xenus cinereus</i>	Terek sandpiper	[x]	[x]			[x]	[x]						LC			National (EPBC Act) – marine, migratory (CMS, CAMBA, JAMBA, ROKAMBA); QLD (<i>Nature Conservation Act 1992</i>) – SL	
Chordata/ mammalia	<i>Dugong dugon</i>	Dugong	[x]	[x]		[x]	[x]				850-1,000	~1995-2016	97%	VU	✓		National (EPBC Act) – marine, migratory (CMS); QLD (<i>Nature Conservation Act 1992</i>) – VU	The population of dugongs within the Bay is considered genetically distinct from other dugong populations, with an estimated 2-3% migration. Southern most distribution of range.
Chordata/ mammalia	<i>Eubalaena australis</i>	Southern right whale	[x]	[x]			[x]							LC	✓	✓	National (EPBC Act) – endangered, cetacean , migratory (CMS); QLD (<i>Nature Conservation Act 1992</i>) – LC	Seasonal visitor, important to tourism

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			2	4	6	9	3	5	7	8								
Chordata/ mammalia	<i>Megaptera novaeangliae</i>	Humpback whale	[x]	[x]			[x]							LC	✓	✓	National (EPBC Act) – vulnerable, cetacean , migratory (CMS); QLD (<i>Nature Conservation Act 1992</i>) – VU	Seasonal visitor, important to tourism
Chordata/ mammalia	<i>Phascolarctos cinereus</i>	Koala	[x]				[x]							VU			National (EPBC Act) – vulnerable; QLD (<i>Nature Conservation Act 1992</i>) – VU	
Chordata/ mammalia	<i>Physeter macrocephalus</i>	Sperm whale	[x]	[x]			[x]							VU	✓	✓	National (EPBC Act) – cetacean, migratory (CMS); QLD (<i>Nature Conservation Act 1992</i>) – LC	
Chordata/ mammalia	<i>Sousa sahalensis</i> (<i>Sousa chinensis</i>)	Australian humpback dolphin	[x]	[x]			[x]							VU	✓		National (EPBC Act) – cetacean, migratory (CMS); QLD (<i>Nature Conservation Act 1992</i>) – VU	Resident population, important to tourism
Chordata/ mammalia	<i>Stenella attenuata</i>	Pantropical spotted dolphin	[x]	[x]			[x]							LC			National (EPBC Act) – cetacean, migratory (CMS)	
Chordata/ mammalia	<i>Stenella longirostris</i>	Spinner dolphin	[x]	[x]			[x]							DD			National (EPBC Act) – cetacean, migratory (CMS)	
Chordata/ mammalia	<i>Xeromys myoides</i>	Water mouse	[x]	[x]		[x]	[x]						>1%	VU	✓		National (EPBC Act) – vulnerable; QLD (<i>Nature Conservation Act 1992</i>) – VU	Wetland dependent. High density population in Pumicestone Passage and Southern Moreton Bay incl. North and South Stradbroke Island. Total population estimated to 10,000 mature individuals and Moreton Bay population estimated to support more than 1% of the population.
Chordata/ reptilia	<i>Caretta caretta</i>	Loggerhead turtle	[x]	[x]		[x]	[x]				20-25	2005-2018	2.5-3.5%	VU	✓	✓	National (EPBC Act) – endangered, marine, migratory (CMS); QLD (<i>Nature Conservation Act 1992</i>) – EN	Resident nesting population in Moreton Bay, strong fidelity to foraging grounds. Population size based on nesting females and a total population of 700-800 females.
Chordata/ reptilia	<i>Chelonia mydas</i>	Green turtle	[x]	[x]		[x]	[x]				10,000	1993-2018	1.4%	EN	✓	✓	National (EPBC Act) – vulnerable, marine, migratory (CMS); QLD (<i>Nature Conservation Act 1992</i>) – VU	Resident population in Moreton Bay. Important feeding grounds with occasional nesting. Percentage population calculated based on an estimated total population of 700,000 individuals.
Chordata/ reptilia	<i>Dermochelys coriacea</i>	Leatherback turtle	[x]	[x]			[x]							VU	✓	✓	National (EPBC Act) – endangered, marine, migratory (CMS); QLD (<i>Nature Conservation Act 1992</i>) – EN	
Chordata/ reptilia	<i>Eretmochelys imbricata</i>	Hawksbill turtle	[x]	[x]			[x]							CE	✓	✓	National (EPBC Act) – vulnerable, marine, migratory (CMS); QLD (<i>Nature Conservation Act 1992</i>) – EN	Resident population in Moreton Bay
Chordata/ reptilia	<i>Lepidochelys olivacea</i>	Olive ridley turtle	[x]	[x]			[x]							VU	✓	✓	National (EPBC Act) – endangered, marine, migratory (CMS); QLD (<i>Nature Conservation Act 1992</i>) – EN	Resident population in Moreton Bay
Chordata/ reptilia	<i>Natator depressus</i>	Flatback turtle	[x]	[x]			[x]							DD	✓		National (EPBC Act) – vulnerable, marine, migratory (CMS); QLD (<i>Nature Conservation Act 1992</i>) – VU	Resident population in Moreton Bay
Invertebrate	<i>Acrodipsas illidgei</i> (<i>Pseudodipsas illidgei</i>)	Illidge's ant-blue butterfly	[x]	[x]		[x]	[x]						>1%	EN			QLD (<i>Nature Conservation Act 1992</i>) – VU	This rarely seen species is restricted to mangrove forests and endemic to the central east coast of Australia. The Moreton Bay Region is one of only six confirmed areas for the species, While there are no published estimations of the population size, number of recordings within Moreton Bay accounts for approximately 40% of total recordings of the species according to Queensland Government (species profile- 18 records) and Atlas of Living Australia (ala.org.au) (49 records). This strongly suggests the site provides for more than 1% of the total population.
Invertebrate	<i>Tenuibranchiurus glypticus</i>	Swamp crayfish	[x]				[x]							EN			QLD (<i>Nature Conservation Act 1992</i>) – EN	

Optional text box to provide further information on animal species of international importance:

(This field is limited to 2500 characters)

*Note that for the listings in table 3.3, all species recorded under an international listing as a migratory species and occurring within the site are marked to contribute to criterion 4.

The Moreton Bay Ramsar site supports an abundance and diversity of native fauna, in particular a high abundance and species diversity of waterbirds, including threatened migratory shorebirds listed under international agreements, conventions and partnerships. It is also noteworthy that Moreton Bay represents the southern limit of the dugong's Australian distribution (Lanyon 2003) and currently contains one of the largest populations of dugongs on the east coast of Australia. Recent surveys suggest that climate and weather events may have a significant influence on the abundance, distribution and fecundity of dugongs, mainly as a result of effects on their seagrass habitats (Sobtzick et al. 2015).

All six marine turtle species known to occur in Australian waters have been recorded in Moreton Bay (Limpus et al. 2006).

Seasonal aggregations occur for manta rays, grey nurse sharks and zebra sharks. Rocky reef outcrops near North Stradbroke Island contain the largest known aggregation of zebra sharks in the world (Couturier et al. 2011; Dudgeon et al. 2013).

A genetically distinct population of koalas (*Phascolarctos cinereus*) (listed as vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999*) breed on North Stradbroke Island (Lee et al. 2010). Trees associated with the island's wetlands provide important koala habitat (GHD 2009). Percentage moisture content in the leaves of food trees needs to be maintained for koala survival (Melzer et al. 2000 in Cox and Specht 2012; Ellis et al. 2010).

3.4 Ecological communities whose presence relates to the international importance of site

Name of ecological community	Community qualifies under Criterion 2	General Description	Justification
a)Subtropical and Temperate Coastal Saltmarsh	X	http://www.environment.gov.au/biodiversity/threatened/communities/pubs/118-conservation-advice.pdf	National (EPBC Act) – Vulnerable
b)Lowland Rainforest of Subtropical Australia	X	http://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=101&status=Critically+Endangered	National (EPBC Act) – Critically endangered
c)Coastal Swamp Oak (<i>Casuarina glauca</i>) Forest of New South Wales and South East Queensland	X	http://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=142&status=Endangered	National (EPBC Act) – Endangered
d)Littoral Rainforest and Coastal Vine Thickets of Eastern Australia	X	http://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=76&status=Critically+Endangered	National (EPBC Act) – Critically endangered
Below are the general descriptions for the regional ecosystems identified at a Queensland state level that would be included within the above listed ecological communities, mapped and classified under the <i>Queensland Vegetation Management Act 1999</i>			
<i>Casuarina glauca</i> woodland on margins of marine clay plains (RE 12.1.1) (applies to (c) above)		<i>Casuarina glauca</i> open forest to low open woodland. Occurs on margins of Quaternary estuarine deposits.	<i>Vegetation Management Act 1999</i> - Of concern. Biodiversity status (QLD) - Of concern. More than 30% of its pre-clearing extent remains and the remnant extent is less than 10,000 ha.
Saltpan vegetation including grassland, herbland and sedgeland on marine clay plains (RE 12.1.2) (applies to (a) above)		Saltpan vegetation comprising <i>Sporobolus virginicus</i> grassland and samphire herbland. Grasses including <i>Zoysia macrantha</i> subsp. <i>macrantha</i> sometimes present in upper portions of tidal flats. Includes saline or brackish sedgelands. Usually occurs on hypersaline Quaternary estuarine deposits. Marine plains/tidal flats.	<i>Vegetation Management Act 1999</i> - Least concern. Biodiversity status (QLD) - No concern at present. Habitat for threatened fauna species including the false water-rat (<i>Xeromys myoides</i>) in the southern part of the bioregion particularly in areas immediately adjacent to mangroves (RE 12.1.3) (Van Dyck 1996; Van Dyck and Gynther 2003)

Name of ecological community	Community qualifies under Criterion 2	General Description	Justification
			and Illidge's ant blue butterfly (<i>Acrodipsas illidgei</i>) (Beale and Zalucki 1995).
Notophyll vine forest on parabolic high dunes (RE 12.2.1) (applies to (d) above)		Notophyll/evergreen notophyll vine forest generally with abundant <i>Archontophoenix cunninghamiana</i> or <i>A. alexandrae</i> in north of bioregion. The plant families Lauraceae, Myrtaceae and Elaeocarpaceae are diagnostic of the type. Occurs on moist/wet, valley floors of parabolic dunes.	<i>Vegetation Management Act 1999</i> - Of concern. Biodiversity status (QLD) - Of concern.
Microphyll/notophyll vine forest on beach ridges (RE 12.2.2) (applies to (d) above)		Microphyll/notophyll vine forest. Characteristic species include <i>Cupaniopsis anacardioides</i> , <i>Acronychia imperforata</i> , <i>Flindersia schottiana</i> , <i>Alectryon coriaceus</i> , <i>Elaeocarpus obovatus</i> , <i>Polyalthia nitidissima</i> , <i>Diospyros spp.</i> , <i>Pleiogynium timorense</i> and <i>Mallotus discolor</i> . <i>Melaleuca spp.</i> and eucalypt emergents may be present, e.g. <i>Melaleuca dealbata</i> and <i>Corymbia tessellaris</i> . Occurs on Quaternary coastal dunes and beaches.	<i>Vegetation Management Act 1999</i> - Of concern. Biodiversity status (QLD) - Endangered - this status reflects that these communities have previously been substantially cleared at a bioregional scale. Over 90% of this ecosystem's pre-clearing distribution is affected by severe degradation and/or biodiversity loss due to extensive weed invasion, localised disturbance from people and vehicles, and the remnant vegetation is less than 10,000 ha.

Name of ecological community	Community qualifies under Criterion 2	General Description	Justification
Complex notophyll vine forest (RE 12.3.1a) (applies to (b) above)		Complex notophyll vine forest. Typical canopy species include <i>Castanospermum australe</i> , <i>Elaeocarpus grandis</i> , <i>Grevillea robusta</i> , <i>Cryptocarya obovata</i> , <i>Beilschmiedia obtusifolia</i> , <i>Dysoxylum mollissimum</i> subsp. <i>molle</i> , <i>Pseudoweinmannia lachnocarpa</i> , <i>Argyrodendron trifoliolatum</i> , <i>Planchonella australis</i> , <i>Ficus watkinsiana</i> , <i>F. macrophylla</i> forma <i>macrophylla</i> , <i>Aphananthe philippinensis</i> , <i>Toona ciliata</i> and <i>Syzygium francisii</i> . Emergent <i>Eucalyptus grandis</i> or <i>Lophostemon confertus</i> may occur. <i>Waterhousea floribunda</i> and <i>Tristaniopsis laurina</i> may occur on banks of stream channels. Typical sub canopy species include <i>Cryptocarya triplinervis</i> , <i>Archontophoenix cunninghamiana</i> , <i>Endiandra pubens</i> , <i>Arytera divaricata</i> , <i>Syzygium moorei</i> and <i>Macadamia</i> spp. Occurs on Quaternary alluvial plains and channels in areas of high rainfall (generally >1300mm). Riverine wetland or fringing riverine wetland.	<i>Vegetation Management Act 1999</i> - Endangered. Biodiversity status (QLD) - Endangered - this status reflects that these communities have previously been substantially cleared at a bioregional scale. Important for fruit-eating birds, many of which migrate seasonally from upland to lowland rainforest.
<i>Melaleuca quinquenervia</i> , <i>Casuarina glauca</i> +/- <i>Eucalyptus tereticornis</i> , <i>E. siderophloia</i> open forest on low coastal alluvial plains (RE 12.3.20) (applies to (c) above)		<i>Melaleuca quinquenervia</i> , <i>Casuarina glauca</i> +/- <i>Eucalyptus tereticornis</i> , <i>E. siderophloia</i> open forest. Occurs on lowest terraces of Quaternary alluvial plains in coastal areas.	<i>Vegetation Management Act 1999</i> - Least concern. Biodiversity status (QLD) - Endangered - this status reflects that these communities have previously been substantially cleared at a bioregional scale. 10–30% of its pre-clearing extent remains unaffected by severe degradation and/or biodiversity loss and the remnant vegetation is less than 10,000 ha.

What is the Site like?

