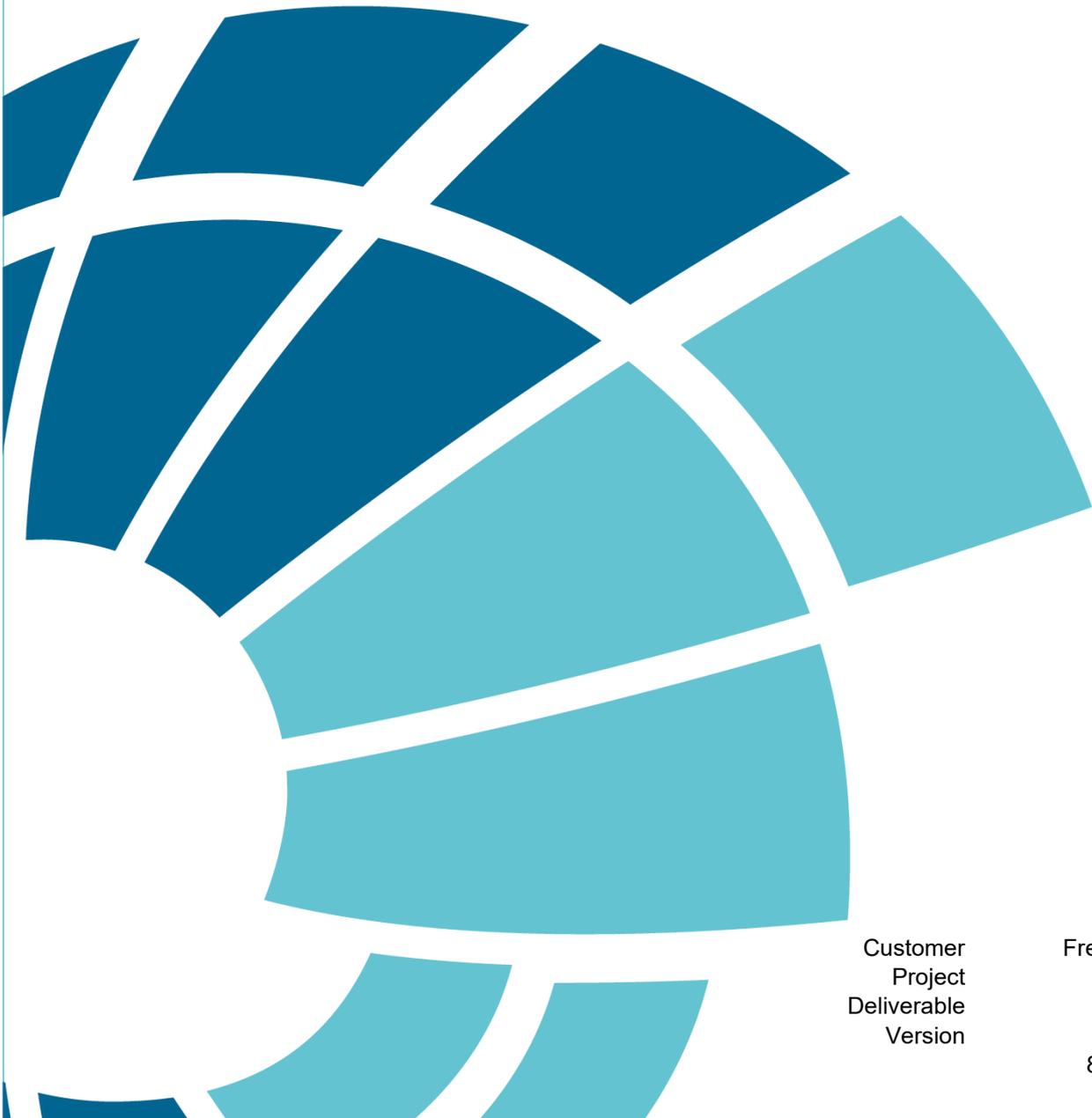


Benthic Habitat Mapping Technical Note

Inner Harbour Maintenance Dredging Project



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Checked By	R DEROACH; P KINDLEYSIDES
Project Manager	L SYNNOT

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Contents

Technical note	4
1 Introduction	5
2 Mapping Methods	6
2.2 Survey design and data acquisition	6
2.3 Video analysis and classification categories.....	7
2.4 Classification and mapping procedures.....	10
2.5 Assessment of accuracy	12
3 Distribution of Benthic Habitats.....	13
4 References	17

