Boskalis Cambridge Gulf Marine Sand Proposal s38 Referral WA EP Act

Referral Report No. 2 - *Proposal Setting & Existing Environment Descriptions*

ANNEX 2 - MSCIENCE BCH METHODS - Boskalis Cambridge Gulf.

Cambridge Gulf Marine Sand Project

19 August 2024

Benthic Habitat Mapping Methodology

Document Information

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Disclaimer

Acronyms and Abbreviations

Abbreviation	Definition
Boskalis	Boskalis Australia
WA	Western Australia
EIA	Environmental Impact Assessment
the Project	Sand production in Cambridge Gulf
LAU	Local Assessment Unit
BCH	Benthic Communities and Habitats
NISB	National Intertidal Subtidal Benthic
HAT	Highest Astronomical Tide
SMB	Structural Macrobiota
ha	Hectare

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EXECUTIVE SUMMARY

Boskalis Australia (Boskalis) has explored for marine sands in Cambridge Gulf, in the Kimberley Region of Western Australia. Boskalis is now proceeding with an assessment of the environmental impacts for sand production in Cambridge Gulf (the Project) to support the Environmental Impact Assessment (EIA) of the Project under section 38 (Part IV) of the *Environmental Protection Act (1986)*.

Boskalis contracted MScience marine research (MScience) to generate a map outlining the key intertidal and subtidal benthic community and habitat (BCH) types within the proposed Project local assessment unit (LAU). MScience drew on field data provided by Boskalis and data publicly available to generate a BCH map in a desktop study.

The habitat classification methodology used in the study was based on the National Intertidal Subtidal Benthic (NISB) Habitat Classification Scheme.

The study has produced PDF and image files showing the distribution of intertidal and subtidal BCH within the proposed LAU and provided Boskalis with GIS files containing all mapping data on the marine habitats. The information contained within the attribute table for the final spatial file was developed to be consistent with the minimum data requirements for the Index of Marine Surveys for Assessments (IMSA).

The habitats identified within this study are known to change their density and distribution over time in response to natural disturbances and seasonal effects. Therefore, the boundaries of each feature must be considered 'soft' and assumed to be variable through time.

This document describes the spatial data used in compiling the mapping, the habitat classification scheme used, and the products delivered. It does not describe the mapped BCH in detail or discuss the relevance of their spatial distribution within a local or regional context.

1 INTRODUCTION

1.1 Background and Purpose

Boskalis Australia (Boskalis) has explored for marine sands in Cambridge Gulf, in the Kimberley Region of Western Australia (WA). Boskalis is now proceeding with an assessment of the environmental impacts for sand production in Cambridge Gulf (the Project) to support the Environmental Impact Assessment (EIA) of the Project under section 38 (Part IV) of the *Environmental Protection Act (1986)*.

Eco Strategic, on behalf of Boskalis, has contracted Marine Science Associates Pty Ltd t/a MScience marine research (MScience) to generate a map(s) outlining the key intertidal and subtidal benthic community and habitat (BCH) types within the proposed Project local assessment unit (LAU). The map(s) will be used by Eco Strategic in a BCH report that will be developed to support the Project EIA.

Mapping was generated in a desktop exercise by aggregating information from existing public sources and field data collected by Eco Strategic during two field surveys conducted in July/August 2023 and February/March 2024.

This document describes the spatial data used in compiling the mapping, the habitat classification scheme used, and the products delivered. It does not describe the mapped BCH in detail or discuss the relevance of their spatial distribution within a local or regional context.

1.2 Structure of this Document

The document lists:

- The mapping methodology;
- The study results; and
- A discussion of the limitations of the results.

The document is current as at the date on the cover page and is referenced as Version 2 (Documents with a lower version number are superseded by this document).

2 METHODOLOGY

2.1 Data Sources

The spatial data sources used in compiling the final BCH data files are shown in Table 2-1. Data was obtained from two Eco Strategic field surveys to the Cambridge Gulf (July/August 2023 and February/March 2024), publicly available data from government sources and from data layers provided from Boskalis. Where necessary, data layers were reprojected onto a common coordinate reference system (GDA2020z52) and split into individual habitat types. Following completion of input of all data source files, data files for each habitat were combined and evaluated for congruence in the extent and placement of habitat features (see Section 2.4)

2.2 Habitat Classification Scheme

The habitat classification methodology used in the current study was based on the National Intertidal Subtidal Benthic (NISB) Habitat Classification Scheme (Mount et al. 2007). The NISB scheme is hierarchical and initially divides habitats according to broad substrate type, and then according to whether they are spatially dominated by 'structural macrobiota' or by the substrate i.e., largely 'bare' of visible biota.

