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and Major Infrastructure

Empowering a thriving community

Mooring Zone extensions – Background information

Swan and Canning Rivers Management Act 2006 - Part 5 application

Background

The METRONET on Swan Ferry Service Expansion (MoS) is a WA Government initiative to expand public transport options on the Swan River. The project is intended to activate high-density riverside precincts, support economic growth through urban revitalisation, enhance tourism through a scenic transport option, reduce pressure on existing infrastructure by providing sustainable transport alternatives, and improve cross-river accessibility for residents and visitors. The expansion includes a new ferry route linking the existing Elizabeth Quay terminal with new terminals at Matilda Bay and Applecross, with additional routes and terminal locations also under consideration.

Swan and Canning Rivers Mooring Control Area

Under the Department of Biodiversity, Conservation and Attractions' (DBCA) Swan Canning Riverpark Mooring Management Program (MMP), management of swing moorings within the Swan Canning Riverpark is undertaken through a coordinated arrangement between DBCA and the Department of Transport and Major Infrastructure (DTMI).

The program provides that DBCA is responsible for the Riverpark management framework, including ensuring that mooring management is aligned with the protection of ecological, community benefit and amenity values and setting the parameters within which moorings may be managed in the Riverpark. DTMI, in turn, is responsible for the administration of swing moorings within the Swan and Canning Rivers mooring control area (MCA), including licensing and ongoing operational management, in accordance with the agreed mooring zones and management settings established through the MMP.

Accordingly, any amendment affecting the MCA should be considered in the context of both DBCA's Riverpark management responsibilities and DTMI's statutory and operational mooring management role.

Impact of Metronet on Swan Ferry Expansion on the Swan and Canning Rivers Mooring Control Area

Phase 1 of the MoS has identified ferry routes between Elizabeth Quay, Applecross and Matilda Bay with new ferry terminal infrastructure to be built in Applecross and Matilda Bay. 34 Matilda Bay Mooring Licence holders are directly impacted by the ferry route and terminal location.

DTMI Maritime (Maritime) consulted with DBCA to consider how these 34 affected mooring licence holders could be accommodated within the broader Swan River MCA, with Maritime proposing to expand some existing mooring zones. Subsequently, Maritime engaged a consultant to undertake sea grass mapping in seven proposed expanded mooring zones to enable further refinement. The output of this work along with a multi-criteria assessment undertaken within Maritime has further refined this down to four proposed mooring zones expansions.

It is proposed that mooring apparatus's belonging to the 34 affected licenses will be removed from the central area of the Matilda Bay mooring zone, and new mooring apparatus including anchoring be installed in the extended mooring zones. This work will be undertaken by a suitably qualified contractor who will be engaged through a government tender process

To progress the expansion and reconfiguration of the mooring zones, two statutory approvals are required under the *Swan and Canning Rivers Management Act 2006;* these include an amendment to the 2022 Mooring Management Program (underway) and Part 5 Development approval. This document provides information in relation to the Part 5 application.

Multi-criteria Assessment

The multi criteria assessment employed by DTMI included:

- Benthic Communities and Habitat Mapping (BCH) outcomes
- Suitable water depth (factoring in cost to install and maintain mooring apparatus)
- Practical shore access for mooring licence holders
- Heritage constraints
- Navigational safety considerations

Additional Assessment Considerations

When the MoS project was announced, Maritime commenced a moratorium on issuing new mooring site licenses through the Riverpark. Under this moratorium when a licensee surrendered their licence, they were held and not reissued by Maritime, with the intention that they could be used for displaced Matilda Bay licensees This has resulted in some sites becoming available within existing Mooring Zones, however upon further analysis several of these sites do not align to the mooring license holders requiring relocation

Taking this into account, following the multi-criteria assessment a broader analysis was undertaken of impacted mooring site licenses and licensed vessel size. A decision was taken (which is yet to be conveyed to the licensees) that the 34 affected mooring licence holders being relocated from Matilda Bay would be offered a new mooring site licence based on the length of their current licensed vessel, rather than the maximum vessel length on their existing mooring site licence. For example, there are some sites where an 8-metre vessel is licensed to a mooring site license with a maximum 20 metres swing room, which is an underutilisation of mooring zone space. Undertaking the analysis has ensured the most efficient use of water space across the four proposed mooring zone expansions.