Tables

Table 2.2 Benthic habitat classifications with example images from towed video	9
Table 3.1 Classification of Benthic Habitat Map over the ‘unknown area’.....	13
Table 3.2 Reclassification of Benthic Habitat Map over the Gage Roads Disposal Area and vicinity.	13
Table 3.3 Total BCH coverage across the disposal and dredging areas for the Inner Harbour Maintenance Dredging project	16

Figures

Figure 2.1 Steps undertaken to update Gage Roads Disposal Area benthic habitat mapping.....	6
Figure 2.2 Benthic Habitat Mapping presented in BMT (2022) showing the ‘unknown’ feature.	8
Figure 2.3 Classification of transects using benthic habitat categories.....	11
Figure 3.1 Distribution of benthic habitat categories over the classified tracklogs along the Gage Roads Disposal Area	14
Figure 3.2 Result of ground truthing survey.....	15

Technical note

Project	Inner Harbour Maintenance Dredging Project		
From:	B Coelho Project Manager – Risk & Environment BMT Commercial Australia Pty Ltd		
Date:	08/03/2023	To:	Melissa Manns
Doc Ref:	Tn-11513-2		Environmental Advisor Fremantle Ports
Subject:	Video tow classification for benthic habitat within Gage Roads Disposal Area and vicinity		

1 Introduction

Fremantle Ports is planning to undertake the Inner Harbour Maintenance Dredging project in 2023 and the sediment that will be removed from the dredging area is proposed to be disposed at Gage Roads shipping lane and anchorage area.

During the Environmental Impact Assessment preparation, the benthic habitat map showed an area assigned as 'unknown' due to water column interference impacting classification. A video ground truthing survey campaign was performed on 20 December 2022 and the 'unknown' area was assessed to update the benthic habitat mapping shapefile.

To inform the environmental review document (ERD, BMT 2022) for the proposed Project, benthic communities and habitats (BCH) adjacent to the areas of influence of the disposal area were investigated. The specific objectives of the mapping project were to:

- collect digital baseline data on the spatial extent and characteristics of BCH in the mapping area
- quantitatively characterise the extent of BCH near the disposal area to develop a map product of suitable quality for environmental referral requirements.

This report provides an overview of the methods and updated map products from the Gage Roads Disposal Area benthic habitat mapping survey.

2 Mapping Methods

An overview of the steps involved in updating the benthic habitat map is presented in Figure 2.1, and described in detail in Sections 3.1 to 3.4.