This broad classification scheme is suited to the remotely sensed data (drone and satellite imagery) that was available for the current study. In addition, this scheme was used to map the intertidal habitats of the Cambridge Gulf as part of the Australian Coastal Vulnerability Project Estuarine, Coastal and Marine National Habitat Map (Mount and Bricher 2008), a joint project between the Commonwealth and the University of Tasmania.

The NISB scheme has been presented as a flow chart in Figure 2-1.

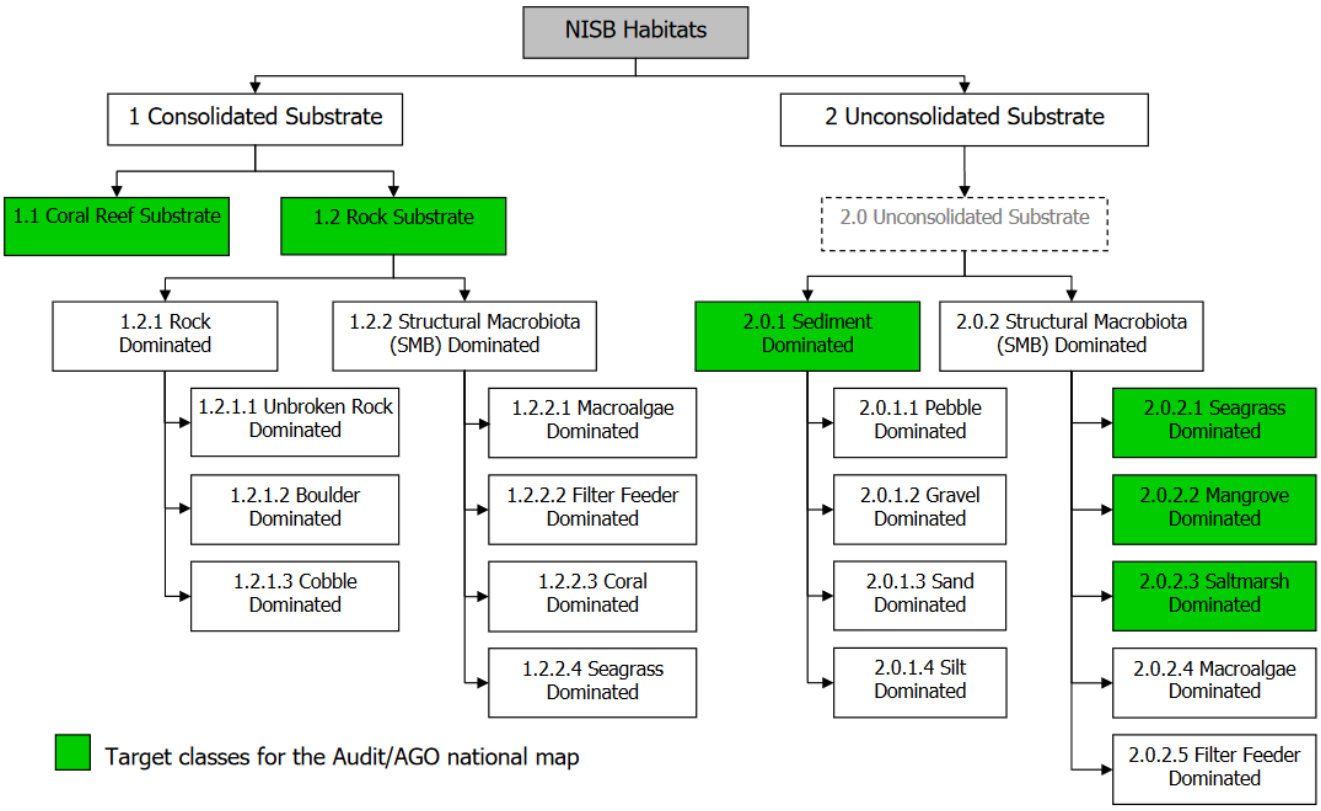

Figure 2-1. NISB classification scheme (Mount et al. 2007)

