Ocean Barramundi Expansion Project - Benthic Communities and Habitats Study

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1 Introduction

To inform the environmental impact assessment for Tassal's Ocean Barramundi Expansion Project (the Proposal), benthic communities and habitats (BCH) within and adjacent to each of the sites were investigated. The specific objectives of the mapping project were to:

- Collect digital baseline data on the spatial extent and characteristics of benthic communities and habitats in the mapping area
- Quantitatively characterise the extent of BCH within and near to the sites to develop map products of suitable quality for environmental referral requirements.

This report provides an overview of the methods and map products from the Tassal benthic habitat mapping surveys.

2 Mapping Methods

An overview of the steps involved in preparing the benthic habitat map is presented below and described in detail in Sections 2.1 to 2.4.

1. Identify present benthic habitat data available for use in this assessment
2. Identify benthic habitat features on satellite imagery
3. Collect side scan logs of each of the proposed sites
4. Identify ground-truthing waypoints based off the presence of benthic consolidated substrate for collection of video data
5. Collect video data at each of the proposed waypoints
6. Classify towed video with biological attributes
7. Classify the side scan data using the ground-truthing video data
8. Collect additional side scan data in areas adjacent to sites
9. Assess habitat mapping level of accuracy
10. Description of type and distribution of benthic communities and habitats

2.1 Survey design and data acquisition

Four preliminary local assessment units (LAU) were defined based on the extent of the proposed sites and has since been altered to capture the relative extent and area of influence of the Proposal (based on modelling described in BMT 2024) to ensure alignment with the EPA *Technical Guidance: Protection of Benthic Communities and Habitats* (EPA 2016) (Figure 2.1). The LAUs together encompasses an area of ~170 km^2 which is spread across areas of the Archipelago in which the sites are proposed. As such, habitat mapping has only been conducted for areas within the zones of impact, as well as for nearshore areas where there are known significant environmental values (e.g. fringing coral reefs). This means there are some habitats, between the zones of impact and the nearshore fringing reefs, within the LAUs which were not mapped. Though this is unusual, this was seen to be the most appropriate approach to ensure understanding of benthic habitats in proximity to the sites while still providing information on the proximity of significant habitats (fringing coral reefs) to the Proposal.

Prior to field surveys, BMT collated available marine spatial data (including existing mapping products and satellite imagery) and overlayed all layers in ArcGIS 10.8 for assessment of the Proposal survey area. Satellite imagery was used to assign habitats to the nearshore regions across the Buccaneer Archipelago in proximity to the sites where there was potential for impacts to BCH. Previous habitat mapping, which was conducted in 2011 to assess habitats within Cone Bay for the Kimberley Aquaculture Development Zone, has also been included within the revised mapping for this Study.