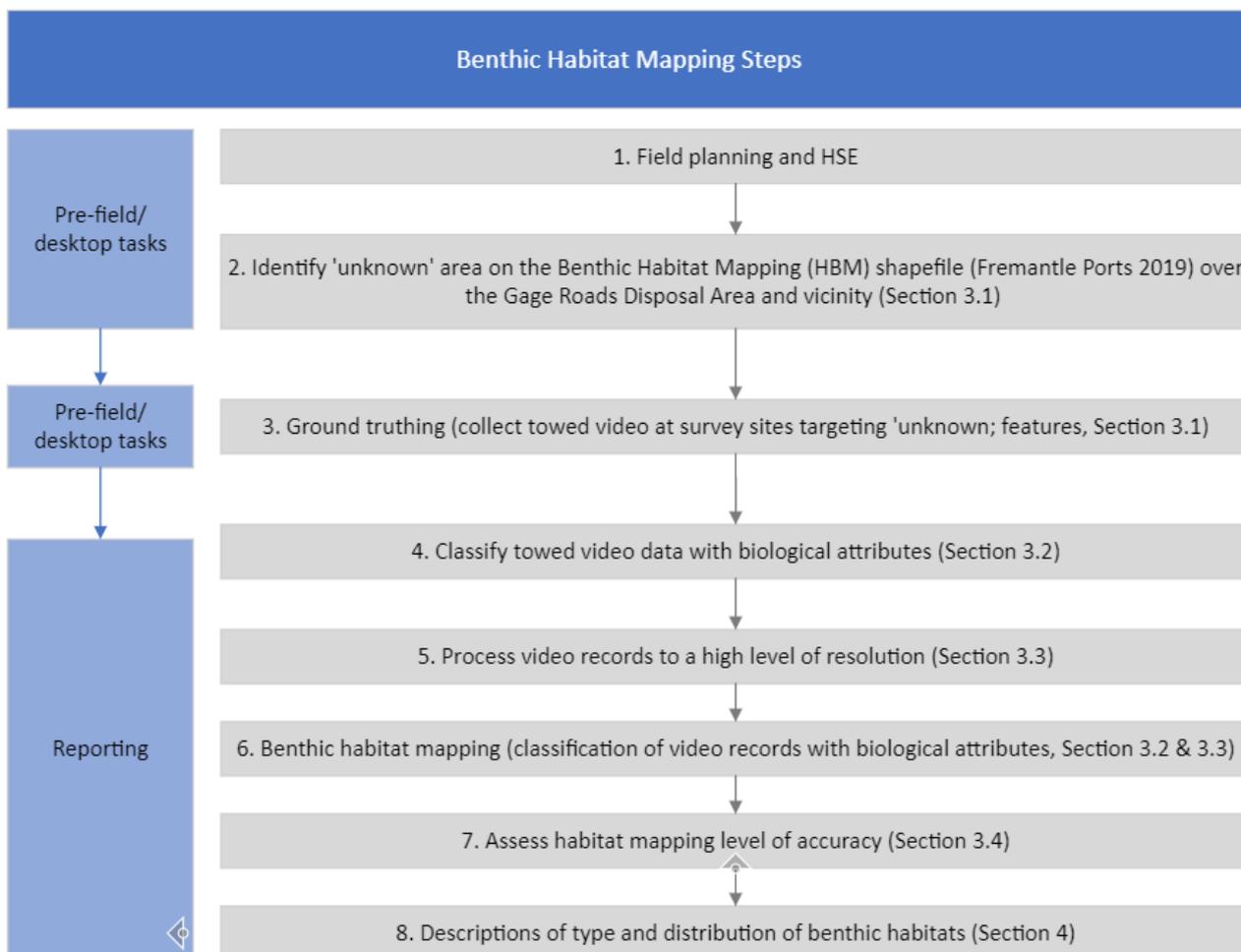


Figure 2.1 Steps undertaken to update Gage Roads Disposal Area benthic habitat mapping

2.2 Survey design and data acquisition

Within the subtidal benthic habitat map included in the Environmental Review Document for Fremantle Ports' Inner Harbour Maintenance Dredging project (BMT 2022), BMT defined an area as 'unknown'. The 'unknown' area covered 108.21 hectares (ha) extending from the southeast corner of Gage Roads Disposal Area to ~1 km south outside the Gage Roads Disposal Area boundary (Figure 2.2). A ground-truthing survey was defined to fully identify the features along the entire 'unknown' area, (see Figure 2.2).

Prior to field survey, BMT collated available marine spatial data at Gage Roads (including zones of impact presented in BMT [2022], infrastructure layers, ecological protection areas, satellite imagery and existing nearshore habitat mapping products) and overlaid all layers in QGIS 3.26.2 for assessment of the Project survey in Figure 2.2.

Video ground truth data were collected on 20 December 2022 to assist with habitat classification to update the benthic habitat mapping data. High-definition video footage was collected along 15 pre-defined transects throughout the survey area to capture features of interest identified during pre-processing of mapping data (see Figure 2.3).

The camera was attached to a towing apparatus, which provided a live feed from the camera to the survey vessel. The height of the camera above the seafloor was moderated by a field crew member in real-time so that the field of view contained a 2–3 m wide band of benthic habitat, resulting in a final total of ~1.2 km² of ground truth survey data. The start time of each video was recorded so that the classified transect data could later be matched with the GPS tracklog.

2.3 Video analysis and classification categories

Video footage was analysed and classified by a marine scientist using the TransectMeasure software (SeaGIS 2013) and the following categories:

- Sand
- Seagrass
- Rock with Algae
- Wrack

The software allows a single benthic habitat type to be assigned to each frame of video footage. Benthic habitat was classified by identifying the dominant substrate and presence or absence of biota in each frame of the video.

Across the transects, the dominant category was sand, followed by seagrass, rock with algae and just one frame presented wrack (the latter was not included due to the insignificant area in relationship with the total area covered by the video tows). Table 2.1 below presents the categories identified for the benthic habitat mapping survey and a few examples of the images recorded.