4.1 Ecological character

Please summarize the ecological components, processes and services which are critical to determining the ecological character of the site. Please also summarize any natural variability in the ecological character of the site, and any known past or current change.

(This field is limited to 2500 characters)

The Moreton Bay Ramsar site supports outstanding coastal wetland values and features. Many of its diverse habitat types are natural or near-natural and are interconnected with other habitats, supporting biodiversity. This includes seagrass and shoals, tidal flats and associated estuarine assemblages, mangroves and saltmarsh, coral communities, freshwater wallum and peatland habitats, as well as ocean beaches and associated foredune areas.

The site is home to threatened plant species that are wetland dependant, such as the endangered swamp daisy (*Olearia hygrophila*), which is only found on North Stradbroke Island. It supports four ecological communities recognised as threatened nationally, including saltmarsh, rainforest and swamp oak (*Casuarina glauca*) communities.

The site provides habitat for humpback whales (*Megaptera novaeangliae*) and dolphins, as well as six species of marine turtles. Other threatened animals, including the dugong (*Dugong dugon*), wallum sedgefrog, (*Litoria olongburensis*), water mouse (*Xeromys myoides*) and oxleyan pygmy perch fish (*Nannoperca oxleyana*), also live in the Bay or in freshwater wetlands within the site.

Moreton Bay is one of the largest estuarine bays in Australia and sits in an 'overlap zone' where both tropical and temperate species occur. Tidal flats and associated estuarine areas help protect the coastline from erosion and provide critical habitat for migratory shorebirds. Mangrove and saltmarsh communities provide important primary production for a range of species, including commercially valuable fish and crab species. Parts of the site contain seagrass meadows vital for sustaining the Moreton Bay dugong (*Dugong dugon*) population. Coral reef communities support coral reef flora and fauna, as well as the loggerhead turtle (*Caretta caretta*).

The Bay's diversity of wetland habitats provides feeding areas, dispersal and migratory pathways, as well as spawning sites, for many fish species. The region supports one of the most productive fisheries in Queensland. Although the Bay only represents about 3% of Queensland's coastline, it produces just over 15% of the seafood for Queensland managed fisheries.

The perched wetlands, including lakes and swamps are abundant in the coastal wallum regions of southeastern Queensland and northern New South Wales (including Moreton and North Stradbroke Islands), but are scarce in most parts of the world. Perched wetlands form in depressions between dunes where impermeable layers develop in the sand and hold water in the wetland above the surrounding water table. They support many unique and interesting animals (Marshall et al. 2011).

Underlying critical processes that are integral to the values and features of the site include:

- physical coastal
- hydrological e.g. tidal inundation, freshwater flows, groundwater interactions
- energy and nutrient dynamics
- biological

- climatic
- geomorphologic

The Bay's proximity to Brisbane and the Gold and Sunshine Coasts makes it ideal for visitors. More than 12 million visits to the Bay occur each year where people enjoy nature-based activities, from boating to snorkelling, diving, recreational fishing and camping (QPWS 2012). The Bay is a destination for watching migratory shorebirds (September to March) and whales (June to October). Visitors can experience and learn more about the wildlife of Moreton Bay at the national parks, conservation parks and environment centres around the Bay.

The Ramsar site wetlands have significant social and cultural values, provide research and education opportunities, as well as a place for recreation and spiritual connection. Tangible evidence of past Traditional Owner occupation is found in many forms throughout Moreton Bay (Quandamooka) the islands, and mainland areas.

There have been modifications to Moreton Bay's catchment hydrology prior to the listing of the site associated with development and an increasing population. This has changed the volume and quality of stream flow and the hydrodynamics of the Bay. In addition, there have been changes associated with high rainfall events, which caused the delivery of large sediment loads, primarily consisting of suspended silts and clays (BMT WBM 2008). Local alterations to hydrology and associated water quality impacts caused by groundwater extraction, changed drainage, urban and road runoff and other activities, have been identified as a threat to wetland plants, wallum wetland freshwater fish and acid frogs (Meyer et al. 2006; BMT WBM 2008; Cox and Specht 2012). Since the site was listed there have been further modifications associated with intensification in the catchment for the site. However, there has also been much improvement in the management of pressures on the site (refer Section 5).

4.2 What wetland type(s) are in the site?

Please list all wetland types which occur on the site, and for each of them: - rank the four most abundant types by area from 1 (greatest extent) to 4 (least extent) in the third column, - if the information exists, provide the area (in ha) in the fourth column - if this wetland type is used for justifying the application of Criterion 1, indicate if it is representative, rare or unique in the last column - you can give the local name of the wetland type if different from the Ramsar classification system in the second column

Marine or coastal wetlands

Wetland types (code and name) ³	Local name	Ranking of extent (1: greatest - 4: least)	Area (ha) of wetland type	Justification of Criterion 1 ⁴
A: Permanent shallow marine waters		4	5,303	
B: Marine subtidal aquatic beds (underwater vegetation)		2	23,759	
C: Coral reefs			1,955	
D: Rocky marine shores			138	
E: Sand, shingle or pebble shores			1,828	
F: Estuarine waters		1	34,112	
G: Intertidal mud, sand or salt flats			4,681	
H: Intertidal marshes			2,733	
I: Intertidal forested wetlands		3	11,847	
J: Coastal brackish / saline lagoons			35	
K: Coastal freshwater lagoons			<1*	

³ A: Permanent shallow marine waters | B: Marine subtidal aquatic beds (Underwater vegetation) | C: Coral reefs | D: Rocky marine shores | E: Sand, shingle or pebble shores | G: Intertidal mud, sand or salt flats | Ga: Bivalve (shell-fish) reefs | H: Intertidal marshes | I: Intertidal forested wetlands | J: Coastal brackish / saline lagoons | F: Estuarine waters | Zk(a): Karst and other subterranean hydrological systems | K: Coastal freshwater lagoons

⁴ | Representative | Rare | Unique

Wetland types (code and name) ³	Local name	Ranking of extent (1: greatest - 4: least)	Area (ha) of wetland type	Justification of Criterion 1 ⁴
Zk(a): Karst and other subterranean hydrological systems			N/A	

Inland wetlands

Wetland types (code and name) ⁵	Local name	Ranking of extent (1: greatest - 4: least)	Area (ha) of wetland type	Justification of Criterion 1 ⁶
M: Permanent rivers/ streams/ creeks			<5* (with N)	
N: Seasonal/ intermittent/ irregular rivers/ streams/ creeks			<5* (with M)	
Y: Permanent freshwater springs; oases			<5*	
O: Permanent freshwater lakes			15	
P: Season/intermittent freshwater lake			81	
Tp: Permanent freshwater marshes/ pools			4	
Ts: Seasonal/ intermittent freshwater marshes/ pools on inorganic soils			557	
W: Shrub-dominated wetlands			106	
Xf: Freshwater, tree-dominated wetlands			2,289	

⁵ M: Permanent rivers/ streams/ creeks | L: Permanent inland deltas | Y: Permanent Freshwater springs; oases | N: Seasonal/ intermittent/ irregular rivers/ streams/ creeks | O: Permanent freshwater lakes | Tp: Permanent freshwater marshes/ pools | P: Seasonal/ intermittent freshwater lakes | Ts: Seasonal/ intermittent freshwater marshes/ pools on inorganic soils | Tp: Permanent freshwater marshes/ pools | W: Shrub-dominated wetlands | Xf: Freshwater, tree-dominated wetlands | Ts: Seasonal/ intermittent freshwater marshes/ pools on inorganic soils | U: Permanent Non-forested peatlands | Xp: Permanent Forested peatlands | Va: Montane wetlands | Vt: Tundra wetlands | Q: Permanent saline/ brackish/ alkaline lakes | R: Seasonal/ intermittent saline/ brackish/ alkaline lakes and flats | Sp: Permanent saline/ brackish/ alkaline marshes/ pools | Ss: Seasonal/ intermittent saline/ brackish/ alkaline marshes/ pools | Zg: Geothermal wetlands | Zk(b): Karst and other subterranean hydrological systems

Wetland types (code and name) ⁵	Local name	Ranking of extent (1: greatest - 4: least)	Area (ha) of wetland type	Justification of Criterion 1 ⁶
U: Permanent non-forested peatlands			3,649	
Xp: Permanent forested peatlands			2,446	

*Wetland type present in Ramsar site but GIS data does not allow exact area to be calculated.

Human-made wetlands

Wetland types (code and name) ⁶	Local name	Ranking of extent (1: greatest - 4: least)	Area (ha) of wetland type	Justification of Criterion 1 ⁶
9: Canals and drainage channels or ditches			16	

What non-wetland habitats are within the site?

Other non-wetland habitat

Other non-wetland habitats within the site	Area (ha) if known
N/A	

Habitat connectivity

A key feature of the Moreton Bay Ramsar site is its large size, the diversity of wetland habitats present and the connectivity between wetland habitats.

The wetland habitats of Moreton Bay provide an important network of foraging and roosting habitat for migratory shorebirds. These habitats enable the birds to building up the energy stores required for successful migration and breeding in other parts of the East Asian-Australasian Flyway.

The southern part of Pumicestone Passage contains a complex mosaic of mangroves, seagrass, unvegetated sand and mud flats and deeper waters in close proximity to each other. This combination and diversity of habitats may represent important nursery habitat for many prawn and fish species of commercial significance (Laegdsgaard and Johnson 1995; Tibbetts and Connolly 1998 in Tibbetts 1998; Sheaves 2009).

More harvested and herbivorous fish species and greater coral recruitment were found in the inshore coral reefs of Moreton Bay that were protected in marine reserves and near mangroves than in similar areas that were subject to fishing (Olds et al. 2012; Yabsley et al. 2016). These results reflect the joint

⁶ 1: Aquaculture ponds | 2: Ponds | 3: Irrigated land | 4: Seasonally flooded agricultural land | 5: Salt exploitation sites | 6: Water storage areas/Reservoirs | 7: Excavations | 8: Wastewater treatment areas | 9: Canals and drainage channels or ditches | Zk(c): Man-made subterranean hydrological systems

influence of mangrove connectivity and marine reserves on the establishment of coral and algae on coral reefs (Yabsley et al. 2016).

There is an emerging view that fish and nektonic crustacean community structure in mangroves and unvegetated habitats is influenced by their proximity to seagrass beds (e.g. Olds 2002; Jelbart 2004). Studies in Moreton Bay and in central NSW (Jelbart 2004) have found that seagrass beds - particularly dense beds (Olds 2002) in close proximity to mangroves tend to contain more abundant nekton assemblages than seagrass remote from mangroves. Both studies also found that the suite of species inhabiting seagrass varied with distance from mangroves. Similarly, piscivores are known as important structuring agents in marine communities and studies in the Bay indicate that they are using the structurally complex reef systems as shelter and foraging over the less complex and large seagrass beds in the eastern Bay (Gilby et al. 2016).

Melville and Connolly (2003) demonstrated that organic matter, particularly from seagrasses, was important as the base of food webs for fish species of commercial significance on adjacent unvegetated mudflats in Moreton Bay.

The intertidal habitats and subtidal areas are also important elements of broader marine migratory pathways for species such as turtles, dugongs and whales.

4.3 Biological components

4.3.1 Plant species

Other noteworthy plant species

Scientific name	Common name <small>(optional)</small>	Position in range / endemism / other <small>(optional)</small>
<i>Acacia baueri</i> subsp. <i>baueri</i>	tiny wattle	Nature Conservation Act 1992 - VU
<i>Blandfordia grandiflora</i>	Christmas bell	Nature Conservation Act 1992 – EN
<i>Duringtonia paludosa</i>	duringtonia	Nature Conservation Act 1992 – NT
<i>Eleocharis difformis</i>	spike rush	Nature Conservation Act 1992 – EN
<i>Maundia triglochoides</i>		Nature Conservation Act 1992 – VU
<i>Prasophyllum exilis</i>		Nature Conservation Act 1992 – NT
<i>Pterostylis nigricans</i>		Nature Conservation Act 1992 – NT
<i>Thelypteris confluent</i>		Nature Conservation Act 1992 – VU

Invasive alien plant species

Scientific name	Common name	Impacts ⁷	Changes at RIS update ⁸
Refer to Attachment 2			

⁷ No impacts | Potentially | Actually (minor impacts) | Actually (major impacts)

⁸ No change | increase | decrease | unknown

4.3.2 Animal species

Other noteworthy animal species

Phylum	Scientific name	Common name	Pop. size (optional)	Period of pop. est. (optional)	% occurrence (optional)	Position in range/ endemism/other (optional)
Chordata/ amphibia	<i>Adelotus brevis</i>	tusked frog				<i>Nature Conservation Act 1992</i> – VU
Chordata/aves	<i>Calyptrorhynchus lathamii</i>	glossy black-cockatoo				<i>Nature Conservation Act 1992</i> – VU
	<i>Ninox strenua</i>	powerful owl				<i>Nature Conservation Act 1992</i> – VU
	<i>Falco hypoleucos</i>	grey falcon				<i>Nature Conservation Act 1992</i> – VU
	<i>Pezoporus wallicus wallicus</i>	eastern ground parrot				<i>Nature Conservation Act 1992</i> – VU
Chordata/ reptilia	<i>Acanthophis antarcticus</i>	common death adder				<i>Nature Conservation Act 1992</i> – VU
Euarthropoda	<i>Ornithoptera richmondia</i>	richmond birdwing				<i>Nature Conservation Act 1992</i> – VU
Chordata/ Chondrichthyes	<i>Hemitrygon/Dasyatis fluviorum</i>	estuary stingray				<i>Nature Conservation Act 1992</i> – NT

Invasive alien animal species

Phylum	Scientific name	Common name	Impacts ⁹	Changes at RIS update ¹⁰
Chordata/ mammalia	<i>Capra hircus</i>	Goat		
	<i>Equus caballus</i>	Horse		
	<i>Felis catus</i>	Cat		
	<i>Lepus europaeus</i>	European brown hare		
	<i>Vulpes vulpes</i>	Red fox		
	<i>Canis lupus familiaris</i>	Dog		
	<i>Mus musculus</i>	House mouse		
	<i>Rattus rattus</i>	Black rat		
Chordata/ aves	<i>Carduelis carduelis</i>	European goldfinch		
	<i>Passer domesticus</i>	House sparrow		
	<i>Lonchura punctulata</i>	Nutmeg mannikin		
	<i>Acridotheres tristis</i>	Common myna		
	<i>Sturnus vulgaris</i>	Common starling		
	<i>Columba livia</i>	Rock dove		
	<i>Streptopelia chinensis</i>	Spotted dove		
	<i>Anas platyrhynchos</i>	Mallard		
	<i>Pavo cristatus</i>	Indian peafowl		
	<i>Cacatua tenuirostris</i>	Long-billed corella		
Chordata/ amphibia	<i>Hemidactylus frenatus</i>	House gecko		
	<i>Rhinella marina</i>	Cane toad		
Chordata/ actinopterygii	<i>Gambusia holbrooki</i>	Mosquito fish		
	<i>Oreochromis mossambica</i>	Mozambique mouthbrooder		

4.4 Physical components

4.4.1 Climate

Please indicate the prevailing climate type(s) by selecting below the climatic region(s) and subregion(s), using the Köppen-Gieger Climate Classification System.