Table 2-1. Data sources and their use

Data Source	Habitats Presented in Data	Data Collection & Spatial Extents	Data Use in Mapping	Notes
Eco Strategic – Aerial and Horizontal Imagery	Intertidal Zone. Unconsolidated and consolidated substrates. Mangroves and salt marshes.	Field survey data collected in July 2023 and February 2024. Aerial imagery collected from priority areas within Cambridge Gulf. Horizontal imagery collected along the coastline adjacent to the priority areas.	The geotagged imagery was used to ground truth satellite imagery and assist with extrapolation of data to other areas within the LAU.	MScience completed a brief qualitative assessment of the geotagged aerial and horizontal imagery prior to its use.
Eco Strategic – Benthic Grabs	Subtidal Zone. Unconsolidated sediment type. Macrofauna type and abundance.	First field survey data collected between 17 July and 02 August 2023. Data collected from 105 sampling points within Cambridge Gulf and 27 sampling points around King Shoals. Second field survey data collected in February 2024. Data collected from 27 sampling points within Cambridge Gulf and 14 sampling points around King Shoals.	The physical sediment observations from the benthic grabs were used to corroborate the publicly available data sets and assist with digitising the spatial extent of subtidal sediments.	The benthic grab data was also used to identify the community composition of biota at spot locations within the Cambridge Gulf. Presence and abundance data is available to present on a separate map.
Boskalis – Sub Bottom Profiler	Subtidal Zone. Unconsolidated sediment type.	Field survey data collected within the footprint of the Block 4 tenement. Date of collection not known to MScience.	The Boskalis data was used to map the physical subtidal habitats within the Block 4 tenement.	-
Department of Climate Change, Energy, the Environment and Water – National Intertidal Subtidal Benthic (NISB) Habitat Classification	Coral reef, rock dominated habitat, sediment dominated habitat, mangroves, saltmarsh, seagrass, macroalgae and filter feeders as defined in the NISB Habitat Classification Scheme (Mount et al. 2007)	National data coverage. Data sourced between 1987 and 2007. Data available for habitats that occur between the approximate position of the highest astronomical tide (HAT) and 50-70 m depth contour.	The NISB data available for the Cambridge Gulf was used as the basis for mapping the intertidal sand substrate, mangrove and salt marsh habitats.	Method of mapping within the Cambridge Gulf unknown however, congruence with satellite imagery suggests features generated from satellite data.

Data Source	Habitats Presented in Data	Data Collection & Spatial Extents	Data Use in Mapping	Notes
Geoscience Australia. Digital Earth Australia - High and Low Tide Imagery and Intertidal Extents	Intertidal zone extent.	National data extent. Data collection began in 1986 and is updated as required. Last updated in 2017.	Intertidal zone extent data was used to define the seaward extent of the mapped intertidal habitats.	Data derived from satellite (Landsat) imagery.
Geoscience Australia. Digital Earth Australia – Mangrove Canopy Cover	Mangroves	National data extent. Data has been sourced annually from 1987 to the present day.	The Digital Earth Australia data was used to verify the location and extent of the NISB mangrove data.	Data derived from satellite (Landsat) imagery.
Geoscience Australia – Marine Geomorphic Features	Maximum extent of geomorphic sand bank units.	Data sourced in 2006 for Australia's Exclusive Economic Zone.	The spatial extent of the mapped sand banks was used as the basis for mapping the subtidal sand habitat.	Data derived from best available bathymetry information at the time of collection.

2.3 Habitat Classification

The NISB class description for the habitats relevant to the current study have been detailed in Table 2-2 (Consolidated substrates) and Table 2-3 (Unconsolidated substrates). Note that the numbering in the 'NISB Class #' column is not consecutive due to the removal of classes that were not identified/relevant to the current study.

Table 2-2. Class descriptions for BCH identified on consolidated substrates

NISB Class #	Class Name	Description
1	Consolidated	Any habitat in which the substrate is predominantly made up of particles of cobble size (>64 mm diameter) or larger. This includes solid rock and boulders.
1.2	Rock substrate	A structure that is predominantly formed by a rock framework.
1.2.1	Rock dominated	A rocky substrate on which there is less than 10% Structural Macrobiota (SMB) cover
1.2.1.1	Unbroken rock dominated	A rock dominated substrate where the cover is dominated by continuous outcropping rock.
1.2.1.2	Boulder dominated	A rock dominated substrate where the cover is dominated by rocks larger than 256 mm diameter.
1.2.1.3	Cobble dominated	A rock dominated substrate where the cover is dominated by rocks between 64 mm and 256 mm diameter.
1.2.2	SMB dominated	A habitat in which one or more groups of SMB cover more than 10% of the substrate
1.2.2.1	Macroalgae dominated	SMB dominated habitat in which macroalgae has greater substrate cover than other SMB