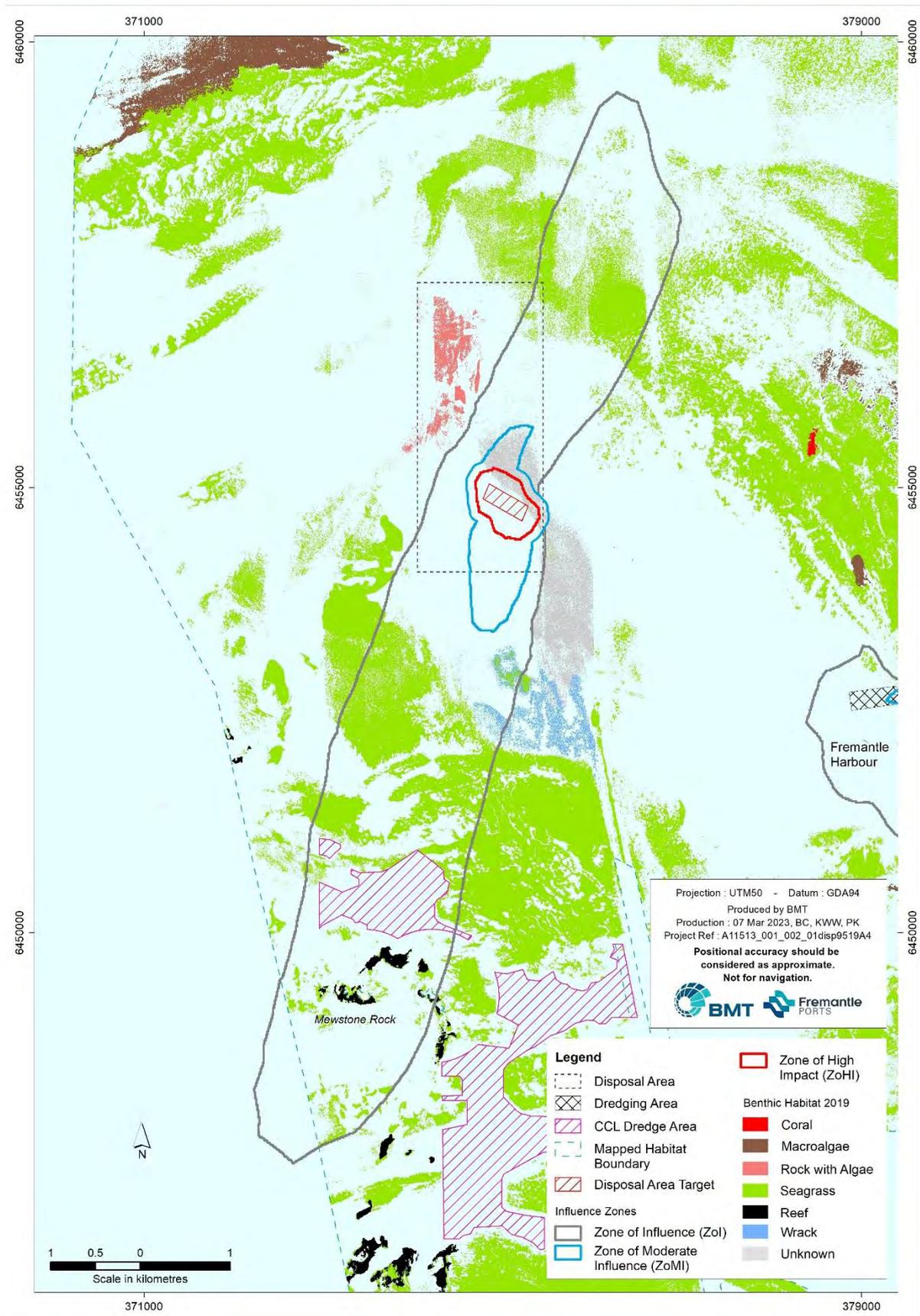
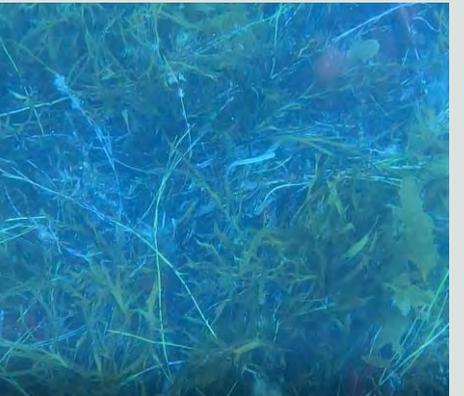
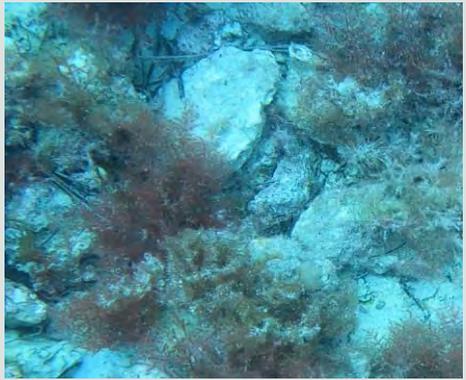


Figure 2.2 Benthic Habitat Mapping presented in BMT (2022) showing the 'unknown' feature.

