

# Towards Understanding the Ecological Health and Character of Moreton Bay

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## ABSTRACT

Moreton Bay is the focus of numerous management plans/initiatives under which scientific monitoring is undertaken to assess achievement of their specific management objectives. All of these monitoring programs include measures of environmental indicators to report on the condition or state of Moreton Bay's ecological health and character. The Healthy Waterways Strategy (2007-2012) and its Ecosystem Health Monitoring Program (EHMP) funded by the stakeholders of the South East Queensland Healthy Waterways Partnership (HWP) is the largest and most comprehensive of these. It provides a detailed assessment of ecosystem health throughout the Bay, its estuaries and catchments, as well as checking if specific management objectives are achieved.

Two other key management plans/initiatives for Moreton Bay are currently being updated, namely the Moreton Bay Marine Park Zoning Plan and the Ecological Character Description (ECD) for the Moreton Bay Ramsar site. Both of these have associated monitoring objectives and programs to check if their management objectives are being achieved. The former Moreton Bay Marine Park Zoning Plan is being reviewed by the Queensland Environmental Protection Agency (EPA 2008). It forms the basis for management of activities within the Marine Park. The Moreton Bay Ramsar Site is one of the largest Ramsar Sites in Australia. BMT WBM was commissioned by the EPA to prepare the ECD for the Moreton Bay Ramsar Site (BMT WBM 2008).

All these plans/initiatives recognise that Moreton Bay contains a diverse range of estuarine and shallow marine habitat types as well as freshwater aquatic habitats and high energy beaches on the Bay's sand islands. To assist with integration of management and monitoring programs for these three (and other) plans/initiatives, this associated project to develop a conceptual framework showing the current understanding of Moreton Bay's ecological health and character was recently completed. BMT WBM worked collaboratively with the HWP and the EPA (and the authors of this paper) to complete this project and ensure a high level of alignment across the three management and monitoring programs.

This paper describes the conceptual framework and its associated conceptual models of the twelve key habitats and eleven key species in Moreton Bay (including the natural processes and attributes for each, the key stressors and threats and their direct and indirect threats to the habitats/species, and key ecological indicators for them). It also uses this conceptual framework to show the overlap and links between the management and monitoring objectives for the three plans/initiatives, as well as future priorities for ecological health monitoring in Moreton Bay.

## INTRODUCTION

Moreton Bay is the focus of numerous conservation/management plans and initiatives under which scientific monitoring is undertaken to assess achievement of management objectives, most of which relate to the condition or state of environmental indicators. The Scientific Expert Panel (SEP) of the Southeast Queensland Healthy Waterways Partnership (HWP) were engaged by the Queensland Environmental Protection Agency (EPA) in mid-2008 to develop a Conceptual Framework to identify and analyse potential alignment and efficiencies between management and monitoring objectives under the three major (and other) conservation/management initiatives occurring in the Bay. The three main initiatives are:

- the Southeast Queensland Healthy Waterways Strategy 2007-2012 (and associated Ecosystem Health Monitoring Program [EHMP]);
- the Ramsar Convention (and associated Ecological Character Description [ECD] being prepared for the EPA by consultants BMT WBM Pty Ltd); and

- the recently updated Moreton Bay Marine Park Zoning Plan (and the associated monitoring plan currently being developed and implemented by the EPA).

As shown in Table 1 below, the Healthy Waterways Strategy, Ramsar Convention, and Marine Parks legislation (administered through the Zoning Plan) share a common management objective to protect and maintain the ecological health and character of Moreton Bay through conservation and wise use. However, the three initiatives are defined by different administrative boundaries, different heads of power for implementation (e.g. statutory or non-statutory), and have slightly different management and monitoring objectives.