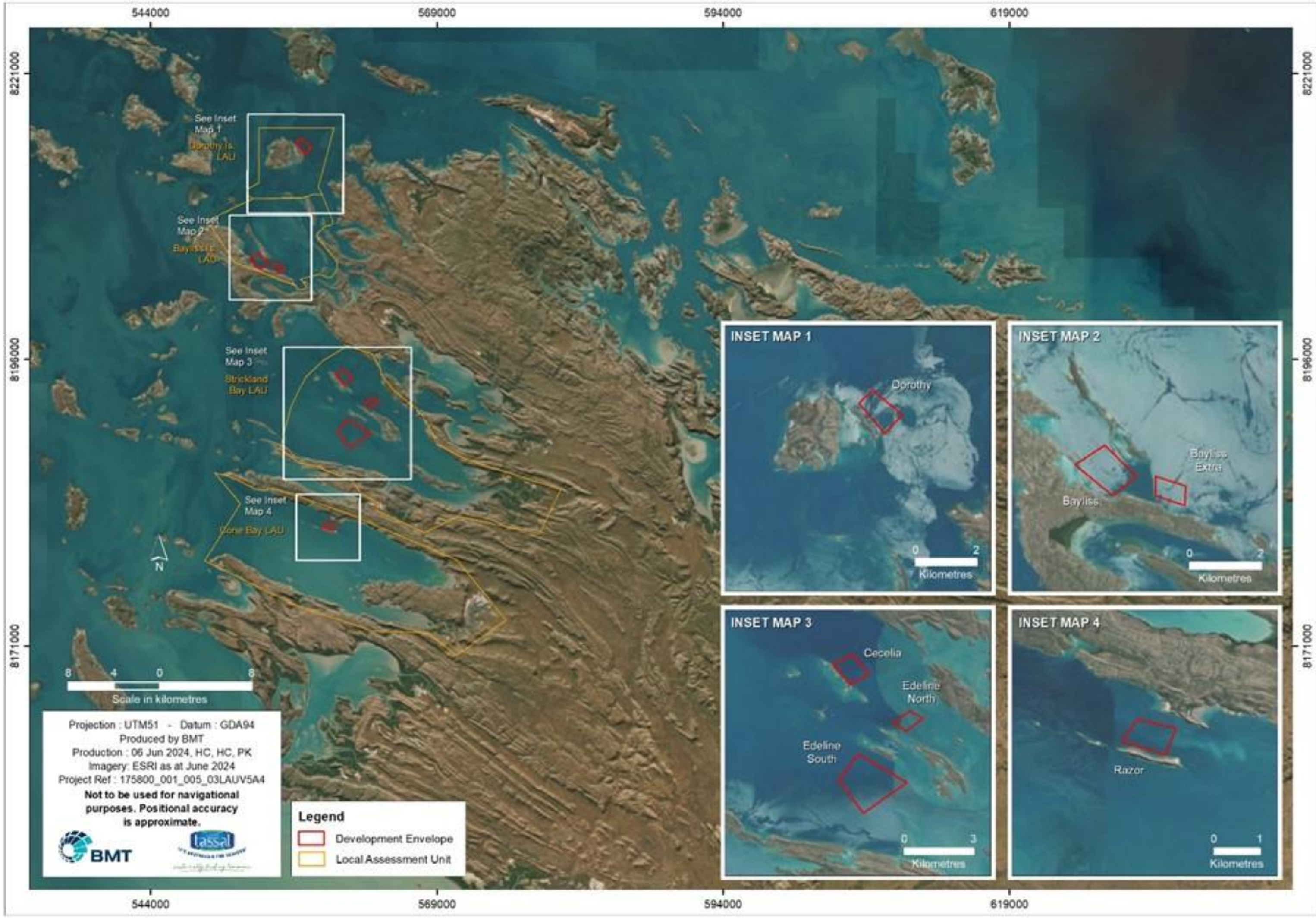

Figure 2.1 Local Assessment Units defined for this study

2.1.2 Side scan surveys – sites

Tassal conducted side scan surveys of each of the proposed sites in May-June 2021. Surveys were collected along transects through each of the sites, with the vessel operating at less than 5 knots to ensure quality scans of the substrate were collected. Bathymetric substrate types can be distinguished in sidescan imagery through the interpolation of intensity of the return values. As seen in Figure 2.2, brighter, sharper colouration represents a strong value and indicates areas of solid structure such as rocky substrate or reef. Darker colourations represent a weaker value and indicate softer substrates such as sand or silt. Care must be taken to not interpret acoustic shadows as objects and to instead, use the shadows to aid in the identification of the size, shape and structure of the feature.