Supplementary Information

The following information to support this Part 5 application can only be provided following the award of a contract for the removal and installation of moorings. It is understood that DBCA may offer conditional approval of the Part 5 application pending Maritime providing the information to an acceptable level at a later date.

- Contractor details
- engineering drawings of mooring design, including materials - in absence of contract provide mooring specifications (conditional approval) - once contract is awarded
- Details of mooring design including factors such as
    - alignment to best practice environmentally friendly mooring design,
    - how the design limits disturbance to seagrass and benthic habitat, and sediment disturbance with the anchor design.
- A Construction Environmental Management Plan for the installation of the moorings

The following information can only be provided following assessment by the Department of Planning, Lands and Heritage:

- Outcome of regulation 7 and 10 permit application under the Aboriginal Heritage Regulations 1974 – application lodgement reference number is: CAS-119456-D5Y5P1.

Summary

All 34 affected Matilda Bay mooring site licenses can be accommodated across three increased mooring zones with a fourth area, Mosman Bay South, needed as a contingency. The four areas have received in principle support from DBCA. The Matilda Bay mooring zone map is not included in this document and can be found at Attachment 1. The Matilda Bay mooring zone reconfiguration will result in a total area reduction of 3.19Ha.

Locations

Eight locations were considered in the multi-criteria assessment:

Location	Depth Range (metres)	Shore Access for Mooring Holders	Heritage Constraints	Environmental Considerations	Navigation Safety
Attadale	2 - 5	✓ Good access	✓ None identified	✗ High seagrass and macroalgae present, including proximity to sensitive areas	✓ No navigation issues
Claremont	6.5 - 12	✓ Good access	✓ None identified	✓ Low environmental constraint	✓ No navigation issues
Dalkeith (North)	4 – 7.2	✓ Good access	✓ None identified	✓ Lower environmental constraint in northern section	✓ No navigation issues
Dalkeith (South)	1 – 7.2	✓ Good access	✓ None identified	✗ Seagrass and mixed habitats	✓ No navigation issues
Mosman Bay North	11 – 17.5	✓ Good access	✓ None identified	✓ Low environmental constraint	✓ No navigation issues
Mosman Bay South	14.5 - 22	✗ Poor shore access from beach	✓ None identified	✓ Acceptable benthic habitat	✗ Close to navigation channel on eastern southern side – potential vessel traffic interaction which is deemed manageable.
Peppermint Grove	8 - 12	✓ Good access	✓ None identified	✓ Low environmental constraint	✓ No navigation issues
Nedlands	1.5 – 6.5	✓ Good access	✓ None identified	✗ Significant seagrass presence	✓ No navigation issues

Claremont

- Recommend this Mooring Zone be expanded as per the following graphic (represented in yellow). Overall, the intended zone increase is in total 1.11Ha.
- This will support an additional 13 mooring site licenses of various sizes.



Figure 1 Claremont Mooring Zone

Peppermint Grove

- Recommend this Mooring Zone be expanded as per the following graphic (represented in yellow). Overall, the intended zone increase is in total 2.47Ha.
- This will support an additional 7 mooring site licenses of various sizes.