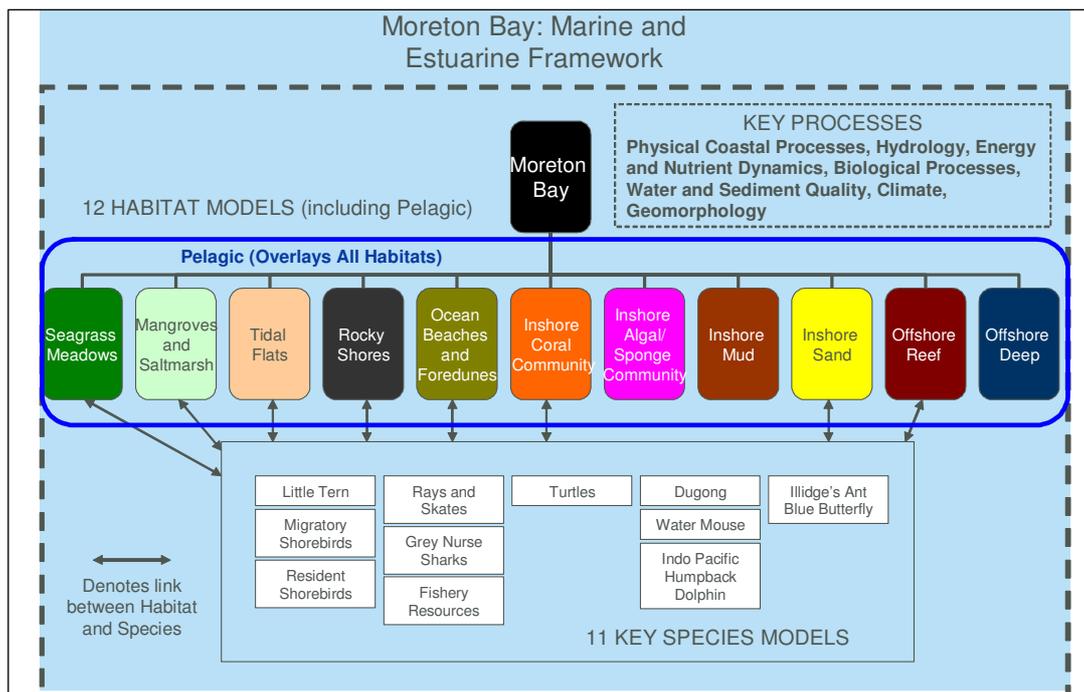
The value of developing a Conceptual Framework for Moreton Bay's ecological health/character is the ability to broadly align the three key management and monitoring initiatives operating within the Bay. This is achieved through identification of the common/shared significant ecological assets of the Bay and by defining an underlying understanding of how these habitats and species interact with the Bay's natural processes and sources of anthropogenic impact.

The process used to develop the Conceptual Framework involved a series of meetings and workshops with a core project group made up of SEP scientists, Queensland Government representatives from the Environmental Protection Agency and Department of Primary Industries and Fisheries and scientists from BMT WBM Pty Ltd.

## CONCEPTUAL FRAMEWORK

Key elements of the Conceptual Framework for Moreton Bay's ecological health/character developed out of these discussions were as follows:

- An overview of the key ecosystem processes underpinning Bay function (and associated 'overview' conceptual model);
- Understanding of how these processes interact and create connectivity between the inshore and offshore habitats of the Bay;
- Recognition of the key threats and stressors operating within and adjacent to the Bay;
- Identification of the key habitats and species of the Bay (see Figure 1 below); and
- Development of conceptual models for the key habitats and species that include:
  - identification of key indicators of habitat/species extent and condition;
  - identification of the key attributes and controls on ecosystem health and character; and
  - identification of stressors and threats (direct and indirect) to the habitats/species.