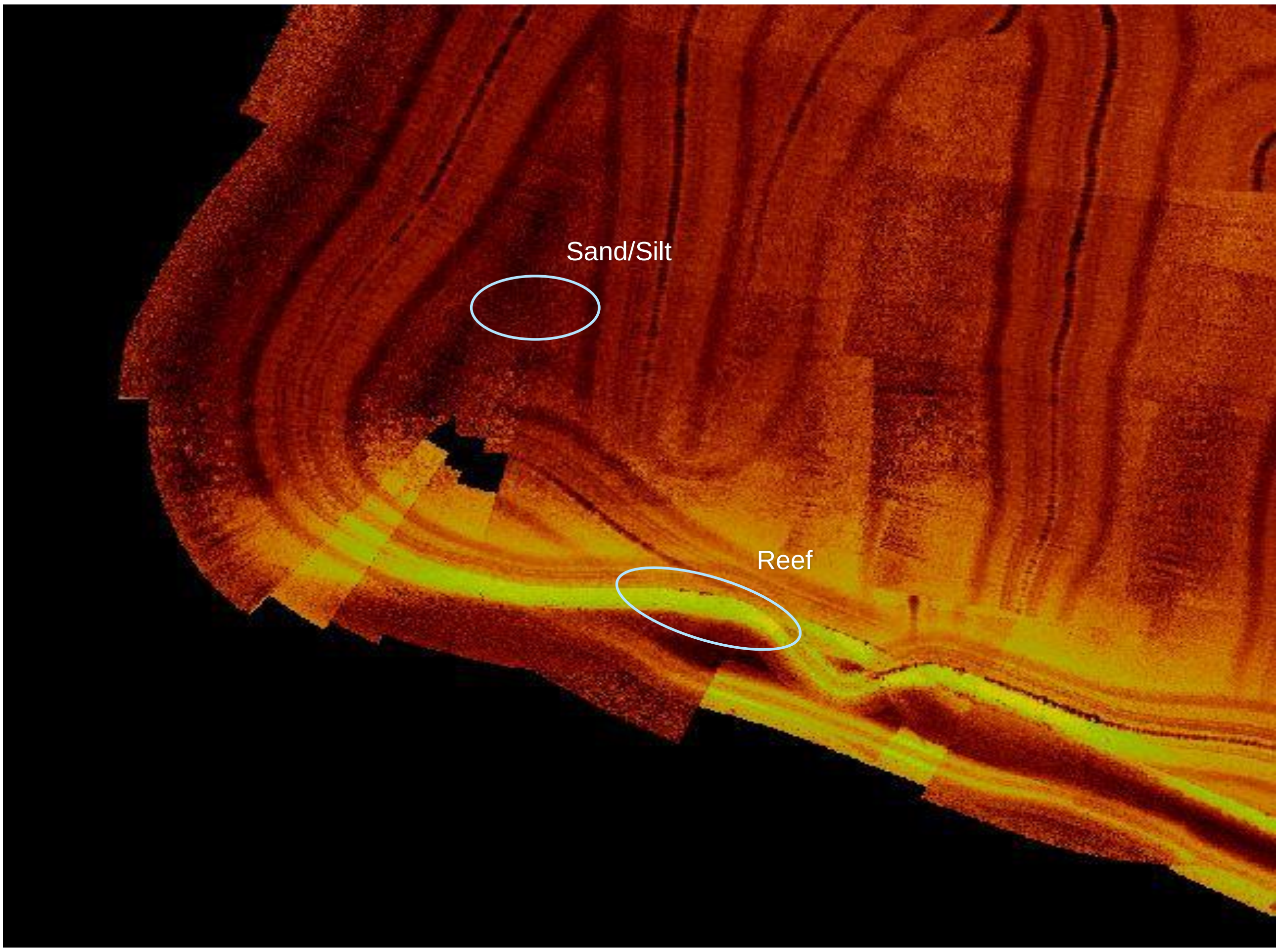

Figure 2.2 Sidescan imagery of bathymetric reflectance for substrate identification

2.1.3 Drop-camera ground-truthing

Video ground-truth data were collected in November 2021 to assist with habitat classification of sidescan data. High-definition video footage was collected at 154 pre-defined points based off areas of consolidated habitat that were identified from the initial side scan surveys (as seen in Figure 2.3). The camera was a "drop camera" which was deployed at each of the pre-defined points for a period of at least 1 minute, to ensure benthic substrates at that waypoint could be clearly defined. A torch was attached to the drop camera to provide artificial lighting as light penetration was considerably reduced as the depth at many of the ground-truth points was greater than 20 m.