Table 2-3. Class descriptions for BCH identified on unconsolidated substrates

NISB Class No.	Class Name	Description
2	Unconsolidated	A substrate that is predominantly made up of particles of pebble size (<64 mm diameter) or smaller. This includes gravels, sands and silts
2.0	Unconsolidated Substrate	A dummy class "holder" at the second level of the hierarchy to enable consistency in the numbering throughout the class hierarchy
2.0.1	Sediment dominated	An unconsolidated habitat with <10% SMB cover
2.0.1.2	Gravel dominated	A sediment dominated habitat which predominantly consists of particles 2 to 4 mm diameter
2.0.1.3	Sand dominated	A sediment dominated habitat which predominantly consists of particles 63 µm to 2 mm diameter
2.0.1.4	Mud/Clay dominated	A sediment dominated habitat which predominantly consists of particles <63 µm diameter
2.0.2	SMB dominated	A habitat in which one or more groups of SMB cover more than 10% of the substrate
2.0.2.1	Salt marsh dominated	Extensive damp and water-logged flats, mostly in near-estuarine areas. The vegetation is dominated by hardy low shrubs, especially samphire communities
2.0.2.2	Mangrove dominated	Intertidal tall forests to shrublands, in areas with low wave energy. NB: Even though mangroves can occur on rocky shores, the substrate under mangroves is rarely mapped. Therefore, an arbitrary decision was made by the NISB scheme to class all mangroves as occurring on unconsolidated substrates.

2.4 Habitat Mapping

The final habitat file was produced by grouping individual habitat layers into one spatial file. The final shape file was assessed for conflicts in habitat classification between grouped layers. Once all layer conflicts had been resolved, features were checked against high-resolution satellite imagery to confirm their validity. In some cases, the boundaries of features were modified based on the available satellite imagery to increase confidence in their validity.

A final assessment of the combined spatial data was performed by checking the layer features within the high priority areas against the aerial and horizontal imagery. The imagery was generally used to confirm the habitat type and modify the spatial extent of features.

3 RESULTS

Using the available data sources, a final spatial file detailing the boundaries of intertidal and subtidal marine habitats within the proposed LAU was produced. Seven habitat types were mapped in the intertidal zone and three habitat types were mapped in the subtidal zone (Figure 3-1). The estimated area of cover for each habitat classification within the proposed LAU is provided in Table 3-1.

Table 3-1. Composition of BCH within the proposed LAU

BCH Classification	Area (ha)	Composition of Total (%)
Intertidal Zone		
Sand Substrate	7,303	2.3
Cobble Substrate	34	0.01
Boulder Substrate	23	0.01
Rock Platform	464	0.15
Macroalgae Community	46	0.01
Saltpan/Saltmarsh Community	60,224	19.2
Mangrove Community	35,058	11.2
Subtidal Zone		
Sand Substrate	35,635	11.4
Mixed Clay, Sand and Gravel Substrate	145,905	46.5
Rocky Seabed	351	0.1
Terrestrial Environment*		
Land and terrestrial vegetation	28,529	9.1
Total	**313,572**	**100**

*Classification and mapping of the terrestrial environment was outside the scope of this study. The area of the terrestrial environment has been provided to give the correct total areas of the LAU.

The information contained within the attribute table for the final spatial file was developed to be consistent with the minimum data requirements for the Index of Marine Surveys for Assessments (IMSA). The attribute table fields have been detailed in Table 3-2.

Table 3-2. Attribute table fields

Field	Description
Habitat zone	The marine zone for the habitat type.
Habitat type	A description of the BCH based on the NISB classification system used for the assessment.
Area (ha)	Area of each feature as calculated by the QGIS area calculation algorithm.
Start date	The date the sampling commenced. Mapping was conducted on a desktop basis, as such, the commencement date for the desktop assessment has been provided.
End date	The date the sampling concluded. Mapping was conducted on a desktop basis, as such, the end date for the desktop assessment has been provided.
Condition	Condition of the biota. In relation to the current study this information included whether physical substrates supported biota, the range of percentage cover for mangroves and additional relevant observations from the field data.
Comment	Additional information which may be important in the interpretation and utilisation of data. This includes details regarding; data sources, the date of collection for field data and the habitat classification system used.