Table 2.1 Benthic habitat classifications with example images from towed video

Category	Example	
Sand		
Seagrass		
		

Category	Example	
Rock with Algae		
Wrack		

2.4 Classification and mapping procedures

The ground truthed transects were overlaid on the existing benthic habitat map shapefile (Fremantle Ports 2019) to update that benthic habitat map over the 'unknown' area. A dominant habitat type was assigned to sections of the transects and then a 100 m 'high confidence' buffer was applied around the transects. Videoed habitats could be reliably divided into vegetated cover (seagrass dense, seagrass sparse, wrack, and rock with algae) and non-vegetated areas (sand), as shown in Figure 2.3.

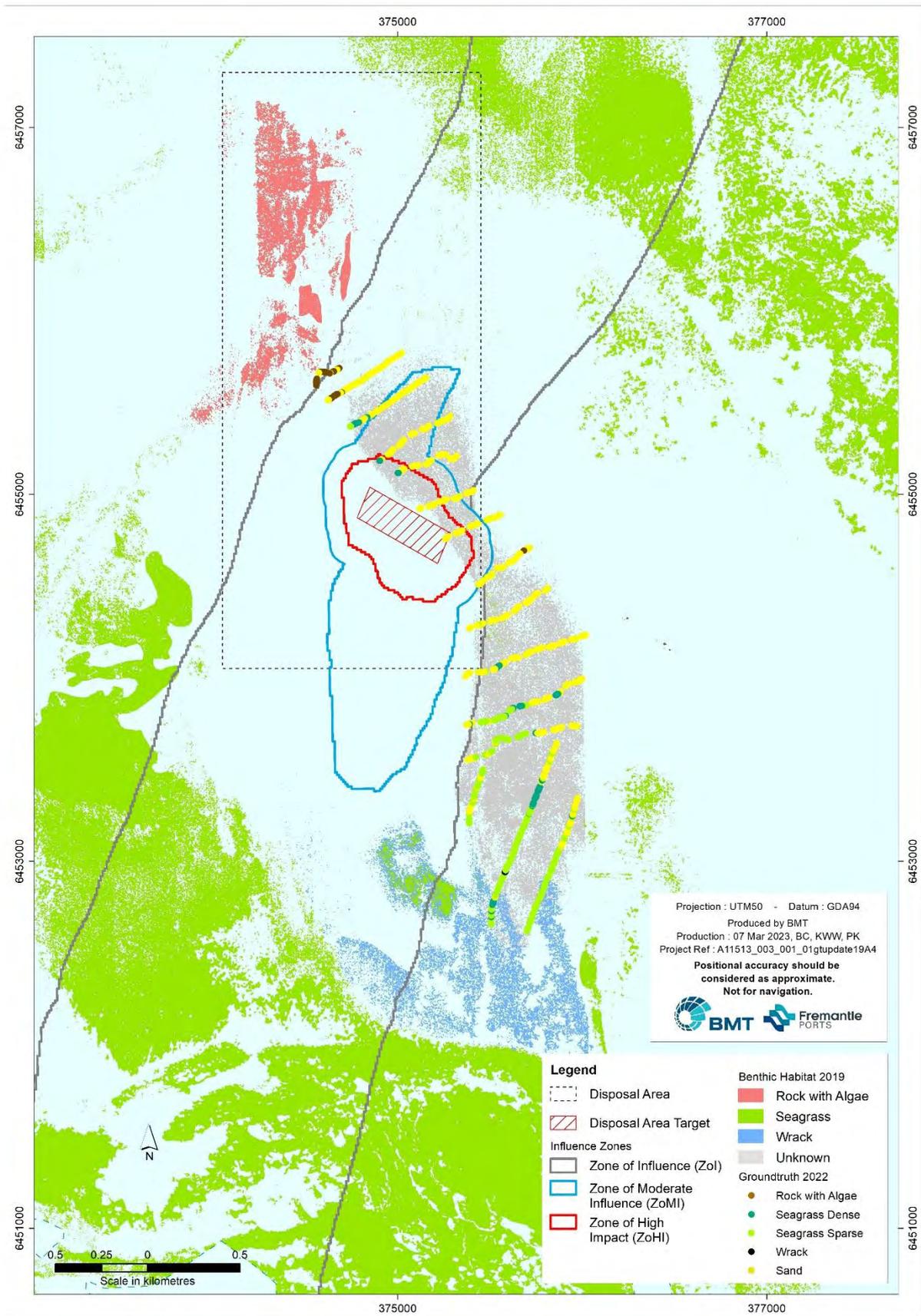


Figure 2.3 Classification of transects using benthic habitat categories.