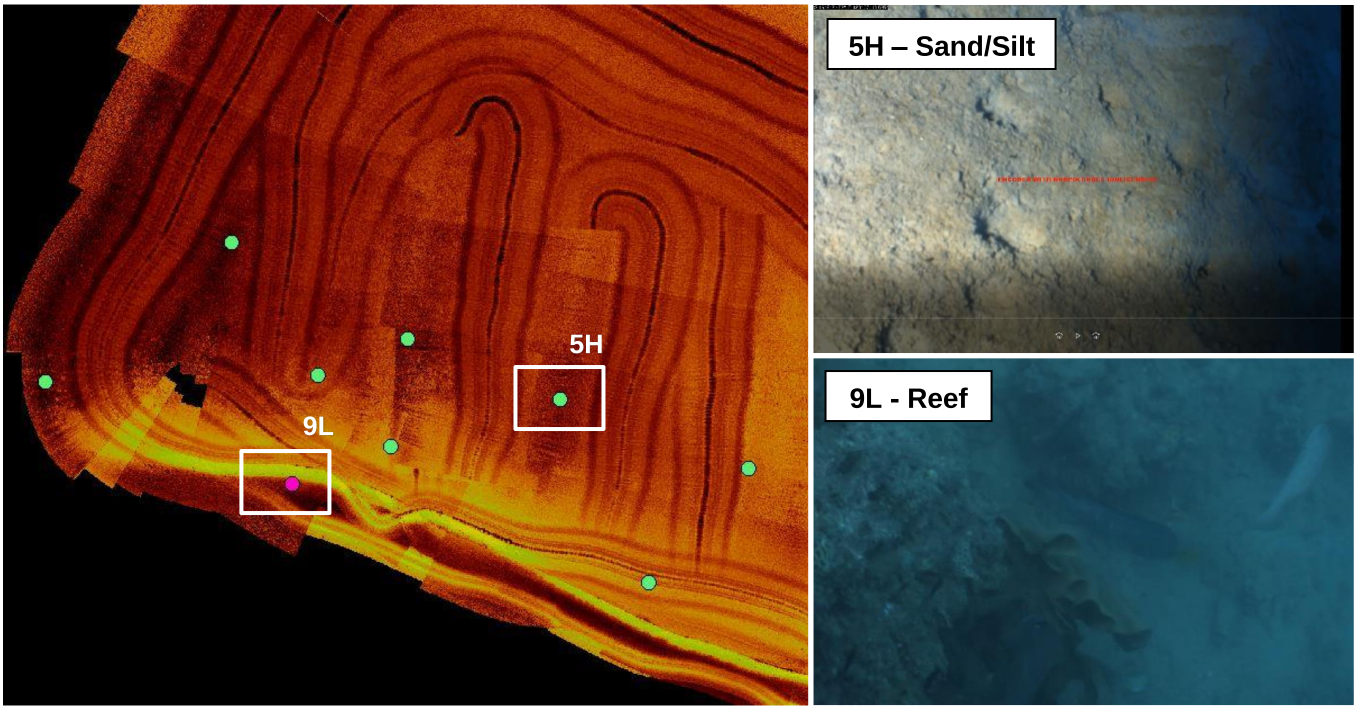

Figure 2.3 Sidescan interpolation of benthic structure type

2.1.4 Side scan surveys – beyond sites

After the integrated modelling completed by BMT (BMT 2024) indicated that impacts from the Proposal may extend beyond the boundaries of the sites, Quest Maritime was engaged to conduct further side scan and multi-beam surveys of these areas. Using the same survey design, whereby Quest ran transects across the areas identified by the modelling as being potentially impacted, Quest were able to gather high quality side scan and multi-beam datasets for these areas. The areas were then verified for the presence/absence of biota using the same ground-truthing data collected for the initial side scan survey, considering the areas in which the data were collected were the same in depth and type for the most part, and as such should have a similar representation.

In 2024, additional scans were conducted by Acoustic Imaging for the Razor Island site, to capture areas of soft sediment that were included within the revised site footprint. This capture followed the same survey design as conducted by Quest.