Climatic region ⁹	Subregion ¹⁰
C. Moist Mid-Latitude climate with mild winters	Cfa: Humid subtropical (Mild with no dry season, hot summer)

If changing climatic conditions are affecting the site, please indicate the nature of these changes:

(This field is limited to 1000 characters)

Human-induced ocean acidification has been suggested as a potential driver of elevated algal populations on reefs (Anthony et al. 2011, Diaz-Pulido et al. 2011 and Fabricius et al. 2011 in Del Monaco et al. 2017) and potentially impact on the health of marine fauna.

Sea level rise may substantially change the distribution and extent of wetlands in Moreton Bay (Runting et al. 2017). Modelling based on higher sea level rise scenarios is estimated to potentially lead to a 4% - 31% loss of the current area of protected wetlands in southern Moreton Bay due to inundation (ibid).

Changing climate is predicted to result in an increase in the intensity of rain events and consequential flooding in the region (DEHP 2017a). Extreme weather events, such as the major floods that occurred in 1974 and 2011, will lead to dramatic increased loads of sediment and nutrients delivered to the Bay. The 2011 flood delivered an estimated 10-20 million tonnes of sediment, which is equal to 20-50 years of average annual sediment loads (Gibbes et al. 2014).

Acid frogs that primarily breed in ephemeral wetlands within the Ramsar site are vulnerable to the impacts of climate change because they rely on temperature and/or rainfall triggers to initiate breeding and create suitable hydroregimes (water duration, timing, frequency, depth) for reproductive success (Greensberg et al. 2017). Hines and Meyer (2011) also highlight the risk of sea level rise and seawater intrusion into the freshwater aquifer (partially climate change related and also draw-down of ground water).

Changes in rainfall patterns may alter recharge of aquifers in the region, as well as frequency and intensity of fires.

⁹ A. Tropical humid climate | B. Dry climate | C. Moist Mid-Latitude climate with mild winters | D. Moist Mid-Latitude climate with cold winters | E. Polar climate with extremely cold winters and summers | H. Highland

¹⁰ Af: Tropical wet (No dry season) | Am: Tropical monsoonal (Short dry season; heavy monsoonal rains in other months) | Aw: Tropical savanna (Winter dry season) | BWh: Subtropical desert (Low-latitude desert) | BSh: Subtropical steppe (Low-latitude dry) | BWk: Mid-latitude desert (Mid-latitude desert) | BSk: Mid-latitude steppe (Mid-latitude dry) | Csa: Mediterranean (Mild with dry, hot summer) | Csb: Mediterranean (Mild with dry, warm summer) | Cfa: Humid subtropical (Mild with no dry season, hot summer) | Cwa: Humid subtropical (Mild with dry winter, hot summer) | Cfb: Marine west coast (Mild with no dry season, warm summer) | Cfc: Marine west coast (Mild with no dry season, cool summer) | Dfa: Humid continental (Humid with severe winter, no dry season, hot summer) | Dfb: Humid continental (Humid with severe winter, no dry season, warm summer) | Dwa: Humid continental (Humid with severe, dry winter, hot summer) | Dwb: Humid continental (Humid with severe, dry winter, warm summer) | Dfc: Subarctic (Severe winter, no dry season, cool summer) | Dfd: Subarctic (Severe, very cold winter, no dry season, cool summer) | Dwc: Subarctic (Severe, dry winter, cool summer) | Dwd: Subarctic (Severe, very cold and dry winter, cool summer) | ET: Tundra (Polar tundra, no true summer) | EF: Ice Cap (Perennial ice) | H: Highland (-)

Climatic drivers negatively influence the proportion of dugong calves. For instance, La Niña episodes result in above average rainfall and a higher incidence of cyclones leading to declines in seagrass nutrient availability (Fuentes et al. 2016).

Coastal development adjacent to the site and the growing value of those assets may lead to the construction of coastal defences such as rock or concrete wall barriers (Abel et al. 2011).

4.4.2 Geomorphic setting

a) Minimum elevation above sea level (in metres) *(The online RIS only accepts numeric values)*

0

a) Maximum elevation above sea level (in metres) *(The online RIS only accepts numeric values)*

270

b) Position in landscape/river basin:

- ☐ Entire river basin
- ☐ Upper part of river basin
- ☐ Middle part of river basin
- ☒ Lower part of river basin
- ☒ More than one river basin
- ☐ Not in river basin
- ☒ Coastal

Please name the river basin or basins. If the site lies in a sub-basin, please also name the larger river basin. For a coastal/marine site, please name the sea or ocean. *(This field is limited to 1000 characters)*

Moreton Bay is located in the North East Coast Drainage Division.

There are six drainage basins: Brisbane, Logan-Albert, Maroochy, Moreton Bay Islands, Pine and South Coast. <http://www.bom.gov.au/water/about/riverBasinAuxNav.shtml>.

Moreton Bay enters the Pacific Ocean.

4.4.3 Soil

- ☒ Mineral
- ☒ Organic
- ☐ No available information

Are soil types subject to change as a result of changing hydrological conditions (e.g., increased salinity or acidification)?

☐ Yes / ☒ No

Please provide further information on the soil (optional) *(This field is limited to 1000 characters)*

Over a geological time-scale, the laying down of a series of sedimentary landscapes has led to the formation of Moreton Bay. Changes to morphological features due to sea-level change, together with geomorphologic processes, such as sedimentation, have resulted in the formation of the present characteristics of the landscape (Hekel et al. 1979; Maxwell 1970).

The eastern margin of the Bay was formed by aeolian dune building, onshore sand transport and northward longshore spit formation, which occurred during the late Quaternary. The modern shoreline was formed during the late Holocene (ibid).

Coastal headlands and most of the islands within the Moreton Bay Ramsar site are formed of Tertiary age basalts and freshwater shales, Mesozoic age sandstones and Palaeozoic age metamorphic rocks with laterite soils developed at the surface (Jones et al. 1978).

The mainland shore of Moreton Bay (on the western side of the Bay) is bordered by extensive estuarine flats formed by coastal progradation during the Quaternary period. The mountains lying to the west of the coastal plains are formed chiefly by Mesozoic and Permian sedimentary rocks and granites. The west (mainland) coast of the Bay is characterised by a number of relatively erosion resistant headlands of Tertiary volcanics with extensive deposits of Quaternary alluvium in the intervening embayments (Jones et al. 1978; Hekel et al. 1979).

The depositional basin of Moreton Bay is comprised of a mixture of fluvial delta sands and muds that dominate the western regions of the Bay, while clean marine sands and carbonate sediments dominate the northern and eastern regions and most of the southern regions surface sediments are sandy mud (Coates-Marnane et al. 2016b; Lockington et al. 2016).

The western side of the Bay associated with the mainland contains extensive mapped areas of acid sulfate soils (this mapping is available via <https://qldglobe.information.qld.gov.au/>). Acid sulfate soils can form in anaerobic environments with a supply of organic matter (e.g. mangrove forest, swamps and salt flats) and are likely to occur in coastal areas lower than 5m AHD (Australian Height Datum). Acid sulfate soils are harmless when undisturbed, but if these soils are exposed to oxygen, acid forms that can cause harm to the environment (Queensland Government DES 2018b). The Queensland Government has strict regulations in regards to development or activities (e.g. dredging) that may disturb acid sulfate soils (Queensland Government DES 2018b). The policy, regulation and management of acid sulfate soils for the site are described in the Queensland acid sulfate soil technical manuals (Dear et al. 2004; Dear et al. 2014) available from <https://qldgov.softlinkhosting.com.au/liberty/opac/search/reset.do>.

4.4.4 Water regime

Water permanence

Presence? ¹¹	Changes at RIS update ¹⁰
Usually permanent water present	No change
Usually seasonal, ephemeral or intermittent water present	No change

¹¹ Usually permanent water present | Usually seasonal, ephemeral or intermittent water present | Unknown

Source of water that maintains character of the site

Presence? ¹²	Predominant water source	Changes at RIS update ¹⁰
Water inputs from rainfall		No change
Water inputs from surface water		No change
Water inputs from groundwater		No change
Marine water		No change

Water destination

Presence? ¹³	Changes at RIS update ¹⁰
Feeds groundwater	No change
Marine	No change

Stability of water regime

Presence? ¹⁴	Changes at RIS update ¹⁰
Water levels largely stable	No change
Water levels fluctuating (including tidal)	No change

Please add any comments on the water regime and its determinants (if relevant). Use this box to explain sites with complex hydrology: (This field is limited to 1000 characters)

<p>Hydrology and Hydrodynamics</p> <p>The coastal ocean to the east of Moreton Bay is dominated by the East Australian Current, which allows the tidal exchange of warm tropical water and associated biota, such as tropical fish and coral larvae, into the Bay through its entrances (e.g. North Entrance, South Passage, Jumpinpin, and Gold Coast Seaway). The majority of the exchange occurs through the approximately 15.5 km wide North Passage (Gibbes et al. 2014).</p> <p>Moreton Bay is a wave-dominated estuary with semi-diurnal tides (Gibbes et al. 2014). The sub-tropical climate is characterised by a distinct seasonal pattern of high summer rainfall leading to large runoff events in short periods of time and occasional floods (Gibbes et al. 2014). During dry periods, a residual clockwise circulation pattern is established within the Bay due to the asymmetry of the flood and ebb tide flows through the four entrances (ibid). This seasonal, event-driven hydrology can result in rapid shifts between two distinct hydrological modes: 1) wind, wave and tidally-dominated oceanic embayment, and 2) freshwater inflow dominated non-marine river valley (ibid).</p>
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¹² Water inputs from rainfall | Water inputs from surface water | Water inputs from groundwater | Marine water | Unknown

¹³ Feeds groundwater | To downstream catchment | Marine | Unknown

¹⁴ Water levels largely stable | Water levels fluctuating (including tidal) | Unknown

Six large river systems exert a significant influence on the sediment and water quality characteristics of the Bay; the Brisbane, Pine (North and South), Caboolture, Logan-Albert, Pimpama and Coomera Rivers.

The Brisbane River is the largest river emptying into Moreton Bay and plays an important role in ecosystem function due to the variability in its freshwater discharge. The average annual discharge of the Brisbane River is approximately 69% of the total annual riverine input into Moreton Bay (Stewart et al. 2015). This has the potential to change the hydrographical structure of the Bay with consequential impacts on the estuarine and marine ecosystem (Yu et al. 2014).

Moderate flood events flowing from the Brisbane River have resulted in plumes extending 5.5 km east of the river mouth (Yu et al. 2011). The major flood event of January 2011 resulted in a sediment plume influencing a large area of the Bay and persisting for 20 days (Yu et al. 2014; <https://eatlas.org.au/rrmmp/qld-flood-plumes-2011>).

Connectivity of surface waters and of groundwater

Surface expressions of both the regional and perched aquifers supports many wetlands on the Island alone (Marshall et al. 2006 in Marshall et al. 2011).

Perched lakes on the islands are fed by seepage from perched aquifers located above the regional water-table. Water table window lakes (such as Blue Lake, North Stradbroke Island) form between dunes in depressions that extend at or below the upper surface of the regional water-table.

Research reveals that Blue Lake's depth and shoreline have remain essentially unchanged over the past century despite climatic variability such as extended droughts (Barr et al. 2013), and it is believed that there has been little change in the chemistry of the lake over the past few millennia. This highlights its importance as a freshwater refuge with groundwater inflow from the large unconfined sand aquifer sustaining characteristic aquatic biota, including endangered flora and fauna (ibid).

Some palustrine wetlands are predominantly fed by the regional groundwater table, while others that are contiguous with nearby perched lakes are often fed by the local groundwater table of the perched lake (ibid).

Surface expression of groundwater also occurs in some creeks. Capembah Creek on the west coast of North Stradbroke Island is one such creek system, receiving freshwater from the lens of groundwater. The spring water discharges approximately 2.4 million litres of groundwater through a paperbark swamp and mangrove forest before entering the coastal waters of Moreton Bay (Natural Resources and Water 2006 and Moss et al. 2011 in Arnold et al. 2014).

The groundwater dependent ecosystems of the Moreton Bay Ramsar site have been extensively mapped and classified and mapping and associated information is available via www.wetlandinfo.des.qld.gov.au (Glandville et al. 2016).

Stratification and mixing regime

The bay part of the Ramsar site is characterised by a broad mixing zone and wetland system and good connections between marine, estuarine and freshwater systems. Moreton Bay is a shallow bay with an average depth of 6.8 m and a maximum depth of 36 m (Davie et al. 2011).

Water temperature, as a result, is relatively homogenous as the surface and deeper layers of water are well mixed (Kienzle et al. 2016).

The stratification and mixing regimes of the freshwater wetlands are very variable.