2.5 Assessment of accuracy

No accuracy assessment could be performed for the habitat categories, as the mapping was generated using a manual approach (and final categories that deviated slightly from the final ground truth categories are due to the scale of ground truthing and required map detail). Instead, the confidence buffers were applied as an indication of mapping accuracy.

3 Distribution of Benthic Habitats

The classification of the benthic habitat mapping shapefile of the Gage Roads Disposal Area is presented in Table 3.1. More than 65% of the 'unknown feature' was classified as non-vegetated area (sand), and approximately 35% was areas with seagrass. The seagrass was dominant in the areas around 500 metres south of the disposal area target, as presented in Figure 3.1.

Table 3.1 Classification of Benthic Habitat Map over the Gage Roads Disposal Area and vicinity including the features revealed over the 'unknown area'.

Category	Area (hectares)	Proportion (%)
Sand	70.78	65.39
Seagrass sparse	34.41	31.82
Seagrass dense	3.01	2.78
Rock with algae	0.01	0.01
TOTAL	108.21	100

An additional 7.03 hectares of benthic habitat mapping was reclassified from non-vegetated area (sand) to one of the vegetated categories (seagrass dense, seagrass sparse and rock with algae). The reclassification results are presented in Table 3.2, and Figure 3.2 presents the final benthic habitat map result.

Table 3.2 Reclassification of Benthic Habitat Map over the Gage Roads Disposal Area and vicinity including the features revealed over the 'unknown area'.

Category	Area (hectares)	Proportion (%)
Seagrass dense	0.82	11.58
Seagrass sparse	3.87	55.1
Rock with algae	2.34	33.32
TOTAL	7.03	100

The habitat coverage of the zones of impact of the Inner Harbour Maintenance Dredging project and its disposal area (BMT 2022) was updated following the classification/reclassification of the ground truthing survey area, and the results are presented in Table 3.3.