**Figure 1: Summary of Habitat and Species Models**

**Table 1: Management and Monitoring Objectives Relevant to the HWS/EHMP, the ECD and the Moreton Bay Zoning Plan**

Components	Healthy Waterways Strategy (and EHMP) (Source: HWS – Moreton Bay Action Plan and other components)	Ramsar and ECD (Source: Draft ECD for Moreton Bay BMT WBM 2008)	Marine Park Zoning Plan (Source: D Rissik EPA Presentation, Moreton Bay Marine Park Monitoring Program 2008-2013)
<b>Area of Application and Overarching Management Objective</b>			
Area of Application	Waters of Moreton Bay and associated estuaries and catchments but excluding deeper offshore areas to the north and east of the sand islands.	Within the declared boundaries of the Ramsar Site, a range of transitional, intertidal and subtidal habitats generally extending to depths of 6m below LAT. The Site includes large areas of the Bay islands, Pumicestone Passage and the Southern Bay but excludes large subtidal areas of the Western Bay, Central Bay and Northern Bay.	Whole of Bay to the limits of Queensland territorial waters but excluding major estuaries and tidal lands and waters of the coast above HAT or otherwise held in private ownership
Overall Management Objective	<b>Sustaining and enhancing the Bay's ecological health.</b>	<b>The conservation and wise use of wetlands through the maintenance of their ecological character.</b>	<b>Provide for ecologically sustainable use of Moreton Bay Marine Park and to protect its natural, recreational, cultural heritage and amenity values.</b>
<b>Management/Monitoring Objectives (Management Objectives shown in bold; Monitoring objectives shown in italics)</b>			
Habitats	<b>Critical habitats remain intact in terms of area and quality.</b> <i>Monitor any change in seagrass distribution and depth range and coral cover</i>	<b>The ecological character of representative, rare, or unique examples of natural or near-natural wetland types found within the biogeographic region are maintained (Ramsar Criteria 1).</b> <i>Ensure the current extent of Ramsar wetland types identified for the site in the ECD continue to be represented into the future</i> <i>Monitor the extent and condition of the six representative habitat areas identified in the ECD</i>	<b>Objects to be achieved for the various zones (refer Schedule 1 of the Marine Parks Regulation 2006)</b> <i>Comparing the condition of key habitat types that have been influenced by activities affected by the new zonings (eg. has the condition, structure and function of key habitat types been influenced by activities affected by the new zonings?)</i> <i>Assessment of whether 'no anchoring' zones lead to an improvement in the condition of reef habitats.</i>
Important Flora and Fauna	<b>Protection of aquatic ecosystem environmental values.</b> <i>Achievement or otherwise of water quality objectives</i>	<b>Vulnerable and endangered wetland flora and fauna species and threatened communities are maintained (Ramsar Criteria 2).</b> <i>Fauna populations of key estuarine and marine species identified in the ECD (dugong, marine turtles, beach stone curlew, little tern, water mouse, Illidge's ant blue butterfly) are monitored at appropriate spatial and temporal scales, cognisant of interim limits of acceptable change</i> <i>Monitoring of the extent and condition of key feeding/breeding/nesting habitats for key species identified in the ECD, cognisant of interim limits of acceptable change</i>	<b>Objects to be achieved for the various zones (refer Schedule 1 of the Marine Parks Regulation 2006)</b> <b>Objects for areas set aside under the zoning plan for special management (eg. grey nurse shark areas, go slow area for turtle and dugong)</b> <i>Identifying and prioritising key species of concern that should be monitored and reported on. Examples include dugongs, turtles, shorebirds, sharks and rays, syngnathids and some reef fish species.</i> <i>Determining the distribution, abundance and condition of vulnerable species, vulnerable habitat and vulnerable life-stages of species within the bay to enable comparison of the effectiveness of the Marine Park to be assessed.</i> <i>Assess whether go-slow areas lead to greater abundance and better condition of turtles and dugongs.</i> <i>Assess if regulations regarding swing moorings are having an effect on seagrass and associated fauna.</i>
Populations	<b>Protection of aquatic ecosystem environmental values.</b> <i>Achievement or otherwise of water quality objectives</i>	<b>Populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region are maintained (Ramsar Criteria 3).</b> <b>The Site continues to regularly support 20,000 or more waterbirds. (Ramsar Criteria 5).</b> <b>The Site continues to regularly support 1 per cent of the individuals in a population of one species or subspecies of waterbird (Ramsar Criteria 6).</b>	<b>Objects to be achieved for the various zones (refer Schedule 1 of the Marine Parks Regulation 2006)</b> <i>Assess if green zones influence community structure and ecological processes of invertebrate fauna.</i> <i>Assess if zoning reduced pressure on shorebirds in important shorebird areas.</i> <i>Assess if reduced pressure in protected areas results in increased numbers of migratory and non-migratory shorebirds utilising the Bay.</i>