4.4.5 Sediment regime

- ☒ Significant erosion of sediments occurs on the site
- ☒ Significant accretion or deposition of sediments occurs on the site
- ☒ Significant transportation of sediments occurs on or through the site
- ☒ Sediment regime is highly variable, either seasonally or inter-annually
- ☐ Sediment regime unknown

Please provide further information on sediment (optional): *(This field is limited to 1000 characters)*

In the northern and eastern areas of the Bay, sediments are predominantly tidal delta sands. In the southern Bay, sediments are predominantly tidal delta sands with fluvial sands and muds adjacent to the mainland coast.

Since European settlement there has been substantial large-scale land use changes in the Bay's catchments resulting in catchment degradation, loss of vegetation from the riparian zone and a highly degraded stream network due to erosion (Narayan et al. 2015).

Terrigenous (land-sourced) sediment and nutrient input to the Bay is highly variable over time and space. Episodic high summer rainfall events deliver highly turbid inflows consisting primarily of suspended silts and clays. These have resulted in the western and southern areas of the Bay having the highest sediment mud content. They have also contributed to the loss of seagrass beds and coral diversity due to the resuspension of finer sediments into the water column, which reduces water clarity and light availability (Lockington et al. 2017).

The 2011 extreme flooding event resulted in a flow rate within the Brisbane River sufficient to scour bed sediments, a magnitude not reached since the 1974 flood (Coates-Marnane et al. 2016a). A significant store of sediments had accumulated in the Brisbane River main channel and its tributaries between floods as a result of agricultural, urban and industrial land uses (ibid). Low freshwater flows, retention of flood waters by the Wivenhoe Dam and extensive tidal ingress extending >80 km (AMTD) inland from the Brisbane River mouth led to trapping of these contaminants (ibid). The high flow event resulted in channel bank scouring and the rapid re-mobilisation of metal-rich sediments from the bed, bank and floodplain sediments and their ultimate downstream flushing to Moreton Bay's coastal waters (ibid).

Muddy sediments cover an estimated area of approximately 860 km² of the Bay representing over 50 per cent of the total surface sediment area (Lockington et al. 2017). This is more than double the area of the Bay covered in mud compared with the previous estimate in 1970. Mud fractions derived from catchment-borne sediments dominate the sediments, particularly fine silts and clays that were deposited to a sediment depth of 10 to >30 cm from the 2011 and 2013 flood events (ibid). The 2011 event was estimated to deliver 5-10 million tonnes of sediment to Moreton Bay (Steven et al. 2014; Coates-Marnane et al. 2016b).

Water turbidity and colour

Regular monitoring of water quality and turbidity in the catchments, rivers, estuaries and bay waters in Moreton Bay is undertaken as part of collaborative efforts between state and local government and regional natural resource management bodies. The most recent 'report card' and associated data (including turbidity) are accessible at www.hlw.org.au. In general, turbidity

varies along a gradient with higher turbidity at the western margins of the Bay (adjacent to rivers) and lower turbidity at the eastern banks. Previous reports have noted that the eastern Bay has low ambient turbidity and nutrient concentrations, reflecting the high degree of tidal flushing and limited influence of riverine discharges (BAC 2007).

The water quality monitoring under the previous Ecosystem Health Monitoring Program (EHMP 2007a; 2007b), noted that water quality within the Pumicestone Passage was degraded in places, with generally poorer quality water (higher nutrients and turbidity) in the northern and central reaches compared with the southern reaches. Several small creeks discharge into the Passage, which are known to contain high levels of nitrogen, sediments and tannins, and are considered to be of 'fair' quality (ibid). Pesticides have also been detected in the Pumicestone passage catchment (Kookana et al. 1998).

Turbidity is a particularly important factor in terms of regulating the depth distribution and extent of seagrass, macroalgae and microphytobenthos. Less well known are the direct physiological and behavioural effects of turbidity on aquatic fauna (e.g. fish larvae behaviour in turbid waters, reduced predation success, and interference of feeding efficiencies of filter feeders).

Light - reaching wetland

Variable

Water temperature

Temperature varies over the Ramsar site depending on the wetland type the water is located in. Sea temperature within the Bay has increased on average 0.6 °C for each of the two decades 1990-1999 and 2000-2010, which has implications for higher predicted mortality rates to commercial fishery species such as prawns (Kienzle et al. 2016).

4.4.6 Water pH

- ☒ Acid (pH<5.5)
- ☒ Circumneutral (pH: 5.5-7.4)
- ☒ Alkaline (pH>7.4)
- ☐ Unknown

Please provide further information on pH (optional): (This field is limited to 1000 characters)

The pH level varies throughout the site.

For the freshwater wetlands, the Oxleyan pygmy perch is thought to be restricted to acidic (pH 4.4 - 6.8) freshwater lakes, pools and small streams with dense, aquatic vegetation (such as emergent and submerged sedges) along the margins, including on Moreton Island and North Stradbroke Island (Arthington and Marshall 1993; Arthington 1996; Kuitert et al. 1996; Pusey et al. 2004).

Given the importance of the Moreton Bay area for acid frogs, wallum swamp and lake waters should remain acidic (within the pH range 3-5) while nitrate levels should not exceed 0.7 mg/L (Meyer, E pers. comm. 2008).

The wallum froglet, *Crinia tinnula* occurs within the Ramsar site primarily in heathland, paperbark (*Melaleuca*) swamps and sedge swamps in areas of sandy soil, which support waters that are typically tannin-stained, acidic (i.e. <5.5 pH) and non-turbid (Straughan and Main 1966; Ingram and Corben 1975; Meyer et al. 2006). Waterbodies used for breeding are typically oligotrophic (low nutrient), naturally acidic (pH 3.0-5.5 as derived from dissolved organic acids leached from humus), and free of predatory fish (Myer et al. 2006).

The Cooloola sedgefrog, *Litoria cooloolensis* is typically more abundant around perched lakes with emergent sedges and reeds (Ehmann 1997, James 1996, Hopkins 2003 and Lewis and Goldingay 2005 in Meyer et al. 2006). The lakes in which *L. cooloolensis* breeds are typically oligotrophic and acidic (pH<5.5). (Liem 1974, Bayly 1964 and Meyer 2004 in Meyer et al. 2006).

Hines and Meyer (2011) found that for Bribie Island *Litoria freycineti* were recorded in acidic tannin stained waters of pH 3.6 – 4.2, *Litoria olongburensis* in waters of pH 3.4 – 4.5, and *Crinia tinnula* in waters of pH 3.2– 5.0.

4.4.7 Water salinity

- ☒ Fresh (<0.5 g/l)
- ☒ Mixohaline (brackish)/Mixosaline (0.5-30 g/l)
- ☒ Euhaline/Eusaline (30-40 g/l)
- ☒ Hyperhaline/Hypersaline (>40 g/l)
- ☐ Unknown

Please provide further information on salinity (optional): (This field is limited to 1000 characters)

Salinity is variable across the wetland types at the sites. The implications of salinity for locally occurring wetlands are largely dependent on the type of wetland, the quantity and quality of flow and/or the wetlands location relative to the freshwater influence. In general terms, freshwater dependent wetlands, such as those in and adjacent to freshwater reaches of watercourses, are those most influenced by freshwater flow patterns. The distribution of mangrove and saltmarsh wetlands in the Ramsar site are influenced mostly by physiographic features and tidal inundation, however their species composition can be determined by prevailing salinity regimes (BMT WBM 2008) and in some areas influenced by fresh water flows from aquifers (Cox and Specht 2012).

Dissolved gases in water

Variable

4.4.8 Dissolved or suspended nutrients in water

- ☒ Eutrophic
- ☒ Mesotrophic
- ☒ Oligotrophic
- ☒ Dystrophic
- ☐ Unknown

Please provide further information on dissolved or suspended nutrients (optional): (This field is limited to 1000 characters)

Nutrients affects the growth of *Lyngbya majuscula* (Cyanobacteria). Increases in bioavailable nutrients (including iron, phosphorus, nitrogen and dissolved organics) as well suitable light, salinity and temperature regimes, and pH can lead to algal blooms (BMT WBM 2008). Within Moreton Bay the Department of Environment and Science provides updates on cyanobacteria observed by the Queensland Parks and Wildlife Service, local councils and other observers. Results can be accessed via www.des.qld.gov.au

Within the Ramsar site, acid frogs are typically associated with oligotrophic waters of low pH and changes to water chemistry through nutrient enrichment is a key threat to these species (Meyer et al 2006; Hines and Meyer 2011).

Dissolved organic carbon (Doc)

The western area of the Bay, close to the coastal mainland had distinct regions of high DOC in surveys undertaken for submarine groundwater discharge, while DOC levels were lowest in the middle of the Bay and off Moreton Island (Stewart et al. 2015).

Redox potential of water and sediments

Variable

Water conductivity

Variable

4.4.9 Features of the surrounding area which may affect the Site

Please describe whether, and if so how, the landscape and ecological characteristics in the area surrounding the Ramsar Site differ from the site itself:

☐ i) broadly similar / ☒ ii) significantly different

If the surrounding area differs from the Ramsar Site, please indicate how: (Please tick all categories that apply)

☒ Surrounding area has greater urbanisation or development

☒ Surrounding area has higher human population density

☐ Surrounding area has more intensive agricultural use

☒ Surrounding area has significantly different land cover or habitat types

Please describe other ways in which the surrounding area is different: (This field is limited to 1000 characters)

The broader Moreton Bay area is subject to significant impacts due to its proximity to the cities of Brisbane, Logan, the Gold Coast and many other urban centres. Its condition has been modified due to development that has led to the loss of wetlands; dredging and entrance modification including substantial reclamation; urbanisation including the development of canal estates; discharges from industry, sewage and wastewater treatment plants; and natural freshwater flow modification resulting from weirs and dams, water extraction and sand mining. In addition, large estuaries discharge a range of pollutants from urban and rural land uses, such as high sediment and nutrient loads, which has led to chronic adverse impacts on water quality and aquatic ecosystem health in the western and southern sections of Moreton Bay (BMT WBM 2008).

Significant investments have been made to upgrade sewage and wastewater treatment plants in the past decade to reduce nutrient loads and associated phytoplankton blooms in the western embayments. The timing, volume and quality of treated wastewater release is regulated under the *Queensland Environmental Protection Act 1994*. Water quality and ecosystem health standards are now regulated requiring new development to meet urban stormwater quality management and water sensitive urban design standards. The South East Queensland Healthy Waterways Strategy 2007-2012 has led to the Queensland state government and an alliance of other parties such as local governments, regional natural resource management (NRM) bodies and science providers, regularly monitoring the catchments, rivers, estuaries and coastal areas of Moreton Bay. An annual 'report card' reports on the monitoring results for each catchment and provides an environmental condition grade for both the habitat and water quality (www.hlw.org.au).

4.5 Ecosystem services

4.5.1 Ecosystem services/benefits

Please select below all relevant ecosystem services/benefits currently provided by the site and indicate their relative importance in the right-hand column.

Provisioning Services

Ecosystem service ¹⁵	Examples ¹⁶	Importance/Extent/Significance ¹⁷
Food for humans	Sustenance for humans (e.g., fish, molluscs, grains)	The Ramsar site's wetlands provide important primary production for a range of species, including commercially valuable fish and crab species. The region supports one of the most productive fisheries in Queensland. Although the Bay only represents about 3% of Queensland's coastline, it produces just over 15% of the seafood for Queensland managed fisheries. In 2001, the estimated gross value of production of commercial fisheries was approximately \$33.2 million (Pascoe et al. 2014).
Fresh water	Drinking water for humans and/or livestock	Groundwater aquifers on North Stradbroke Island supply fresh water to the Redlands Community and the southeast Queensland Region. Groundwater aquifers on Bribie Island supply fresh water to local residents and the Moreton Bay Regional Council area. The availability of clean, fresh, usable water underpins southeast Queensland's economic and social development.
	Water for industry	
	Ornamental species (live and dead)	There are numerous products derived from nature found within the Moreton Bay Ramsar site that can be used as ornamental resources including plants, branches/wood, shells, rocks, sand, drift wood etc. However, take of these is subject to any limitations on protected or restricted species.

Regulating Services

¹⁵ Food for humans | Fresh water | Wetland non-food products | Biochemical products | Genetic materials

¹⁶ Sustenance for humans (e.g., fish, molluscs, grains) | Drinking water for humans and/or livestock | Water for irrigated agriculture | Water for industry | Water for energy production (hydro-electricity) | Timber | Fuel wood/fibre | Peat | Livestock fodder | Reeds and fibre | Other | Extraction of material from biota | Medicinal products | Genes for tolerance to certain conditions (e.g., salinity) | Genes for resistance to plant pathogens | Ornamental species (live and dead)

¹⁷ not relevant for site | Low | Medium | High

Ecosystem service ¹⁸	Examples ¹⁹	Importance/Extent/Significance ¹⁹
Maintenance of hydrological regimes	Groundwater recharge and discharge	<p>Groundwater recharge areas are within the Ramsar area, including on the islands of Moreton, Bribie and North Stradbroke Islands.</p> <p>Several islands contain perched lakes on sand that are rare globally.</p> <p>The large sand islands also act as recharge zones based on direct observations of groundwater levels between 2007 and 2013.</p>
Erosion protection	Soil, sediment and nutrient retention	<p>Soil, regolith and vegetation within the Ramsar site buffer the effects of wind, water and waves through water and energy storage capacity and surface resistance (Barbier 2016).</p> <p>Vegetation enhances infiltration and provides surface resistance. Degraded soils and landscapes have a reduced capacity to do this.</p> <p>The relatively natural condition of the Ramsar site islands maximises its potential to buffer against extremes and reduce erosion.</p>
Pollution control and detoxification	Water purification/waste treatment or dilution	Wetlands can transport, store and transform certain excesses of organic and inorganic wastes through distribution, assimilation, transport and chemical recomposition (Clouston 2002; Adame and Lovelock 2011).
Climate regulation	Local climate regulation/buffering of change	The relatively natural condition of the Ramsar site contributes to climate regulation.
	Regulation of greenhouse gases, temperature, precipitation and other climatic processes	<p>Mangrove forests are known to play an important role in the carbon cycle by sequestering and storing carbon dioxide (Lovelock et al. 2014).</p> <p>Wetlands are also known to play a role in localised climate regulation (Marsden et al. 2012)</p>
Hazard reduction	Flood control, flood storage	<p>There are many ways that ecosystems buffer human society from extreme events, including the ability of rivers, dams, floodplains and soils to store and disperse water in times of high rainfall.</p> <p>The extensive coastal wetlands of the Moreton Bay Ramsar area help mitigate impacts of flooding.</p>