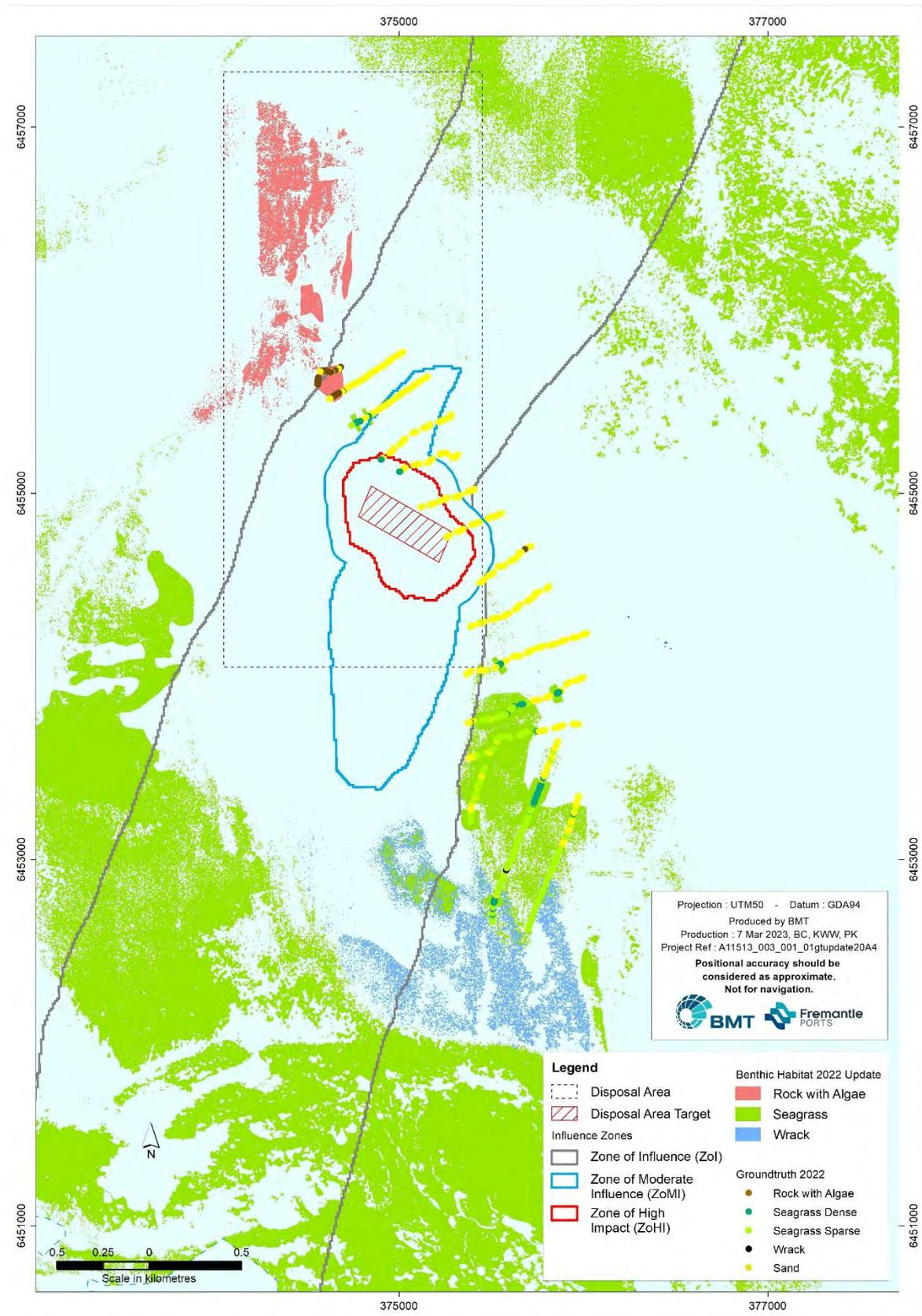


Figure 3.1 Distribution of benthic habitat categories over the classified tracklogs along the Gage Roads Disposal Area