Components	Healthy Waterways Strategy (and EHMP) (Source: HWS – Moreton Bay Action Plan and other components)	Ramsar and ECD (Source: Draft ECD for Moreton Bay BMT WBM 2008)	Marine Park Zoning Plan (Source: D Rissik EPA Presentation, Moreton Bay Marine Park Monitoring Program 2008-2013)
		<p>See above for Important Flora and Fauna plus:</p> <ul style="list-style-type: none"> <li>• Early and late summer monitoring events at key roost sites and feeding ground to target Bar-tailed Godwit, Eastern Curlew, and Pacific Golden Plover (indicator species for migratory shorebird usage of the site)</li> <li>• Annual audit of roost sites (condition and use)</li> <li>• Monitor habitat usage and breeding success of Pied Oyster Catcher as the key resident shorebird that meets the 1% criterion.</li> </ul>	
Biodiversity / Refugia Values	<p><b>Protection of aquatic ecosystem environmental values.</b> <i>Achievement or otherwise of water quality objectives</i></p>	<p><b>Plant and/or animal species at a critical stage in their life cycles, or habitats that provides refuge during adverse conditions should be maintained (Ramsar Criteria 4).</b></p> <p><b>The Site continues to support a significant proportion of indigenous fish subspecies, species or families, life-history stages, species interactions and/or populations that are representative of wetland benefits and/or values and thereby contributes to global biological diversity (Ramsar Criteria 7).</b></p> <p><b>The Site continues to provide an important source of food for fishes, spawning ground, nursery and/or migration path on which fish stocks, either within the wetland or elsewhere, depend. (Ramsar Criteria 8).</b></p> <p><i>Monitor the extent and condition of key fisheries nursery habitat areas identified in the ECD (mangroves and saltmarsh, seagrass and other key habitats)</i></p> <p><i>Continue fish stock monitoring by the DPIF with consideration of key commercial and recreational fishery species being included within EHMP</i></p>	<p><b>Objects to be achieved for the various zones (refer Schedule 1 of the Marine Parks Regulation 2006)</b></p> <p><i>Assessing whether green zones have a greater abundance of commercially and recreationally important adult fish and invertebrates than before proclamation and non-protected areas.</i></p> <p><i>Assessing whether Moreton Bay has a greater abundance of commercially and recreationally important adult fish and invertebrates as a result of spill-over from the green zones compared with before proclamation.</i></p> <p><i>Determination of the effects of the artificial reef on fish communities on the reef, and in nearby green zones</i></p>
Natural Processes	<p><b>Key processes operate to maintain healthy ecosystems.</b> <i>Achievement or otherwise of water quality objectives</i></p>	<p><b>Critical ecosystem processes that underpin ecological character are maintained.</b></p> <p><i>A range of indicators for wetland processes are set out in the ECD in the context of the representative habitats. These include monitoring of changes to hydrodynamics, water quality and several biotic indicators (such as crab burrow and invertebrate infauna density)</i></p>	<p><b>Objects to be achieved for the various zones (refer Schedule 1 of the Marine Parks Regulation 2006)</b></p> <p><i>Determine other external drivers of fish diversity, size and abundance in Moreton Bay, including catchment processes and management.</i></p>
Cultural Values / Socio-economic Values	<p><b>Sustain and enhance the Bay's social, economic and cultural values. Zones of human impacts do not expand or deteriorate.</b> <i>Achievement or otherwise of relevant water quality objectives including, primary and secondary contact, consumption of fish and shellfish, industrial uses including aquaculture, spiritual values)</i></p>	<p><b>The wetland values of the Site continue to provide indigenous/ traditional values.</b></p> <p><b>The wetland values of the Site continue to provide an important education and research asset.</b></p> <p><b>The wetland values of the Site continue to provide wetland-based tourism and recreation.</b></p> <p><i>Specific monitoring measures for these cultural services are a key information gap and need to be developed</i></p>	<p><b>Objects to be achieved for the various zones (refer Schedule 1 of the Marine Parks Regulation 2006)</b></p> <p><i>Assess whether the green zones affect commercial and recreational fish catches and how these affect the secondary businesses which rely on trade from these professions.</i></p> <p><i>Assessing whether there is less fishing pressure in green zones than there was prior to the changes to zones.</i></p> <p><i>Assess if change to the marine park zoning have had any effect on house prices adjacent to the Bay.</i></p>