¹⁸ Maintenance of hydrological regimes | Erosion protection | Pollution control and detoxification | Climate regulation | Biological control of pests and disease | Hazard reduction

¹⁹ Groundwater recharge and discharge | Storage and delivery of water as part of water supply systems for agriculture and industry | Soil, sediment and nutrient retention | Water purification/waste treatment or dilution | Local climate regulation/buffering of change | Regulation of greenhouse gases, temperature, precipitation and other climatic processes | Support of predators of agricultural pests (e.g., birds feeding on locusts) | Flood control, flood storage | Coastal shoreline and river bank stabilization and storm protection

	Coastal shoreline and river bank stabilization and storm protection	<p>Sand banks, dunes, mangroves and rocky shores in the site provide a barrier to storm surges and protection from large waves that can erode headlands and beaches and threaten coastal communities (Barbier 2016).</p> <p>Vegetation, in general, helps prevent the erosion of soils through root structure and by providing ground cover.</p>
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Cultural Services

Ecosystem service ²⁰	Examples ²¹	Importance/ Extent/ Significance ¹⁹
Recreation and tourism	Recreational hunting and fishing	Wetlands within the Ramsar site provide a spectrum of leisure opportunities such as tourism, outdoor pursuits, sports and fishing. Moreton Bay Marine Park is the most visited park by domestic tourists in Queensland with an estimated 12.4 million visits per year (SEQC 2016). It is a popular location for recreational fishing with direct expenditure by fishers in Moreton Bay estimated to be between \$156m and \$194m per year (McPhee et al. 2008). In addition, it is estimated that 21,262 patrons participate in fishing charters in and around Moreton Bay per year. Contributing to the direct employment of 58 people in charter fishing businesses and a gross value of product of \$2.4m per year (SEQC 2016). The value of recreational boating has been estimated to be \$1.7m per year (Driml and McBride 1982). An estimated 2,000 people visit Moreton Bay each year to watch migratory birds (Clouston 2002).
	Water sports and activities	
	Picnics, outings, touring	
	Nature observation and nature-based tourism	

²⁰ Recreation and tourism | Spiritual and inspirational | Scientific and educational

²¹ Recreational hunting and fishing | Water sports and activities | Picnics, outings, touring | Nature observation and nature-based tourism | Inspiration | Cultural heritage (historical and archaeological) | Contemporary cultural significance, including for arts and creative inspiration, and including existence values | Spiritual and religious values | Aesthetic and sense of place values | Educational activities and opportunities | Important knowledge systems, importance for research (scientific reference area or site) | Long-term monitoring site | Major scientific study site | Type location for a taxon

Spiritual and inspirational	Cultural heritage	<p>Sites of significant Aboriginal cultural heritage are located throughout the site including on Bribie, North Stradbroke (Minjerriba), Peel (Turkrooar), St Helena (Noogoon), Macleay, Lamb (Ngudooroo), Karragarra and Russell (Canaipa) Islands as well as Toorbul Point, Caboolture River and Victoria Point. Types of sites include middens, fish traps, artefact scatters, quarries and scarred trees</p> <p>Tangible evidence of past occupation is found in many forms throughout the site. The archaeological heritage of the Moreton Bay Islands is an extensive, rich and diverse cultural record. It comprises over 1000 known sites, including shell middens, stone artefact scatters, stone artefact quarries, burials, scarred trees, earthen ceremonial rings, story places, pathways, and stone fish traps. Archaeological sites are found on all the Moreton Bay islands, although the type and character of the evidence varies according to a range of factors including the resource availability, accessibility, seasonal use and social factors.</p> <p>Contemporary cultural knowledge relating to these sites and landscapes remains strong, and is tangibly associated with living traditions, ideas and beliefs. Although there have been significant impacts on parts of the islands, much of the cultural landscape is intact and remains associated with living traditions and beliefs. There is abundant evidence of traditional human settlement, land and sea use.</p> <p>Within the Quandamooka state, traditional management practices are being progressively introduced through collaboration between the Department of Environment and Science and the Quandamooka Aboriginal traditional owners, who have consented to the formal declaration of National Parks over their Aboriginal Land Act land.</p>
	Spiritual and religious values	<p>Ecosystems are a source of spiritual inspiration and religious experience to many people (Maynard et al. 2010).</p>

	Aesthetic and sense of place values	<p>Shared places provide opportunities for people to develop a sense of belonging, commitment, identity and community.</p> <p>A range of ecosystem services, geographic and socio-economic variables will contribute to an individual's sense of place (e.g. geography, climate, cultural and religious values, level of previous interaction with nature, time living in the area, personal relationships and socio-economic position - to name just a few).</p> <p>Moreton Bay is well known and appreciated for its beauty and aesthetics.</p> <p>Overseas studies have shown a link between increased house prices and proximity to wetland areas (Marsden et al. 2010).</p>
Scientific and educational	Educational activities and opportunities	The Ramsar site is used extensively for research and education purposes (Clouston 2002).

Supporting Services

Ecosystem service ²²	Examples ²³	Importance/ Extent/ Significance ¹⁹
Biodiversity	Supports a variety of all life forms including plants, animals and microorganisms, the genes they contain, and the ecosystems of which they form a part	There are a range of natural and near-natural wetland types that provide supporting habitat for biodiversity within the Ramsar site. Refer section 3.1
Soil formation	Sediment retention and accumulation of organic matter	The wetlands in the Ramsar area assist in stabilising the sands and soils. Mangrove forest and seagrass beds in particular play important roles in sediment retention and the accumulation of organic matter (Adame et al. 2010).

²² Biodiversity | Soil formation | Nutrient cycling | Pollination

²³ Supports a variety of all life forms including plants, animals and microorganisms, the genes they contain, and the ecosystems of which they form a part | Sediment retention | Accumulation of organic matter | Storage, recycling, processing and acquisition of nutrients | Carbon storage/sequestration | Support for pollinators

Nutrient cycling	Storage, recycling, processing and acquisition of nutrients	Mangrove communities, saltmarsh, seagrass and other wetlands of the Ramsar area support nutrient capture, recycling and storage. Seagrass beds are very important sites for fixing nitrogen via nitrogen-fixing bacteria, with 0.2 to 0.4knN/HA/Day being fixed in Moreton Bay seagrass sediments (Clouston 2002). Mangrove forests have also been shown to play an important role in nitrogen fixation and de-nitrification (Adame and Lovelock 2011).
	Carbon storage/sequestration	Mangrove communities, saltmarsh, seagrass and the other wetlands of the Ramsar area support carbon storage and sequestration (Lovelock et al. 2014).
Pollination	Support for pollinators	Pollination is critical to the reproduction of most wild plants and the production of food for consumption by animals and humans (Schulp et al. 2014). Plants benefit from pollination, out-crossing with other plants to maintain genetic diversity. This contributes to the resilience of an ecosystem and its capacity to continue to perform its functions and provide continuous benefits to us as humans.

Other ecosystem service(s) not included above: *(This field is limited to 1000 characters)*

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Please make a rough estimate of the approximate number of people who directly benefit from the ecological services provided by this site (estimate at least in orders of magnitude: 10s, 100s, 1000s, 10 000s etc.):

Within the site:

	1,000,000s
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Outside the site:

	1,000,000S
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Have studies or assessments been made of the economic valuation of ecosystem services provided by this Ramsar Site?

☒ Yes / ☐ No / ☐ Unknown

Where economic studies or assessments of economic valuation have been undertaken at the site, it would be helpful to provide information on where the results of such studies may be located (e.g. website links, citation of published literature): *(This field is limited to 2500 characters)*

	<ul style="list-style-type: none"> Literature Review of the Economic Value of Ecosystem Services that Wetlands Provide (including Moreton Bay) - http://www.environment.gov.au/water/wetlands/publications/literature-review-economic-value-ecosystem-services-wetlands-provide Linking the Ecological and Economic Values of Wetlands: A Case Study of the Wetlands of Moreton Bay PhD Thesis by Clouston, Elizabeth, 2002- https://www120.secure.griffith.edu.au/rch/file/d2a213de-1c8a-bfbb-47a8-cd985df89109/1/02Whole.pdf
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- Sean Pascoe, Amar Doshi, Quentin Dell, Mark Tonks, Rob Kenyon (2014) “Economic value of recreational fishing in Moreton Bay and the potential impact of the marine park rezoning” in Tourism Management 41 (2014) 53-63, <https://doi.org/10.1016/j.tourman.2013.08.015>
- McPhee, D. P., Mills, M., Hundloe, T. J. A., Buxton, C. D., Knuckey, I., & Williams, K. A. (2008). A participatory and coordinated fishing industry solution to the rezoning of the Moreton Bay Marine Park. Canberra: Fisheries Research and Development Corporation.
- K.A. Williams, D.P. McPhee, T.J.A. Hundloe, C.D. Buxton, I. Knuckey and S. Stone (2009) Regional Impact Assessment for the Moreton Bay Marine Park; FRDC Project No. 2007/053 – 2009

4.5.2 Social and cultural values

Is the site considered internationally important for holding, in addition to relevant ecological values, examples of significant cultural values, whether material or non-material, linked to its origin, conservation and/or ecological functioning? If so, please describe this importance under one or more of the four following categories. You should not list here any values derived from non-sustainable exploitation or which result in detrimental ecological changes.

☐ (i) the site provides a model of wetland wise use, demonstrating the application of traditional knowledge and methods of management and use that maintain the ecological character of the wetland

Description if applicable *(This field is limited to 2500 characters)*

☐ (ii) the site has exceptional cultural traditions or records of former civilizations that have influenced the ecological character of the wetland

Description if applicable *(This field is limited to 2500 characters)*

☐ (iii) the ecological character of the wetland depends on its interaction with local communities or indigenous peoples

Description if applicable *(This field is limited to 2500 characters)*

☐ (iv) relevant non-material values such as sacred sites are present and their existence is strongly linked with the maintenance of the ecological character of the wetland

Description if applicable *(This field is limited to 2500 characters)*

4.6 Ecological processes

This section is not intended for completion as part of a standard RIS, but is included for completeness as part of the agreed format of a 'full' Ecological Character Description (ECD) outlined by Resolution X.15

Primary production

<input type="checkbox"/>	Occurring, variable
<input type="checkbox"/>	<p>Primary productivity is a central ecosystem service provided by the major wetland flora habitats – mangroves, saltmarsh, seagrass and vegetated swamps. These plants support local and regional marine/estuarine and freshwater food webs. Mangrove primary production varies between communities, with influencing factors such as soil nutrient status, redox potential, salinity, temperature, light intensity, associated fauna and tidal flushing. These coastal vegetated habitats support critical primary productivity for biodiversity of flora and fauna found within and outside the Ramsar site (Sheaves 2009; Martin et al. 2015).</p> <p>Mangrove and saltmarsh vegetation are the notable macrophyte vegetation units covering much of the coastal upper intertidal flats within the Ramsar site. These mangrove and saltmarsh systems provide critical habitat and primary productivity supporting regionally important stocks of baitfish and fisheries species (Manson et al. 2005). Saltcouch (<i>Sporobolus virginicus</i>) is a critical primary producer providing nutritional support to wetland food webs (Platell and Freewater 2009; Morton et al. 1987).</p>

Nutrient cycling

<input type="checkbox"/>	Occurring, variable
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Carbon cycling

<input type="checkbox"/>	Occurring, variable
--------------------------	---------------------

Animal reproductive productivity

<input type="checkbox"/>	Occurring, variable
--------------------------	---------------------

Vegetational productivity, pollination, regeneration processes, succession, role of fire, etc.

<input type="checkbox"/>	Occurring, variable
--------------------------	---------------------

Notable species interactions, including grazing, predation, competition, diseases and pathogens

<input type="checkbox"/>	Occurring, variable
--------------------------	---------------------

Notable aspects concerning animal and plant dispersal

<input type="checkbox"/>	Occurring, variable
--------------------------	---------------------

Notable aspects concerning migration

<input type="checkbox"/>	<p>Shorebirds, whales, dolphins, marine turtles and fish are some of the wetland species that undertake migrations through, in or around the Ramsar site as part of their lifecycle. For migratory shorebirds, foraging and roosting habitat in the Ramsar site are not only essential during the stationary non-breeding period (approx. Nov-Mar), but also during migration to and from northern hemisphere breeding grounds. Access to a network of undisturbed roost sites and high quality feeding areas is particularly important shortly before, during, and shortly after migration when individuals face exceptionally high energetic demands.</p> <p>Australia is party to bilateral agreements for migratory bird conservation with Japan, China and the Republic of Korea. Australia is also a member of the East Asian-Australasian Flyway Partnership and signatory to two multilateral agreements that are relevant to flyway conservation of shorebirds, the Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention) and the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention).</p>
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Pressures and trends concerning any of the above, and/or concerning ecosystem integrity

Shorebird populations face a number of threats, including habitat loss and degradation from coastal development, human disturbance, predation and disturbance by domestic and feral animals, commercial and recreational fishing impacts on prey species, and the introduction of exotic plants to important nesting locations. Migratory shorebirds are particularly susceptible to disturbance and habitat degradation before, during, and after migration when their energetic and food requirements are extremely high as they prepare for, undertake, or recover from long migratory journeys (Colwell 2010). Non-migratory shorebirds, on the other hand, are highly sensitive to disturbance during the breeding season when caring for eggs and young.

Migratory shorebird declines are occurring despite relatively high levels of habitat protection in Australia (Dhanjal-Adams et al 2016), suggesting that factors outside Australia, including loss of intertidal habitats upon which they depend, are primarily driving the decline (Lisson et al 2017; Clemens et al 2016; Studds et al. 2017). Many species using the East Asian-Australasian Flyway stop over at Yellow Sea tidal mudflats in China, North Korea and South Korea to rest and refuel during migration. This threatened ecosystem has shrunk by more than 65 per cent in the past 50 years with much of the remainder impacted by pollution and degradation, such as algal blooms, discharge of heavy metals and pesticides, and spread of exotic plants. Migratory shorebird species with the greatest reliance on Yellow Sea stopover sites have shown the greatest population declines (Studds et al. 2017). Nonetheless, coastal development and human disturbance within Australia can cause declines in local abundance (Stigner et al. 2016), which could have important cumulative effects at the species level, highlighting the importance of habitat protection.