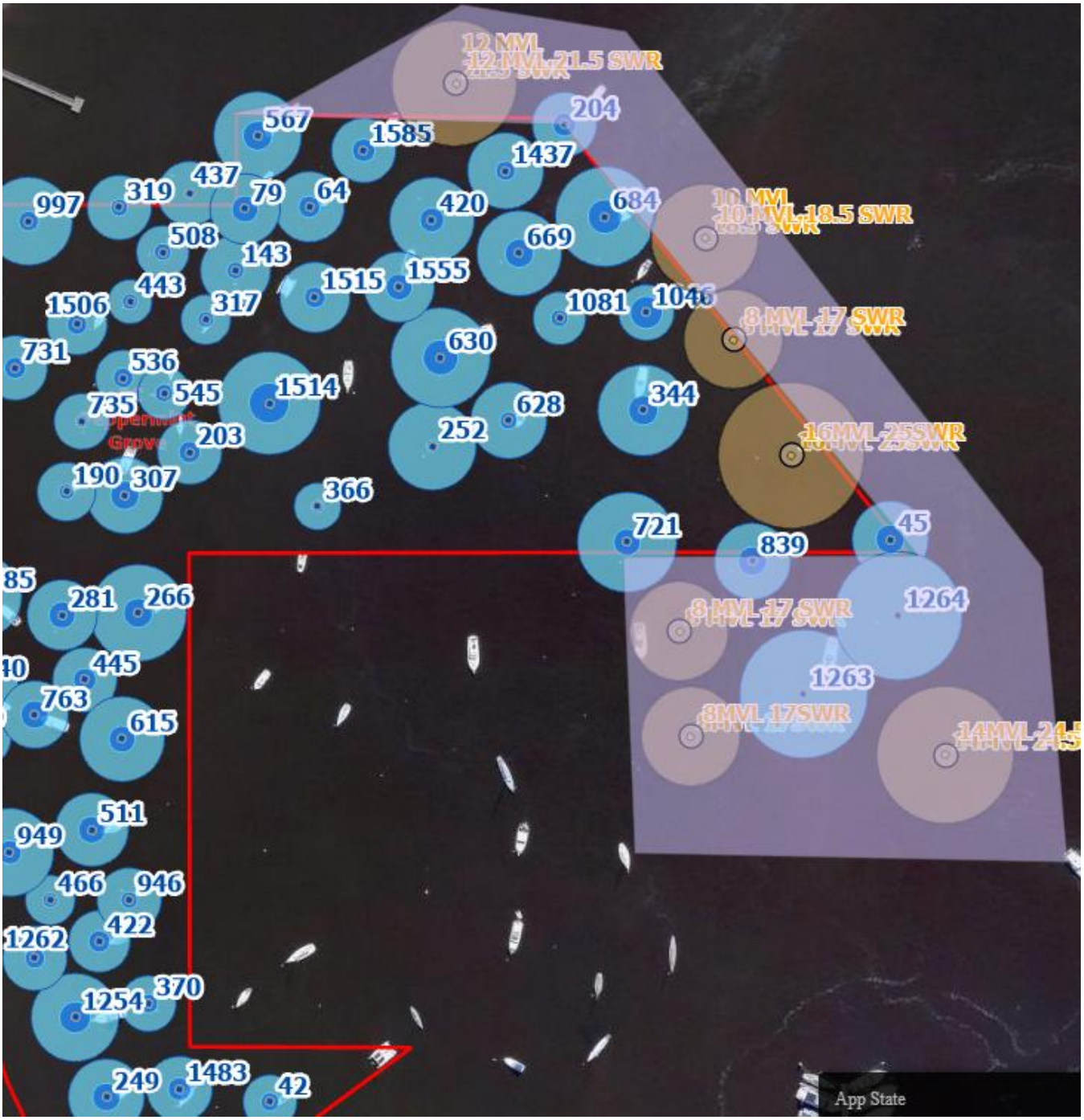


Figure 2 Peppermint Grove Mooring Zone

Mosman Bay North

- Recommend this Mooring Zone be expanded as per the following graphic (represented in yellow). Overall, the intended zone increase is in total 0.89Ha. This will support an additional 6 mooring site licenses of various sizes.