## CONCEPTUAL MODELS OF KEY HABITATS AND SPECIES

The twelve key habitats and eleven key species identified within the Conceptual Framework (and shown in Figure 1) are representative of the full range of estuarine, coastal and marine environments found within the Moreton Bay Marine Park. The contemporary understanding of each of these was depicted through a series of box models (with examples of a habitat model shown in Figure 2 and a species model shown in Figure 3). The habitats were also indicatively mapped using existing data sources (including the EPA's Marine Park Zoning Plan Habitat Map) at a whole-of-Bay scale (Figure 4).

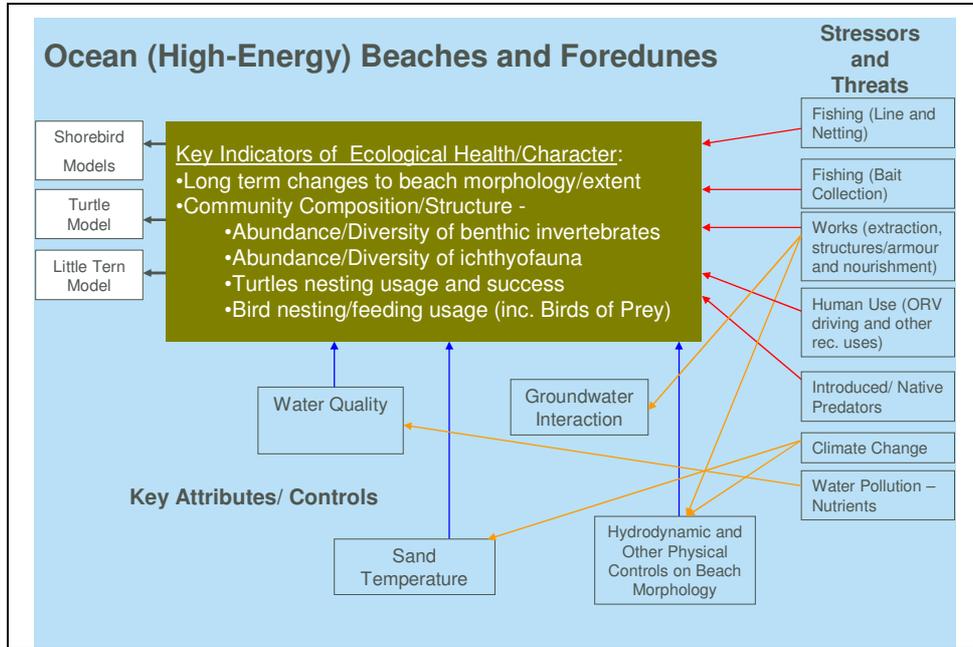


Figure 2: Habitat Model Example (Ocean Beaches)