How is the Site managed?

5.1 Land tenure and responsibilities (Managers)

5.1.1 Land tenure/ownership

Please specify if this category applies to the Ramsar Site, to the surrounding area or to both, by ticking the relevant option(s).

Public ownership

Category ²⁴	Within the Ramsar Site	In the surrounding area
Public land (unspecified)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
National/Federal government		
Provincial/region/state government	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Local authority, municipality, (sub) district, etc.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Other public ownership		

Private ownership

Category ²⁵	Within the Ramsar Site	In the surrounding area
Commercial (company)		<input checked="" type="checkbox"/>
Other types of private/individual owners		<input checked="" type="checkbox"/>

Other

Category ²⁶	Within the Ramsar Site	In the surrounding area
Commoners/customary rights Native title exclusive and non exclusive rights	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Provide further information on the land tenure / ownership regime (optional): (This field is limited to 1000 characters)

<p>Moreton Bay Marine Park is a management layer, tenure is state land/waters as identified above.</p> <p>Moreton Bay Marine Park covers a total of 3,400 km² extending seawards to the limit of Queensland waters and incorporates nearly all of the Ramsar site. It was re-zoned in 2008</p>

²⁴ Public land (unspecified) | National/Federal government | Provincial/region/state government | Local authority, municipality, (sub)district, etc. | Other public ownership

²⁵ Cooperative/collective (e.g., farmers cooperative) | Commercial (company) | Foundation/non-governmental organization/trust | Religious body/organization | Other types of private/individual owner(s)

²⁶ Unspecified mixed ownership | No information available |

creating four zone types, one – the marine national park (green) zone – covers 16% of the bay and is a 'no-take area' of high conservation value (State of Queensland 2010). There are also designated areas for protecting natural values and marine fauna such as dugong and turtles. It is managed by the Department of Environment and Science (DES) as a multi-use marine protected area, with the Queensland Parks and Wildlife Service (QPWS) responsible for day-to-day management.

Land areas above the high water mark within the Ramsar site are largely State or local government owned lands including national parks, conservation parks, reserves, esplanades and unallocated State land. Areas of freehold land in the Ramsar site are held by local government.

Within the Ramsar site, active Native Title claims exist to Moreton Island (Gnoorganbin) (Quandamooka People #4), western Moreton Bay (Quandamooka) waters and areas of the mainland (Quandamooka Coast Claim), Bribie Island and inland waters (Kabi Kabi First Nation) and mainland (Kabi Kabi Undambi Area Claim) areas.

5.1.2 Management authority

Please list the local office / offices of any agency or organization responsible for managing the site: *(This field is limited to 1000 characters)*

Queensland State Government

Queensland Department of Environment and Science – www.des.qld.gov.au

The Moreton Bay Marine Park, adjacent National Parks, Conservation Parks and Recreation Areas are managed by the Queensland Department of Environment and Science, Queensland Parks and Wildlife Service (QPWS).

Queensland Department of Agriculture and Fisheries – www.daf.qld.gov.au

Queensland Department of Transport and Main Roads – www.tmr.qld.gov.au

Queensland Department of Natural Resources, Mines and Energy – www.dnrm.qld.gov.au

Local Governments

Sunshine Coast Council – www.sunshinecoast.qld.gov.au

Moreton Bay Regional Council – www.moretonbay.qld.gov.au

Brisbane City Council – www.brisbane.qld.gov.au

Redland City Council – www.redland.qld.gov.au

City of Gold Coast – www.goldcoast.qld.gov.au

Quandamooka Yoolooburrabee Aboriginal Corporation – www.qyac.net.au

Port of Brisbane – www.portbris.com.au

Gold Coast Waterways Authority - www.gcwa.qld.gov.au

Provide the name and title of the person or people with responsibility for the wetland:

Manager, Wetlands Team, Queensland Department of Environment and Science

Postal address: *(This field is limited to 254 characters)*

Queensland Department of Environment and Science

GPO Box 2454

Brisbane QLD 4001

E-mail address: *(The online RIS only accepts valid e-mail addresses, e.g. example@mail.com)*

info@des.gov.au

5.2 Ecological character threats and responses (Management)

5.2.1 Factors (actual or likely) adversely affecting the Site's ecological character

Please specify if this category applies to the Ramsar Site, to the surrounding area or to both, by ticking the relevant option(s).

Human settlements (non agricultural)

Factors adversely affecting site ²⁷	Actual threat ²⁸	Potential threat ³⁰	Within the site	Changes ¹⁰	In the surrounding area	Changes ¹⁰
Housing and urban areas	[x]	[x]			[x]	
Commercial and industrial areas	[x]	[x]	[x]		[x]	
Tourism and recreation areas	[x]	[x]	[X]		[x]	
Unspecified development	[x]	[x]	[x]		[x]	

Water regulation

Factors adversely affecting site ²⁹	Actual threat ³⁰	Potential threat ³⁰	Within the site	Changes ¹⁰	In the surrounding area	Changes ¹⁰
Dredging	[x]	[x]	[x]		[x]	
Drainage	[x]	[x]	[x]		[x]	
Water releases	[x]	[x]	[x]		[x]	
Canalisation and river regulation		[x]			[x]	
Water abstraction	[x]	[x]	[x]			

Agriculture and aquaculture

Factors adversely affecting site ³⁰	Actual threat ³⁰	Potential threat ³⁰	Within the site	Changes ¹⁰	In the surrounding area	Changes ¹⁰

²⁷ Housing and urban areas | Commercial and industrial areas | Tourism and recreation areas | Unspecified development

²⁸ Low impact | Medium impact | High impact | unknown impact |

²⁹ Drainage | Water abstraction | Dredging | Salinisation | Water releases | Canalisation and river regulation

³⁰ Annual and perennial non-timber crops | Wood and pulp plantations | Livestock farming and ranching | Marine and freshwater aquaculture | Non specified

Wood and pulp plantations	[x]	[x]			[x]	
Annual and perennial non-timber crops		[x]			[x]	
Livestock farming and ranching		[x]			[x]	
Marine and freshwater aquaculture	[x]	[x]	[x]		[x]	

Energy production and mining

Factors adversely affecting site ³¹	Actual threat ³⁰	Potential threat ³⁰	Within the site	Changes ¹⁰	In the surrounding area	Changes ¹⁰
Mining and quarrying		[x]			[x]	

Transportation and service corridors

Factors adversely affecting site ³²	Actual threat ³⁰	Potential threat ³⁰	Within the site	Changes ¹⁰	In the surrounding area	Changes ¹⁰
Roads and Railways	[x]	[x]			[x]	
Utility and service lines (e.g.pipelines)	[x]	[x]	[x]		[x]	
Aircraft flight path	[x]	[x]	[x]		[x]	
Shipping lanes		[x]	[x]		[x]	

Biological resource use

Factors adversely affecting site ³³	Actual threat ³⁰	Potential threat ³⁰	Within the site	Changes ¹⁰	In the surrounding area	Changes ¹⁰
Fishing and harvesting aquatic resources	[x]	[x]	[x]		[x]	

Human intrusions and disturbance

³¹ Oil and gas drilling | Mining and quarrying | Renewable energy | Unspecified

³² Roads and railroads | Utility and service lines (e.g., pipelines) | Shipping lanes | Aircraft flight paths | Unspecified

³³ Hunting and collecting terrestrial animals | Gathering terrestrial plants | Logging and wood harvesting | Fishing and harvesting aquatic resources | Unspecified

Factors adversely affecting site ³⁴	Actual threat ³⁰	Potential threat ³⁰	Within the site	Changes ¹⁰	In the surrounding area	Changes ¹⁰
Recreation and tourism activities	[x]	[x]	[x]		[x]	

Natural system modifications

Factors adversely affecting site ³⁵	Actual threat ³⁰	Potential threat ³⁰	Within the site	Changes ¹⁰	In the surrounding area	Changes ¹⁰
Vegetation clearance/ land conversion	[x]	[x]	[x]		[x]	
Fire and Fire suppression	[x]	[x]	[x]		[x]	
Dams and water management/use	[x]	[x]			[x]	

Invasive and other problematic species and genes

Factors adversely affecting site ³⁶	Actual threat ³⁰	Potential threat ³⁰	Within the site	Changes ¹⁰	In the surrounding area	Changes ¹⁰
Invasive non-native alien species	[x]	[x]	[x]		[x]	

Pollution

Factors adversely affecting site ³⁷	Actual threat ³⁰	Potential threat ³⁰	Within the site	Changes ¹⁰	In the surrounding area	Changes ¹⁰
Industrial and military effluents	[x]	[x]			[x]	
Household sewage, urban waste water	[x]	[x]	[x]		[x]	
Agricultural and forestry effluents	[x]	[x]	[x]		[x]	
Garbage and solid waste	[x]	[x]	[x]		[x]	

³⁴ Recreational and tourism activities | (Para)military activities | Unspecified/others

³⁵ Fire and fire suppression | Dams and water management/use | Vegetation clearance/ land conversion | Unspecified/others

³⁶ Invasive non-native/ alien species | Problematic native species | Introduced genetic material | Unspecified

³⁷ Household sewage, urban waste water | Industrial and military effluents | Agricultural and forestry effluents | Garbage and solid waste | Air-borne pollutants | Excess heat, sound, light | Unspecified

Excess heat, sound, light	[x]	[x]	[x]		[x]	
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Geological events

Factors adversely affecting site ³⁸	Actual threat ³⁰	Potential threat ³⁰	Within the site	Changes ¹⁰	In the surrounding area	Changes ¹⁰

Climate change and severe weather

Factors adversely affecting site ³⁹	Actual threat ³⁰	Potential threat ³⁰	Within the site	Changes ¹⁰	In the surrounding area	Changes ¹⁰
Habitat shifting and alteration	[x]	[x]	[x]		[x]	
Droughts	[x]	[x]	[x]		[x]	
Temperature extremes	[x]	[x]	[x]		[x]	
Storms and flooding	[x]	[x]	[x]		[x]	

Please describe any other threats (optional): (This field is limited to 2500 characters)

Illegal collection or interference with native flora and fauna. Highly regulated mosquito control programs operate within the site. Jamella leaf hopper (<i>Jamella australiae</i>) outbreaks and myrtle rust (<i>Puccinia psidii</i>) fungal disease have been noted.
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³⁸ Volcanoes | Earthquakes/tsunamis | Avalanches/landslides | Unspecified

³⁹ Habitat shifting and alteration | Droughts | Temperature extremes | Storms and flooding | Unspecified

5.2.2 Legal conservation status

Please list any other relevant conservation status, at global, regional or national level and specify the boundary relationships with the Ramsar Site:

Global legal designations

Designation type ⁴⁰	Name of area	Online information url	Overlap with Ramsar Site ⁴¹
None			

Regional (international) legal designations

Designation type ⁴²	Name of area	Online information url	Overlap with Ramsar Site ⁴³
Other international designation	East Asian-Australasian Flyway Network Site (Site code EAAF013)	http://eaaflyway.net/	Whole

National legal designations

Designation type	Name of area	Online information url	Overlap with Ramsar Site ⁴³
Declared Fish Habitat Area (QLD)	Peel Island (FHA-10); Pumicestone Channel (FHA-011); Hays Inlet (FHA-012); Deception Bay (FHA-013); Kippa-Ring (FHA-014); Moreton Banks (FHA-015); Coombabah (FHA-16); Myora–Amity Banks (FHA-017); Jumpinpin-Broadwater (FHA-021); Pimpama (FHA-022); Coomera (FHA-023)	https://www.npsr.qld.gov.au/managing/habitat-areas/area-plans.html	Whole and partially
State Protected Area (QLD)	Beachmere Conservation I Park	https://www.npsr.qld.gov.au/parks/ - and search	Partially
State Protected Area (QLD)	Beerburrum East State Forest		Partially
State Protected Area (QLD)	Beerwah State Forest		Partially
State Protected Area (QLD)	Bird Island Conservation Park		Whole
State Protected Area (QLD)	Bribie Island National Park		Partially
State Protected Area (QLD)	Bribie Island State Forest		Partially
State Protected Area (QLD)	Buckleys Hole Conservation Park		Partially

⁴⁰ World Heritage site | UNESCO Biosphere Reserve | Other global designation

⁴¹ whole | partly

⁴² EU Natura 2000 | Other international designation

State Protected Area (QLD)	Bullock Creek Conservation Park		Partially
State Protected Area (QLD)	Carbrook Wetlands Conservation Park 2		Partially
State Protected Area (QLD)	Coombabah Lake Conservation Park		Partially
State Protected Area (QLD)	Deception Bay Conservation Park		Partially
State Protected Area (QLD)	Goat Island Conservation Park		Whole
State Protected Area (QLD)	Hays Inlet Conservation Park 1 & 2		Whole
State Protected Area (QLD)	King Island Conservation Park		Whole
State Protected Area (QLD)	Main Beach Conservation Park		Whole
State Protected Area (QLD)	Moreton Bay Marine Park		Partially
State Protected Area (QLD)	Moreton Island National Park		Partially
State Protected Area (QLD)	Mud Island Conservation Park		Partially
State Protected Area (QLD)	Myora Conservation Park		Partially
State Protected Area (QLD)	Naree Budjong Djara Conservation Park		Partially
State Protected Area (QLD)	Naree Budjong Djara National Park		Whole
State Protected Area (QLD)	Ningi Creek Conservation Park		Partially
State Protected Area (QLD)	Pumicestone National Park		Partially
State Protected Area (QLD)	South Stradbroke Island Conservation Park		Partially
State Protected Area (QLD)	Southern Moreton Bay Islands National Park		Partially
State Protected Area	St Helena Island National Park		Whole
State Protected Area (QLD)	Teerk Roo Ra Conservation Park		Partially
State Protected Area	Teerk Roo Ra National Park		Partially