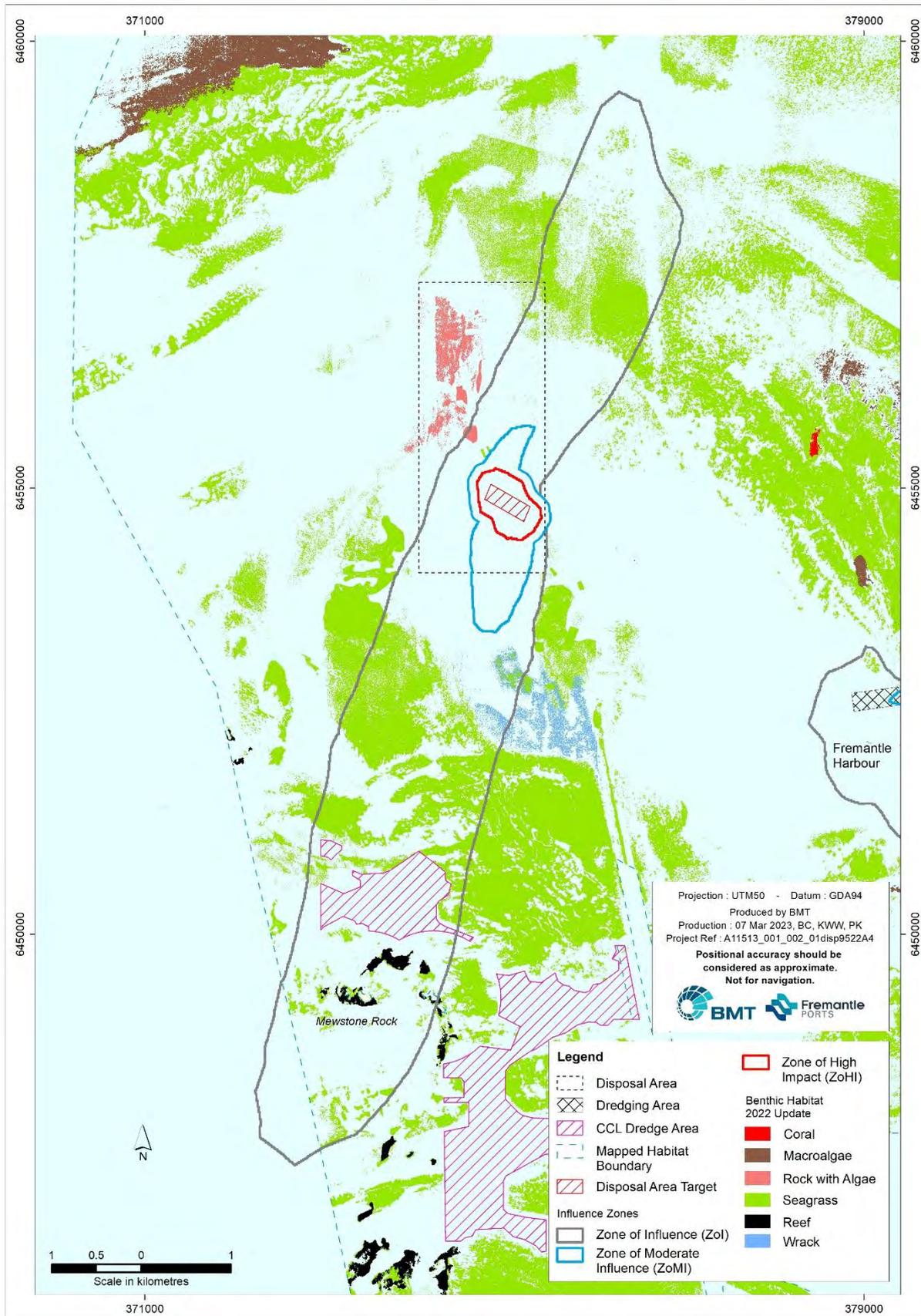


Figure 3.2 Result of ground truthing survey

Table 3.3 Total BCH coverage across the disposal and dredging areas for the Inner Harbour Maintenance Dredging project

Habitat	Dredging area			Disposal area			LAU (ha ¹)
	Zol (ha ¹)	ZoMI (ha ¹)	ZoHI (ha ¹)	Zol (ha ¹)	ZoMI (ha ¹)	ZoHI (ha ¹)	
Seagrass ²	28.35	0.17	0.44	366.18	0.11	0.02	3,593.23
Sand ³	178.21	16.89	11.96	1,262.92	96.46	37.26	9,669.36
Macroalgae ⁴	0.40	0.18	0.68	0.00	0.00	0.00	182.90
Reef	11.39	0.00	0.00	12.03	0.00	0.00	103.11
Wrack	0.00	0.00	0.00	9.08	0.00	0.00	38.29
Coral	0.00	0.00	0.00	0.00	0.00	0.00	1.99
Rock with Algae	0.00	0.00	0.00	1.89	0.00	0.00	34.64
No Data ⁵	98.21	158.25	81.30	0.00	0.00	0.00	13.43
Total	316.49	175.49	94.38	1,652.18	96.57	37.73	13,540.00

Notes:

1: ha – hectare; LAU – local assessment unit.

2: 'seagrass' is the compilation of Fremantle Ports (2019) classes 'seagrass dense', 'seagrass sparse', 'seagrass dense low confidence', and 'seagrass sparse low dense', and the CCL (2019) class 'vegetated'.

3: sand is the compilation of Fremantle Ports (2019) class 'sand' and CCL (2019) class 'non-vegetated'.

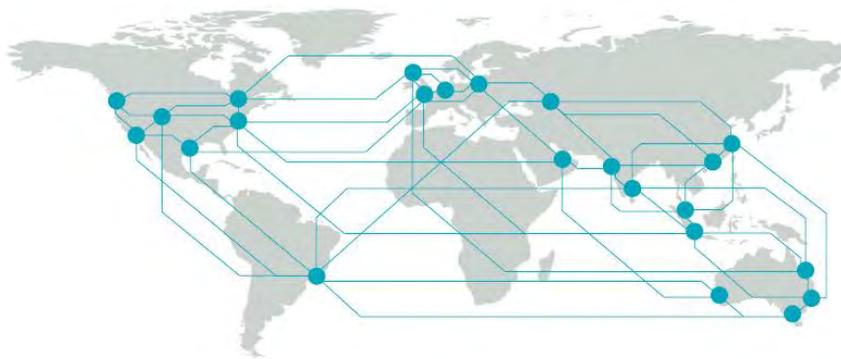
4: macroalgae is the compilation of Fremantle Ports (2019) classes 'macroalgae' and 'macroalgae low confidence'.

5: No data: area outside Fremantle Ports (2019) and CCL (2019). Investigations are not proposed as the 'no data' area is located in the south of the disposal area Zol, where impacts of the dredging are unlikely to occur.

4 References

BMT (2022) Environmental Review Document: Inner Harbour Maintenance Dredging Project. Prepared for Fremantle Ports by BMT Commercial Australia Pty Ltd, Report No. R-11513-5, version 0, 31 October 2022.

Fremantle Ports (2019) Benthic Habitat Classification. Dataset.



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Level 4
20 Parkland Rd
Osborne Park
WA 6017
Australia
+61 (8) 6163 4900

Registered in Australia
Registered no. 010 830 421
Registered office
Level 5, 348 Edward Street,
Brisbane QLD 4000 Australia

For your local BMT office visit www.bmt.org

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