2.2 Video analysis and classification categories

Video footage was analysed and classified by a marine scientist using the categories listed in Table 2.1. Benthic habitat was classified by identifying the dominant substrate and presence or absence of biota in each video. A percent cover category was not applied considering the lack of biota present throughout the survey.

The majority of substrates identified in the videos were sand or silt, with some rocky substrata present which occasionally had a covering of corals. Corals included branching, massive and encrusting morphotypes. Filter feeders were largely associated with bare sand and/or rock/rubble substrate and were not classified taxonomically because of the species variation and very low abundance.

Table 2.1 Preliminary benthic habitat classification

Biota (major category)	Biota (minor species category)	Biota (minor category description)
Coral	Coral reef/rubble	Presence of individual corals, consolidated reef with corals or coral rubble
Filter feeders	Filter feeders	Presence of filter feeders (i.e. sponges)
Sand	Bioturbated sand	Bioturbated sand
Silt	Bioturbated silt	Bioturbated silt

Table 2.2 Benthic habitat and percent cover classifications with example images from drop camera

Category	Description	Example	
Coral reef/rubble	Presence of individual corals, consolidated reef with corals or coral rubble		
Filter feeders	Presence of filter feeders (i.e. sponges)		

Category	Description	Example	
Bioturbated sand	Bioturbated sand		
Bioturbated silt	Bioturbated silt		

2.3 Classification and mapping procedures

2.3.1 Coastal Habitat Classification

The classification of coastal habitat utilised ESRI aerial base imagery (as at May 2022) at a scale of 1:4,000 as this provided the most detailed imagery of coastal habitat across the study region. The extent of coastline that was classified is outlined in Figure 2.1. Habitat that could be easily distinguishable in aerial imagery at the designated scale was manually interpretated and digitised by a skilled marine scientist in ESRI ArcGIS 10.8. Polygons of costal habitat were classified within the following classes:

- Reef (later converted to coral)
- Sand
- Rubble
- Rubble and Macroalgae
- Sand and Macroalgae
- Sand and Rubble
- Sand and Rock and Macroalgae

2.3.2 Benthic structure classification

The study area was mapped using a combination of methods as the depth of the study area reduced the visibility of benthic habitat features in the satellite imagery, meaning satellite imagery could only be used to classify nearshore areas. Classification of benthic structure in and surrounding the sites utilised sidescan imagery, depth hardness scans, multi-beam echo sounder and drop-camera ground-truth sites. Structure classification was interpolated in ESRI ArcGIS 10.8 and carried out by a skilled marine scientist, utilising a number of geospatial tools to assist with the classification of benthic structure. At each location, drop-camera imagery was assessed where ground-truth sites were taken and sidescan structure imagery collected by Tassal, Quest Maritime and Acoustic Imaging, along with depth hardness scans and multi-beam echosounder imagery (as seen in Figure 2.4) was interpolated to manually digitise and classify areas of benthic substrate in and surrounding the sites. At Razor Island site, a benthic habitat map produced in 2011 (DHI 2011) had a higher level of detail derived using towed video and satellite image classification. Rock (Coral) and Rock (Sparse Coral) areas around Razor Island were used to replace the manually digitised Coral areas.

In some locations, sidescan or multi-beam data were not available to interpolate the benthic substrate. Subsequently, these locations were classified using the category applied to the nearby substrate types, based on the known bathymetry and similarity in benthic structure to other nearby locations. This was only completed for some areas adjacent to the Bayliss Islands sites, and at Dorothy Island, and has been separately classified as a ‘low confidence’ assessment.