Non-statutory designations

Designation type ⁴³	Name of area	Online information url	Overlap with Ramsar Site ⁴³
KBA – Key Biodiversity Area	Moreton Bay & Pumicestone Passage	http://datazone.birdlife.org/site/factsheet/23545	Partially
Important Bird Area	Moreton Bay & Pumicestone Passage	http://birdlife.org.au/documents/OTHPUB-IBA-suppl.pdf	Partially
Hope spot	Moreton Bay hope spot	https://mission-blue.org/2017/08/citizen-scientist-nurture-the-moreton-bay-hope-spot/	Partially

5.2.3 IUCN protected areas categories (2008)

☐ Ia Strict Nature Reserve

☐ Ib Wilderness Area: protected area managed mainly for wilderness protection

☒ II National Park: protected area managed mainly for ecosystem protection and recreation

☐ III Natural Monument: protected area managed mainly for conservation of specific natural features

☒ IV Habitat/Species Management Area: protected area managed mainly for conservation through management intervention

☒ V Protected Landscape/Seascape: protected area managed mainly for landscape/seascape conservation and recreation

☐ VI Managed Resource Protected Area: protected area managed mainly for the sustainable use of natural ecosystems

⁴³ Important Bird Area | Important Plant Area | Other non-statutory designation

5.2.4 Key conservation measures

Legal protection

Measures ⁴⁴	Status ⁴⁵
Legal protection	Implemented

Habitat

Measures ⁴⁶	Status ⁴⁷
Catchment management initiatives/controls	Partially implemented
Improvement of water quality	Partially implemented
Habitat manipulation/enhancement	Partially implemented
Hydrology management/restoration	Partially implemented
Re-vegetation	Partially implemented
Soil management	Partially implemented

Species

Measures ⁴⁷	Status ⁴⁷
Threatened/rare species management programmes	Partially implemented
Control of invasive alien plants	Partially implemented
Control of invasive alien animals	Partially implemented

Human Activities

Measures ⁴⁸	Status ⁴⁷
Management of water abstraction/takes	Partially implemented
Regulation/management of wastes	Partially implemented
Livestock management/exclusion (excluding fisheries)	Partially implemented
Fisheries management/regulation	Partially implemented
Regulation/management of recreational activities	Partially implemented
Communication, education, and participation and awareness activities	Partially implemented
Research	Partially implemented

Other: (This field is limited to 2500 characters)

In Australia, the ecological character of Ramsar sites is protected as a Matter of National Environmental Significance (MNES) under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

*The measures outlined above as partially implemented are ongoing.

⁴⁴ Legal protection

⁴⁵ Proposed | Partially implemented | Implemented

⁴⁶ Catchment management initiatives/controls | Improvement of water quality | Habitat manipulation/enhancement | Hydrology management/restoration | Re-vegetation | Soil management | Land conversion controls | Faunal corridors/passage

⁴⁷ Threatened/rare species management programmes | Reintroductions | Control of invasive alien plants | Control of invasive alien animals

⁴⁸ Management of water abstraction/takes | Regulation/management of wastes | Livestock management/exclusion (excluding fisheries) | Fisheries management/regulation | Harvest controls/poaching enforcement | Regulation/management of recreational activities | Communication, education, and participation and awareness activities | Research

5.2.5 Management planning

Is there a site-specific management plan for the site?

Management plans exist for the island protected areas on Bribie Island, Moreton Island, North and South Stradbroke Islands. The Moreton Bay Marine Park Zoning Plan is not a management plan but provides guidance on use. Compliance for the Marine Park is undertaken in accordance with the *Marine Parks Act 2004* and relevant subordinate legislation. Local Governments undertake catchment action planning and management planning for reserves.

There are a range of management plans and strategies that pertain to the management of the site and its values, including wetlands, flora and fauna, these are administered by the range of site managers. Refer to www.wetlandinfo.des.qld.gov.au or the relevant management authority website

Queensland State Government

Queensland Department of Environment and Science – www.des.qld.gov.au

The Moreton Bay Marine Park, adjacent National Parks, Conservation Parks and Recreation Areas are managed by the Queensland Department of Environment and Science, Queensland Parks and Wildlife Service (QPWS).

Queensland Department of Agriculture and Fisheries – www.daf.qld.gov.au

Queensland Department of Transport and Main Roads – www.tmr.qld.gov.au

Queensland Department of Natural Resources, Mines and Energy – www.dnrm.qld.gov.au

Local Governments

Sunshine Coast Council – www.sunshinecoast.qld.gov.au

Moreton Bay Regional Council – www.moretonbay.qld.gov.au

Brisbane City Council – www.brisbane.qld.gov.au

Redland City Council – www.redland.qld.gov.au

City of Gold Coast – www.goldcoast.qld.gov.au

Quandamooka Yoolooburrabee Aboriginal Corporation – www.qyac.net.au

Port of Brisbane – www.portbris.com.au

Gold Coast Waterways Authority - www.gcwa.qld.gov.au

Is the management plan/planning implemented?

☒ Yes / ☐ No

The management plan covers

☐ Key areas of the Ramsar site.

Is the management plan currently subject to review and update?

☐ Yes / ☒ No

Has a management effectiveness assessment been undertaken for the site?

☐ Yes / ☒ No

Please give link to site-specific plan or other relevant management plan if this is available via the Internet or upload it in section 'Additional material': (This field is limited to 500 characters)

Marine Parks (Moreton Bay) Zoning Plan 2008:

<https://www.legislation.qld.gov.au/LEGISLTN/CURRENT/M/MarinePMBZnP08.pdf>

If the site is a formal transboundary site as indicated in section Data and location > Site location, are there shared management planning processes with another Contracting Party?

☐ Yes / ☒ No

Please indicate if a Ramsar centre, other educational or visitor facility, or an educational or visitor program is associated with the site: *(This field is limited to 1000 characters)*

	There are a number of educational and visitor facilities associated with the site
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URL of site-related webpage (if relevant):

	https://www.npsr.qld.gov.au/parks/moreton-bay/ https://wetlandinfo.des.qld.gov.au/wetlands/facts-maps/ramsar-wetland-moreton-bay/
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5.2.6 Planning for restoration

Is there a site-specific restoration plan?

	<p>No. However, there are restoration activities undertaken by the range of site managers that oversee the site.</p> <p>Refer to www.wetlandinfo.des.qld.gov.au</p> <p>See also</p> <p>Queensland State Government Queensland Department of Environment and Science – www.des.qld.gov.au Queensland Department of Agriculture and Fisheries – www.daf.qld.gov.au Queensland Department of Transport and Main Roads – www.tmr.qld.gov.au Queensland Department of Natural Resources, Mines and Energy – www.dnrm.qld.gov.au</p> <p>Local Governments Sunshine Coast Council – www.sunshinecoast.qld.gov.au Moreton Bay Regional Council – www.moretonbay.qld.gov.au Brisbane City Council – www.brisbane.qld.gov.au Redland City Council – www.redland.qld.gov.au City of Gold Coast – www.goldcoast.qld.gov.au</p> <p>Port of Brisbane – www.portbris.com.au Gold Coast Waterways Authority - www.gcwa.qld.gov.au</p> <p>Additionally, non-government organisations and natural resource management groups undertake a range of restoration activities that contribute to the protection and enhancement of site values (including through national, state, local government and NGO programs)</p>
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Has the plan been implemented?

☐ Yes / ☐ No

The restoration plan covers:

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Is the plan currently being reviewed and updated?

☐ Yes / ☐ No

Where the restoration is being undertaken to mitigate or respond to a threat or threats identified in this RIS, please indicate it / them: *(This field is limited to 1000 characters)*

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5.2.7 Monitoring implemented or proposed

Monitoring ⁴⁹	Status ⁵⁰
Water quality	Implemented
Plant community	Implemented
Plant species	Implemented
Animal species (please specify)	Implemented
Birds	Implemented

Please indicate other monitoring activities:

(This field is limited to 2500 characters)

A comprehensive list of monitoring programs relating to aquatic ecosystems, including those underway in the Ramsar site is provided on www.wetlandinfo.des.qld.gov.au

⁴⁹ Water regime monitoring | Water quality | Soil quality | Plant community | Plant species | Animal community | Animal species (please specify) | Birds

⁵⁰ | Implemented | Proposed

Additional material

6.1 Additional reports and documents

6.1.1 Bibliographical references

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6.1.2 Additional reports and documents

i. taxonomic lists of plant and animal species occurring in the site (see section 4.3)

-UPLOAD via online form-

ii. a detailed Ecological Character Description (ECD) (in a national format)

-UPLOAD via online form-

iii. a description of the site in a national or regional wetland inventory

-UPLOAD via online form-

iv. relevant Article 3.2 reports

-UPLOAD via online form-

v. site management plan

-UPLOAD via online form-

vi. other published literature

-UPLOAD via online form-

Please note that any documents uploaded here will be made publicly available.

6.1.3 Photograph(s) of the Site

Please provide at least one photograph of the site:

File	Copyright holder	Date on which the picture was taken	Caption

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6.1.4 Designation letter and related data

Designation letter*

-UPLOAD via online form-

Date of Designation

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Number of certificates wished *(The online RIS only accepts numeric values)*

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Attachments

Attachment 1 – Migratory shorebird species Moreton Bay Ramsar Site (recorded in the last 5 years)

Asian Dowitcher *Limnodromus semipalmatus*

Bar-tailed Godwit *Limosa lapponica*

Black - tailed Godwit *Limosa limosa*

Broad billed Sandpiper *Limicola falcinellus*

Common Greenshank *Tringa nebularia*

Common Sandpiper *Actitis hypoleucos*

Curlew Sandpiper *Calidris ferruginea*

Double banded Plover *Charadrius bicinctus*

Eastern Curlew *Numenius madagascariensis*

Great Knot *Calidris tenuirostris*

Greater Sand Plover *Charadrius leschenaultii*

Grey Plover *Pluvialis squatarola*

Grey tailed Tattler *Tringa brevipes*

Latham's Snipe *Gallinago hardwickii*

Lesser Sand Plover *Charadrius mongolus*

Marsh Sandpiper *Tringa stagnatilis*

Pacific Golden Plover *Pluvialis fulva*

Pectoral Sandpiper *Calidris melanotos*

Red Knot *Calidris canutus*

Red necked Stint *Calidris ruficollis*

Ruddy Turnstone *Arenaria interpres*

Ruff *Calidris pugnax*

Sanderling *Calidris alba*

Sharp tailed Sandpiper *Calidris acuminata*

Terek Sandpiper *Xenus cinereus*

Wandering Tattler *Tringa incana*

Whimbrel *Numenius phaeopus*

Wood Sandpiper *Tringa glareola*

Attachment 2 – Invasive plant species Moreton Bay Ramsar Site

Species name	Common name	Impacts	Changes at RIS update
<i>Acanthospermum australe</i>		Site specific assessment not undertaken	Not reported
<i>Acokanthera oblongifolia</i>	bushman's poison		
<i>Agave americana</i>			
<i>Agave americana</i> var. <i>americana</i>			
<i>Agave sisalana</i>	sisal hemp		
<i>Agave vivipara</i> var. <i>vivipara</i>			
<i>Ageratina adenophora</i>	crofton weed		
<i>Ageratina riparia</i>	mistflower		
<i>Ageratum conyzoides</i> subsp. <i>conyzoides</i>			
<i>Ageratum houstonianum</i>	blue billygoat weed		
<i>Aloe arborescens</i>			
<i>Aloe maculata</i>			
<i>Alpinia zerumbet</i>			
<i>Alternanthera pungens</i>	khaki weed		
<i>Amaranthus viridis</i>	green amaranth		
<i>Ambrosia artemisiifolia</i>	annual ragweed		
<i>Andropogon virginicus</i>	whiskey grass		
<i>Anredera cordifolia</i>	Madeira vine		
<i>Antigonon leptopus</i>			
<i>Ardisia elliptica</i>			
<i>Argemone ochroleuca</i> subsp. <i>ochroleuca</i>	Mexican poppy		
<i>Aristea ecklonii</i>	blue stars		
<i>Artemisia verlotiorum</i>			
<i>Asclepias curassavica</i>	red-head cottonbush		
<i>Asparagus aethiopicus</i> cv. <i>Sprengeri</i>	basket asparagus fern		
<i>Asparagus macowanii</i>			
<i>Asparagus officinalis</i>	asparagus		

<i>Asparagus plumosus</i>	feathered asparagus fern		
<i>Asparagus virgatus</i>			
<i>Avena sativa</i>	common oats		
<i>Axonopus compressus</i>			
<i>Axonopus fissifolius</i>			
<i>Baccharis halimifolia</i>	groundsel bush		
<i>Bacopa caroliniana</i>			
<i>Biancaea decapetala</i>			
<i>Bidens bipinnata</i>	bipinnate beggar's ticks		
<i>Bidens pilosa</i>			
<i>Bougainvillea glabra</i>			
<i>Brassica x juncea</i>	Indian mustard		
<i>Bromus catharticus</i>	prairie grass		
<i>Bryophyllum delagoense</i>			
<i>Bryophyllum fedtschenkoi</i>			
<i>Bryophyllum pinnatum</i>	resurrection plant		
<i>Cajanus cajan</i>	pigeon pea		
<i>Cakile edentula</i>	sea rocket		
<i>Cakile maritima</i>			
<i>Cakile maritima subsp. maritima</i>			
<i>Calliandra surinamensis</i>			
<i>Callisia fragrans</i>			
<i>Callisia repens</i>			
<i>Calyptocarpus vialis</i>	creeping cinderella weed		
<i>Cardamine flexuosa</i>	wood bittercress		
<i>Cardiospermum grandiflorum</i>	heart seed vine		
<i>Carica papaya</i>	pawpaw		
<i>Catharanthus roseus</i>	pink periwinkle		
<i>Celtis sinensis</i>	Chinese elm		
<i>Cenchrus americanus</i>			
<i>Cenchrus clandestinus</i>			
<i>Cenchrus echinatus</i>	Mossman River grass		
<i>Centaurium erythraea</i>	common centaury		
<i>Centaurium tenuiflorum</i>			
<i>Chamaecrista rotundifolia</i> var. <i>rotundifolia</i>			
<i>Chenopodium album</i>	fat-hen		
<i>Chloris gayana</i>	rhodes grass		
<i>Chloris virgata</i>	feathertop rhodes grass		