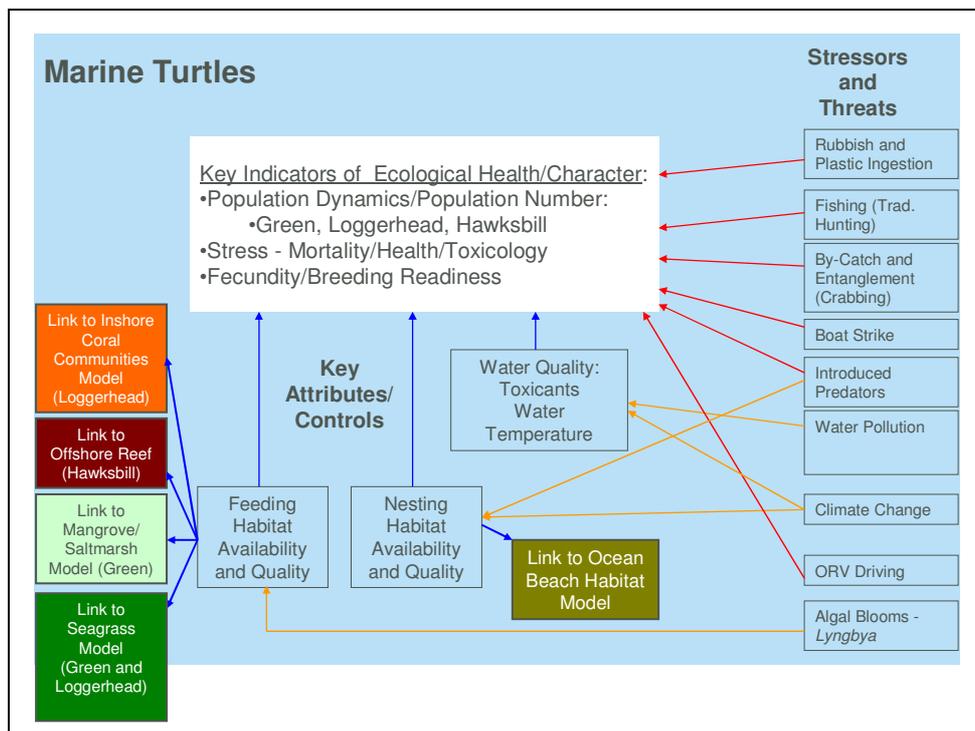


Figure 3: Species Model Example (Marine Turtles)

## MONITORING PRIORITIES

The Framework and associated habitat and species models were used to identify priorities and efficiencies in future monitoring (particularly for those habitats and species that were relevant across the three conservation/management initiatives).

Of the twelve key habitats and eleven key species identified and modelled, those habitats and species viewed by the project group as being priorities for future monitoring across the three conservation/management initiatives in Moreton Bay included:

- For habitats – seagrass meadows, mangrove and saltmarsh, ocean beaches and inshore coral communities; and
- For species – dugong, marine turtles, several migratory and resident shorebird species, grey nurse sharks, water mouse, and Indo-pacific humpback dolphin.

## CONCLUSION / TAKE HOME MESSAGE

The Conceptual Framework provides an understanding of the current information/knowledge base about Moreton Bay's key ecological assets that need to be considered in current and future planning and management activities. In particular, the information presented provides a basis for the next phase of monitoring and sampling design under the EHMP and other monitoring programs.

While robust, the Framework represents the outputs of a limited expert elicitation process. As such, it should be seen as an evolutionary and adaptive management tool that can be added to as additional research and knowledge about the Bay's habitats and species are developed. In this context, recommendations related to the further development and refinement of the Framework have been developed for future consideration.

A copy of the full report for the study is available from the Environmental Protection Agency ([www.epa.qld.gov.au](http://www.epa.qld.gov.au)) or the Southeast Queensland Healthy Waterways Partnership ([www.healthywaterways.org](http://www.healthywaterways.org)) websites.