Benthic substrate was classified into the following classes:

- Sand
- Silt
- Sand and Silt
- Coral
- Rubble
- Sand and Rubble

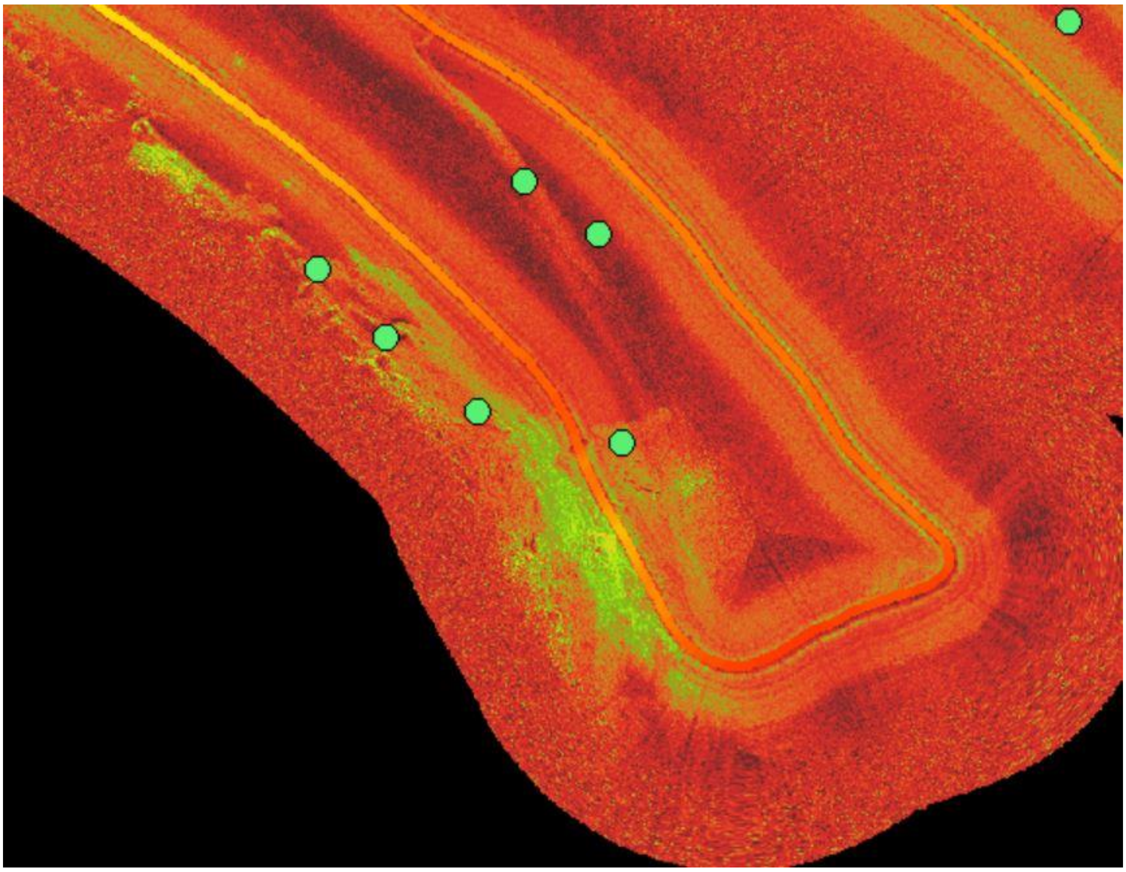

Figure 2.4 Sidescan image with depth hardness values and drop-camera ground-truth sites used for substrate classification.

Habitats could be reliably divided into consolidated vs unconsolidated areas, with the assumption that all consolidated areas had the potential to contain vegetated habitat. Areas of unconsolidated habitats with filter feeders present were also reliably able to be differentiated based off the sidescan and multi-beam imagery

2.4 Assessment of accuracy

No accuracy assessment could be performed for the habitat categories, as the mapping was a combination of supervised classification and manual approaches. Final categories deviated slightly from the final ground truth categories due to the different scale of the ground truthing, satellite imagery and required map detail. Instead, the confidence buffers were applied as an indication of mapping accuracy.

3 Distribution of Benthic Habitats

Sand, sand with rock (rubble) and sand with silt were the dominant benthic substrates found across the LAUs (total cover of 42%, 18% and 23% respectively). The majority of the sites themselves, as well as the deep waters adjacent to the sites, contained soft sediments either of silt or sand. Coral were found for the most part in nearshore areas on fringing reefs. Overall, coral made up 6% of the habitats identified. Other vegetated habitats, such as macroalgae, totalled less than 5% all together across the Archipelago. Mangroves were also identified on some of the islands or along the shoreline, totalling <1% of the habitats identified. A very small patch of seagrass was identified from previous mapping in Cone Bay, though this represented less than 0.01% of habitats across the entire Archipelago. This is unsurprising considering most of the habitats mapped are in deep waters beyond the depth limitations of the majority of seagrass species present in the region.