<i>Chrysanthemoides monilifera</i>			
<i>Chrysanthemoides monilifera</i> subsp. <i>rotundata</i>	bitou bush		
<i>Cinnamomum camphora</i>	camphor laurel		
<i>Cirsium vulgare</i>	spear thistle		
<i>Cleome gynandra</i>			
<i>Clerodendrum heterophyllum</i>			
<i>Clerodendrum x speciosum</i>			
<i>Combretum paniculatum</i>			
<i>Cordia wallichii</i>			
<i>Coreopsis lanceolata</i>			
<i>Cosmos bipinnatus</i>	cosmos		
<i>Cosmos sulphureus</i>			
<i>Crassocephalum crepidioides</i>	thickhead		
<i>Crotalaria incana</i> subsp. <i>incana</i>			
<i>Crotalaria lanceolata</i> subsp. <i>lanceolata</i>			
<i>Crotalaria linifolia</i>			
<i>Crotalaria pallida</i> var. <i>obovata</i>			
<i>Crotalaria trichotoma</i>			
<i>Cyclospermum leptophyllum</i>			
<i>Cynodon dactylon</i>			
<i>Cynodon dactylon</i> var. <i>dactylon</i>			
<i>Cyperus aggregatus</i>			
<i>Cyperus albostratus</i>			
<i>Cyperus brevifolius</i>	Mullumbimby couch		
<i>Cyperus involucratus</i>			
<i>Cyrtomium falcatum</i>	holly fern		
<i>Datura stramonium</i>	common thornapple		
<i>Desmodium incanum</i>			
<i>Desmodium uncinatum</i>			
<i>Digitaria ciliaris</i>	summer grass		
<i>Digitaria didactyla</i>	Queensland blue couch		
<i>Digitaria eriantha</i>			
<i>Digitaria violascens</i>	bastard summergrass		

<i>Dimorphotheca ecklonis</i>			
<i>Dolichandra unguis-cati</i>	cat's claw creeper		
<i>Dracaena fragrans</i>			
<i>Dysphania ambrosioides</i>			
<i>Echinodorus cordifolius</i>			
<i>Eclipta prostrata</i>	white eclipta		
<i>Eleocharis minuta</i>			
<i>Eleusine indica</i>	crowsfoot grass		
<i>Emilia sonchifolia</i>			
<i>Emilia sonchifolia</i> var. <i>javanica</i>			
<i>Emilia sonchifolia</i> var. <i>sonchifolia</i>			
<i>Enydra fluctuans</i>			
<i>Epidendrum x obrienianum</i>			
<i>Eragrostis atrovirens</i>			
<i>Eragrostis bahiensis</i>			
<i>Eragrostis curvula</i>			
<i>Eragrostis tenuifolia</i>	elastic grass		
<i>Erechtites valerianifolius</i> <i>forma valerianifolius</i>			
<i>Erigeron bonariensis</i>			
<i>Erigeron pusillus</i>			
<i>Erigeron sumatrensis</i>			
<i>Eriobotrya japonica</i>	loquat		
<i>Eugenia uniflora</i>	Brazilian cherry tree		
<i>Euphorbia cyathophora</i>	dwarf poinsettia		
<i>Euphorbia heterophylla</i>			
<i>Euphorbia hirta</i>			
<i>Euphorbia hyssopifolia</i>			
<i>Euphorbia tithymaloides</i> subsp. <i>smallii</i>			
<i>Euphorbia umbellata</i>			
<i>Freesia laxa</i>			
<i>Freesia leichtlinii</i>			
<i>Gaillardia pulchella</i>			
<i>Galinsoga parviflora</i>	yellow weed		
<i>Gamochaeta antillana</i>			
<i>Gamochaeta coarctata</i>			
<i>Gamochaeta pennsylvanica</i>			
<i>Gazania rigens</i>			
<i>Genista monspessulana</i>	Montpellier broom		

<i>Gladiolus x gandavensis</i>			
<i>Gloriosa superba</i>	glory lily		
<i>Gomphocarpus physocarpus</i>	balloon cottonbush		
<i>Gomphrena celosioides</i>	gomphrena weed		
<i>Guilleminea densa</i>	small matweed		
<i>Guizotia abyssinica</i>	niger seed		
<i>Gymnocoronis spilanthoides</i>			
<i>Heterotheca grandiflora</i>	telegraph weed		
<i>Hibiscus rosasinensis</i>			
<i>Hydrocotyle bonariensis</i>			
<i>Hylocereus undatus</i>	night blooming cactus		
<i>Hyparrhenia rufa subsp. rufa</i>			
<i>Hypochaeris albiflora</i>			
<i>Hypochaeris glabra</i>	smooth catsear		
<i>Hypochaeris radicata</i>	catsear		
<i>Indigofera spicata</i>	creeping indigo		
<i>Indigofera suffruticosa</i>			
<i>Ipomoea batatas</i>	sweet potato		
<i>Ipomoea cairica</i>			
<i>Ipomoea indica</i>	blue morning-glory		
<i>Ipomoea purpurea</i>	common morning glory		
<i>Jacaranda mimosifolia</i>	jacaranda		
<i>Juncus acutus subsp. acutus</i>			
<i>Juncus articulatus</i>	jointed rush		
<i>Justicia betonica</i>			
<i>Lactuca saligna</i>	wild lettuce		
<i>Lantana camara</i>	lantana		
<i>Lantana montevidensis</i>	creeping lantana		
<i>Lepidium bonariense</i>	Argentine peppergrass		
<i>Lepidium virginicum</i>	Virginian peppergrass		
<i>Leptospermum laevigatum</i>	coast tea-tree		
<i>Leucaena leucocephala subsp. glabrata</i>			
<i>Leucaena leucocephala subsp. leucocephala</i>			
<i>Lolium perenne</i>	perennial ryegrass		
<i>Lupinus cosentinii</i>	sandplain lupin		
<i>Lysimachia arvensis</i>			
<i>Macroptilium atropurpureum</i>	siratro		
<i>Macroptilium lathyroides</i>			

<i>Macrotyloma uniflorum</i> <i>var. uniflorum</i>			
<i>Malvastrum</i> <i>coromandelianum</i> <i>subsp.</i> <i>coromandelianum</i>			
<i>Medicago lupulina</i>	black medic		
<i>Medicago polymorpha</i>	burr medic		
<i>Megathyrsus maximus</i>			
<i>Megathyrsus maximus</i> <i>var. maximus</i>			
<i>Megathyrsus maximus</i> <i>var. pubiglumis</i>			
<i>Melastoma candidum</i>			
<i>Melinis minutiflora</i>	molasses grass		
<i>Melinis repens</i>	red natal grass		
<i>Mirabilis jalapa</i>	four o'clock		
<i>Mitracarpus hirtus</i>			
<i>Morus alba</i>	white mulberry		
<i>Neonotonia wightii</i> <i>var.</i> <i>wightii</i>			
<i>Nerium oleander</i>	oleander		
<i>Nymphaea caerulea</i>			
<i>Ochna serrulata</i>	ochna		
<i>Oenothera affinis</i>	long-flowered evening primrose		
<i>Oenothera drummondii</i> <i>subsp. drummondii</i>			
<i>Oenothera indecora</i> <i>subsp. bonariensis</i>			
<i>Oenothera mollissima</i>			
<i>Olea europaea subsp.</i> <i>cuspidata</i>			
<i>Olea europaea subsp.</i> <i>europaea</i>			
<i>Opuntia monacantha</i>			
<i>Opuntia stricta</i>			
<i>Oxalis corniculata</i>			
<i>Oxalis debilis</i> <i>var.</i> <i>corymbosa</i>	pink shamrock		
<i>Parthenocissus</i> <i>quinquefolia</i>			
<i>Paspalum dilatatum</i>	paspalum		
<i>Paspalum notatum</i>	bahia grass		
<i>Paspalum urvillei</i>	vasey grass		
<i>Passiflora edulis</i>			
<i>Passiflora foetida</i>			

<i>Passiflora pallida</i>			
<i>Passiflora suberosa</i>	corky passion flower		
<i>Passiflora suberosa</i> <i>subsp. litoralis</i>			
<i>Passiflora subpeltata</i>	white passion flower		
<i>Pellaea viridis</i> var. <i>viridis</i>			
<i>Petrorhagia dubia</i>			
<i>Phyllanthus tenellus</i>			
<i>Phyllostachys aurea</i>	fishpole bamboo		
<i>Phytolacca dioica</i>	bella sombra		
<i>Phytolacca octandra</i>	inkweed		
<i>Pinus elliottii</i>	slash pine		
<i>Plantago lanceolata</i>			
<i>Plantago major</i>	greater plantain		
<i>Plectranthus amboinicus</i>	allspice		
<i>Plectranthus verticillatus</i>			
<i>Poa annua</i>	annual poa		
<i>Polycarpon tetraphyllum</i>			
<i>Polygala paniculata</i>			
<i>Polygala virgata</i>			
<i>Portulaca oleracea</i>	pigweed		
<i>Portulaca pilosa</i>			
<i>Praxelis clematidea</i>			
<i>Proboscidea lutea</i>			
<i>Prunus persica</i> var. <i>persica</i>			
<i>Psidium cattleianum</i> var. <i>cattleianum</i>			
<i>Psidium guajava</i>	guava		
<i>Psidium guineense</i>	cherry guava		
<i>Pueraria montana</i> var. <i>lobata</i>	kudzu		
<i>Pyrostegia venusta</i>			
<i>Rapistrum rugosum</i>			
<i>Rhaphiolepis indica</i>	Indian hawthorn		
<i>Richardia brasiliensis</i>	white eye		
<i>Ricinus communis</i>	castor oil bush		
<i>Rivina humilis</i>			
<i>Rumex crispus</i>	curled dock		
<i>Salvia coccinea</i>	red salvia		
<i>Sansevieria trifasciata</i>	mother-in-law's tongue		
<i>Sansevieria trifasciata</i> cv. <i>Laurentii</i>			
<i>Sansevieria trifasciata</i> var. <i>trifasciata</i>			

<i>Schinus terebinthifolius</i>			
<i>Schoenoplectiella erecta</i>			
<i>Scoparia dulcis</i>	scoparia		
<i>Senecio macroglossus</i>			
<i>Senna alata</i>			
<i>Senna didymobotrya</i>			
<i>Senna pendula</i> var. <i>glabrata</i>	Easter cassia		
<i>Setaria parviflora</i>	slender pigeon grass		
<i>Setaria sphacelata</i>			
<i>Sida cordifolia</i>			
<i>Sida rhombifolia</i>			
<i>Sisymbrium officinale</i>	hedge mustard		
<i>Sisyrinchium rosulatum</i>			
<i>Solanum chrysotrichum</i>			
<i>Solanum linnaeanum</i>	apple of Sodom		
<i>Solanum lycopersicum</i> var. <i>cerasiforme</i>			
<i>Solanum mauritianum</i>	wild tobacco		
<i>Solanum nigrum</i> subsp. <i>nigrum</i>			
<i>Solanum nodiflorum</i>			
<i>Solanum seaforthianum</i>	Brazilian nightshade		
<i>Solanum torvum</i>	devil's fig		
<i>Soliva anthemifolia</i>	dwarf jo jo weed		
<i>Sonchus oleraceus</i>	common sowthistle		
<i>Sorghum arundinaceum</i>	Rhodesian Sudan grass		
<i>Sorghum bicolor</i>	forage sorghum		
<i>Sorghum x alnum</i>			
<i>Spergularia rubra</i>	sand spurry		
<i>Sphagneticola trilobata</i>			
<i>Sporobolus africanus</i>	Parramatta grass		
<i>Sporobolus fertilis</i>	giant Parramatta grass		
<i>Sporobolus natalensis</i>			
<i>Stachys arvensis</i>	stagger weed		
<i>Stachytarpheta jamaicensis</i>	Jamaica snakeweed		
<i>Stachytarpheta mutabilis</i>	pink snakeweed		
<i>Stellaria media</i>	chickweed		
<i>Stenotaphrum secundatum</i>	buffalo grass		
<i>Stylosanthes hamata</i>			
<i>Stylosanthes scabra</i>			
<i>Syagrus romanzoffiana</i>	Queen palm		

<i>Symphyotrichum subulatum</i>			
<i>Syngonium podophyllum</i>			
<i>Tagetes minuta</i>	stinking roger		
<i>Tecoma stans</i> var. <i>stans</i>			
<i>Tecoma stans</i> var. <i>velutina</i>			
<i>Tecomaria capensis</i> subsp. <i>capensis</i>			
<i>Tephrosia glomeruliflora</i>	pink tephrosia		
<i>Thunbergia alata</i>	black-eyed Susan		
<i>Tithonia diversifolia</i>	Japanese sunflower		
<i>Tradescantia fluminensis</i>			
<i>Tradescantia zebrina</i>			
<i>Tridax procumbens</i>	tridax daisy		
<i>Trifolium repens</i> var. <i>repens</i>	white clover		
<i>Triumfetta rhomboidea</i>	chinese burr		
<i>Urena lobata</i>	urena weed		
<i>Urochloa decumbens</i>			
<i>Urochloa ramosa</i>			
<i>Vachellia farnesiana</i>			
<i>Verbena incompta</i>			
<i>Verbena litoralis</i> var. <i>brevibracteata</i>			
<i>Verbena litoralis</i> var. <i>litoralis</i>			
<i>Vicia sativa</i> subsp. <i>nigra</i>			
<i>Vicia tetrasperma</i>	slender vetch		
<i>Vitex triflora</i>			
<i>Westringia fruticosa</i>			
<i>Yucca aloifolia</i>			
<i>Zephyranthes drummondii</i>			
<i>Zinnia peruviana</i>	wild zinnia		
<i>Zornia latifolia</i>			