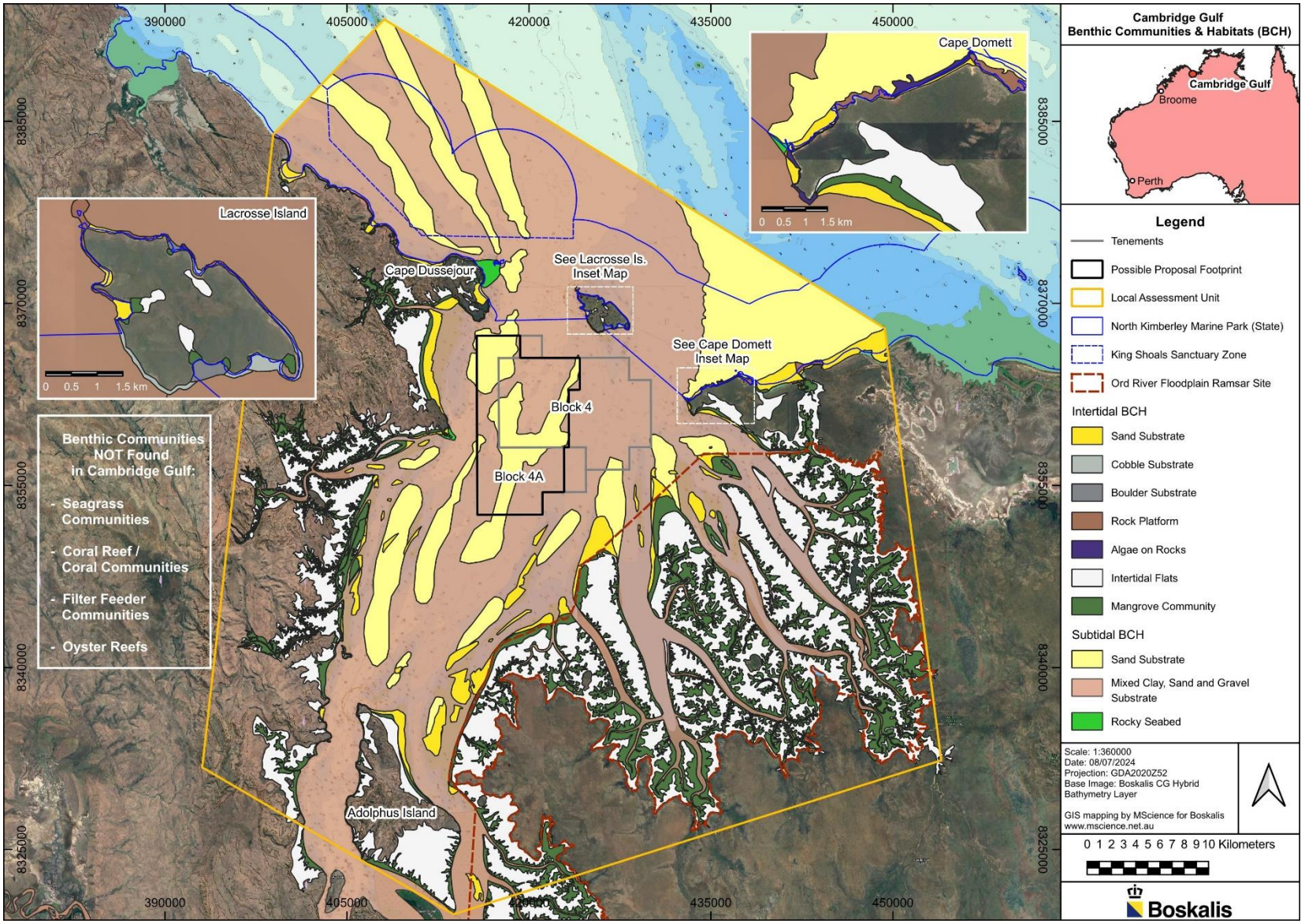

Figure 3-1. Cambridge Gulf BCH map

4 MAPPING LIMITATIONS

It is important to recognise the limitations of the provided mapping. Field data used to corroborate the remotely sensed data was collected at a single point in time during the wet and dry seasons. Any mapped habitat is subject to natural variability, especially macroalgae beds which are known to change seasonally. Moreover, environmental changes following the collection of the publicly available spatial data may have resulted in significant expansions or contractions of any habitat type. Therefore, the boundaries of each feature must be considered 'soft' and assumed to be variable through time. Moreover, MScience is unable to comment on the quality or validity of the publicly available data conducted by other parties which was used in the mapping. While every effort was made to only include valid data, if the mapping or classification methods used by other parties were erroneous, some issues may persist in the data.

5 REFERENCES

Mount R, Bricher P (2008) Estuarine, Coastal and Marine (ECM) National Habitat Mapping Project. ECM National Habitat Map Series User Guide. Department of Climate Change and University of Tasmania

Mount R, Bricher P, Newton J (2007) National Intertidal/Subtidal Benthic (NISB) Habitat Classification Scheme Version 0.1 October 2007ID - 4750.