Between the LAUs, there was a clear difference between those in the north of the Archipelago and those in the south. The LAUs in Strickland Bay and around Razor Island were dominated by sand or sand with rubble habitats, with little to no silty sediments identified. Deep water habitats in the Bayliss LAU and the Dorothy Island LAU however were predominantly silt or silt and sand. The composition of the nearshore areas in terms of coral reef habitats vs sandy shorelines were relatively similar.

Table 3.1 Extent of benthic habitat categories in mapped area across the Archipelago within each respective LAU

Habitat	Cone Bay LAU		Strickland Bay LAU		Bayliss Islands LAU		Dorothy Island LAU	
	Area (km^2)	Proportion (%)	Area (km^2)	Proportion (%)	Area (km^2)	Proportion (%)	Area (km^2)	Proportion (%)
Mangrove	0.03	<1	0.09	1	0.04	1	0.15	1
Filter Feeders	0.09	<1	0.00	0	0.00	0	0.00	0
Coral	0.76	7	0.75	6	0.50	8	0.51	5
Rock (Rubble)	0.13	1	0.44	3	0.21	4	0.32	3
Rock (Rubble) and Macroalgae	0.00	0	0.03	2	0.02	0	1.51	15
Sand	10.48	90	5.19	36	1.02	17	0.38	4
Sand and Macroalgae	0.10	0	0.13	1	0.11	2	0.00	0
Sand and Rock (Rubble)	0.00	<1	6.22	52	0.69	12	0.22	2
Sand and silt	0.00	0	0.00	0	2.79	47	6.41	64
Sand and silt (LC)	0.00	0	0.00	0	0.57	10	0.04	<1
Seagrass	<0.01	<1	0.00	0	0.00	0	0.00	0
Silt	0.00	0	0.00	0	0.00	0	0.41	4
Total	11.6	100	12.87	100	5.96	100	9.95	100