## ACKNOWLEDGEMENTS

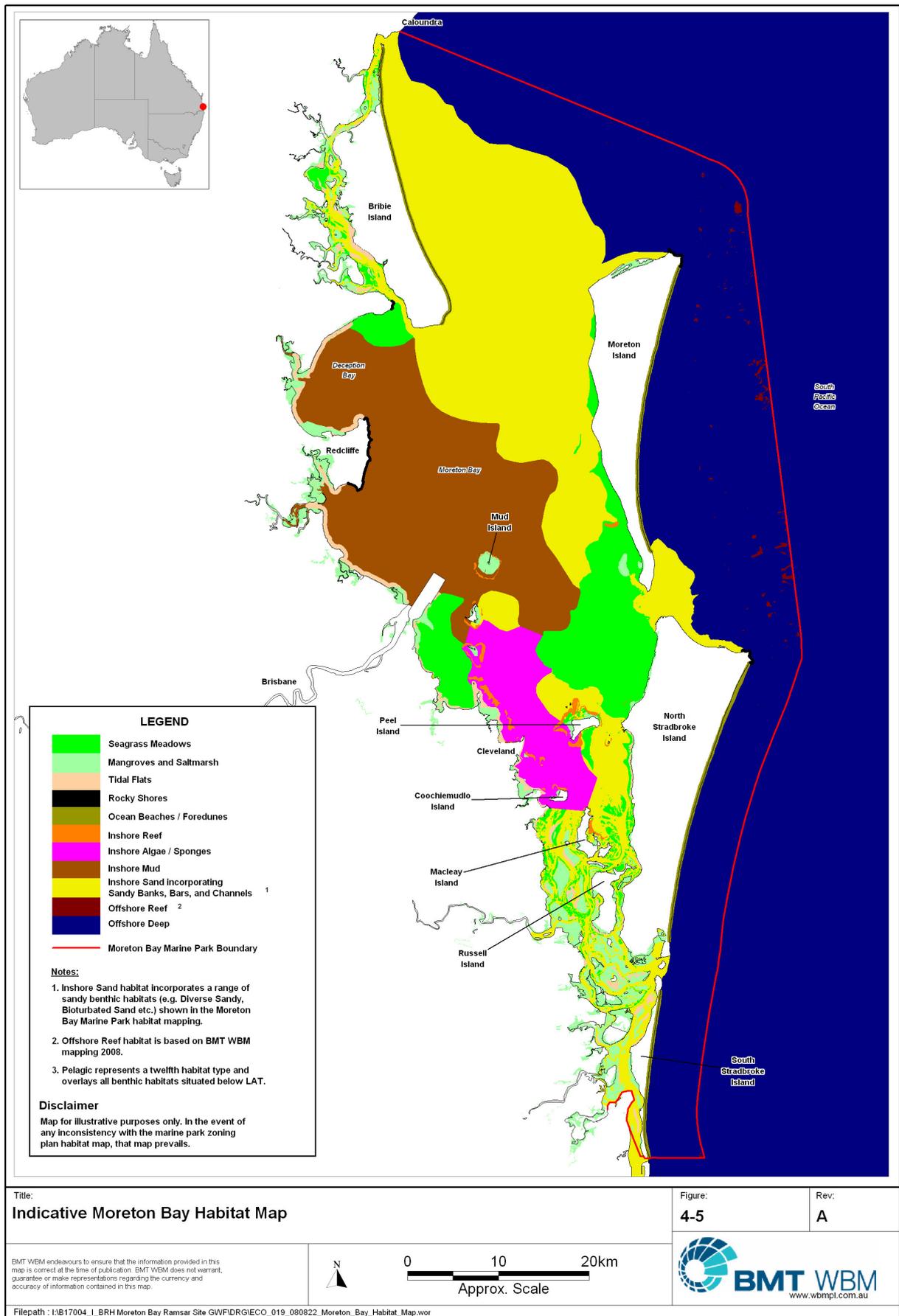
The principal authors gratefully acknowledge the other members of the project group for their constructive input into the process as well as the expert review of the models and other outputs. The involvement of BMT WBM and SEP scientists in the project was commissioned by the Queensland Government Environmental Protection Agency under funding supplied by the Australian Government Department of Environment, Water, Heritage and the Arts under the Coastal Catchments Initiative.

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**Figure 4: Indicative Habitat Map**