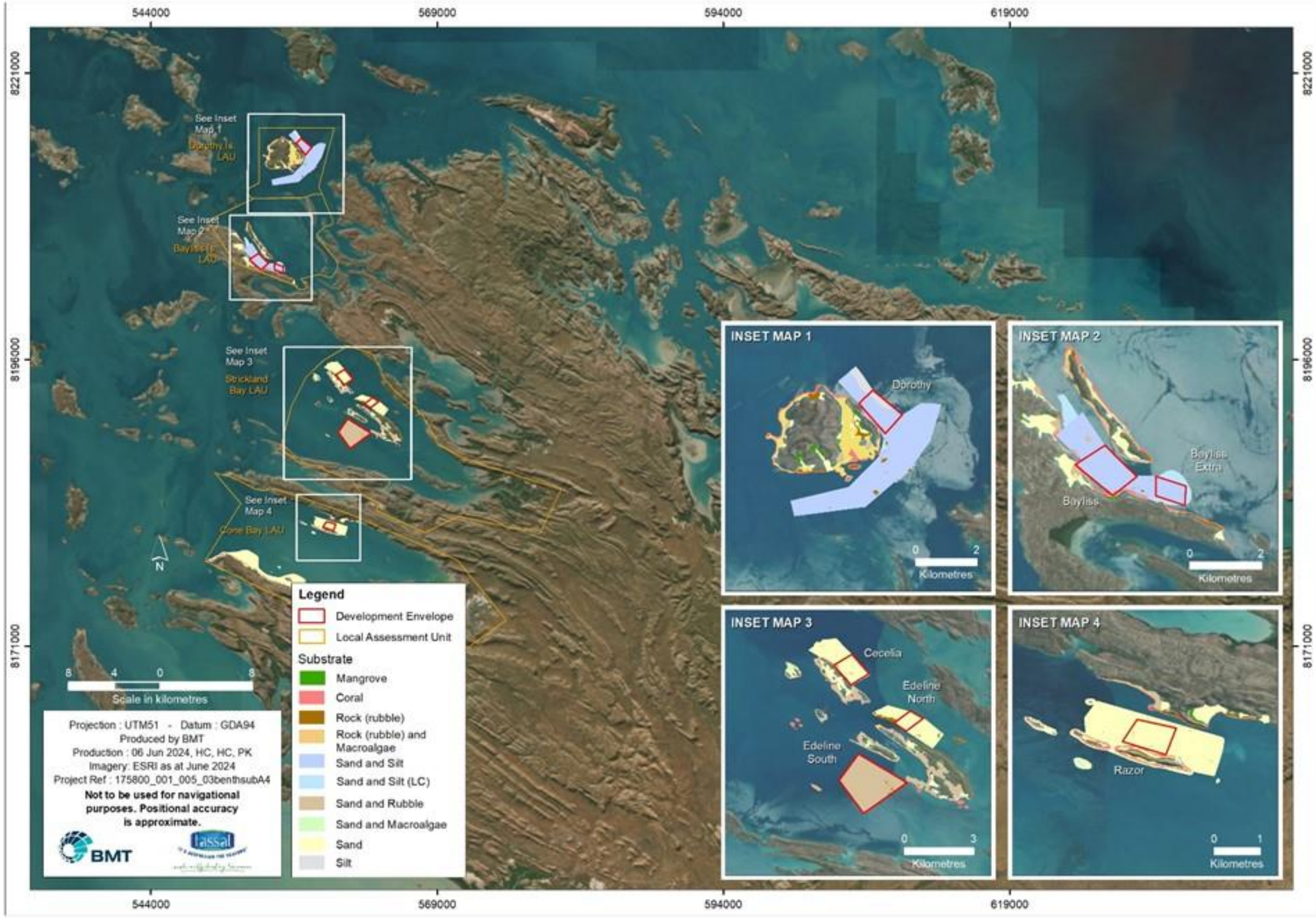

Figure 3.1 Habitat map for all sites

4 Conclusion

The extent and distribution of BCH within and adjacent to the sites were successfully mapped using satellite images, side scan/multi-beam and ground truthing data. Sand and silt were dominant throughout, particularly in the deep waters within and around the sites. Some scattered coral reef or filter feeder habitat was present in the shallower areas of the sites where islands and fringing reefs were in close proximity. Coral reef/rubble was present around almost every mapped island/shoreline.

The mapped benthic habitats were representative of known regional and local habitats and no new BCH were observed.

5 References

BMT (2024) Ocean Barramundi Project – Integrated Model Report. Prepared by BMT for Tassal. Report No. 175801.000_4.

EPA (2016) Environmental Factor Guideline – Benthic Communities and Habitats. Environmental Protection Authority, Perth, Western Australia, December 2016

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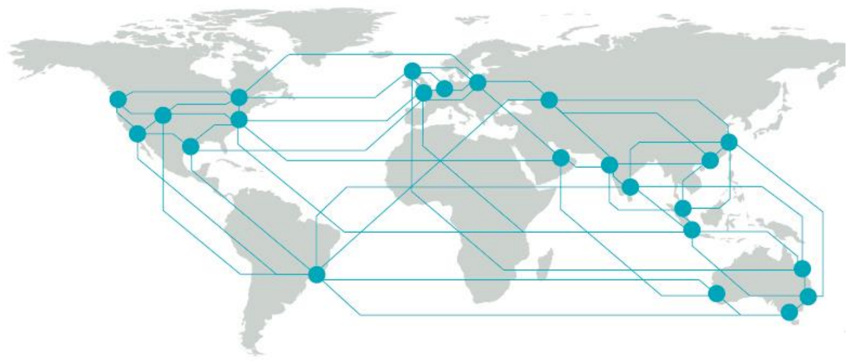

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