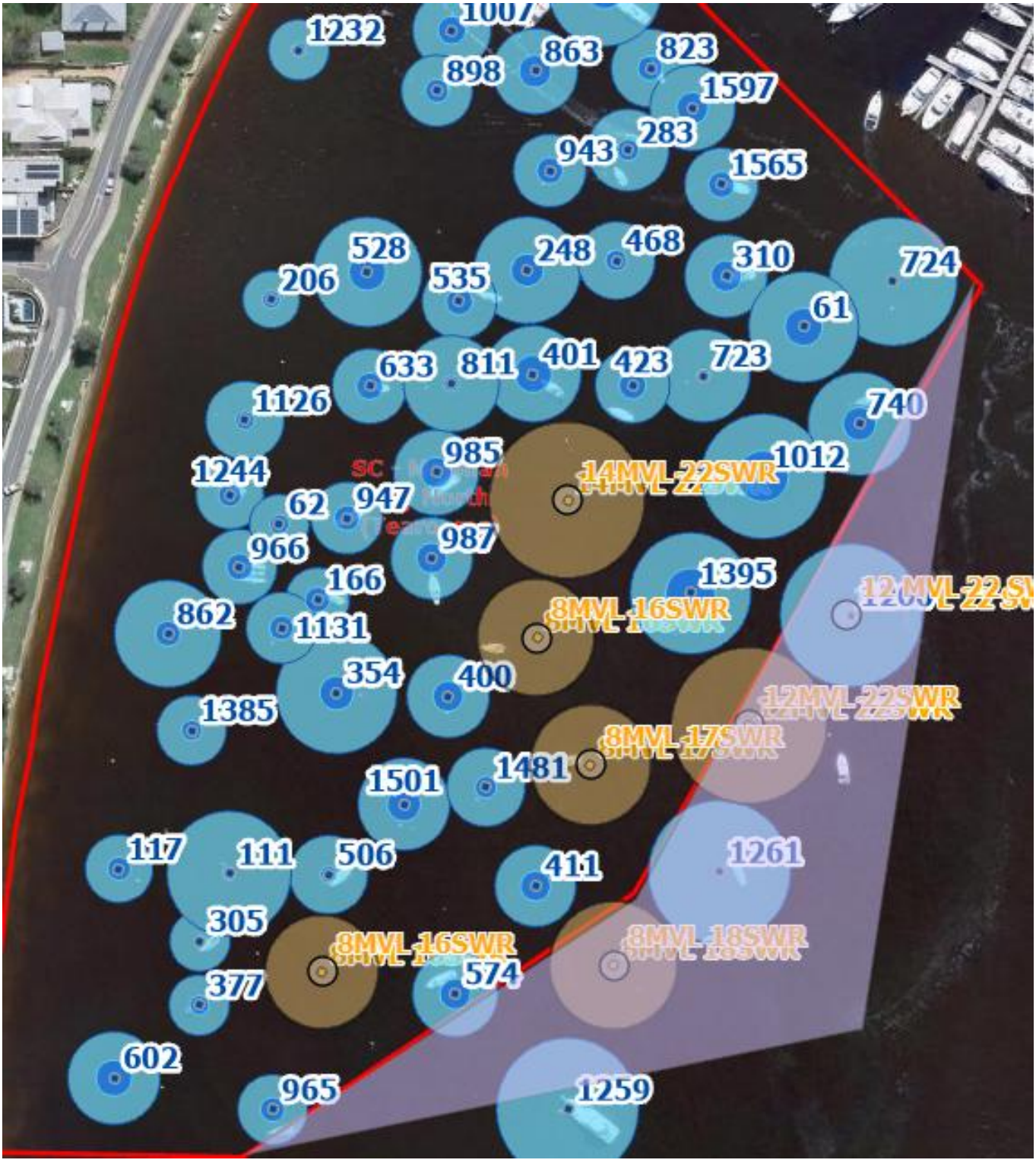


Figure 3 Mosman Bay North

Mosman Bay South

- Nil mooring site licenses have been considered for this site as it is known to be an undesirable location due to the limited access to the site from the land and the depth of water. Although it is noted that the area may be ideal for larger vessels. Overall, the intended zone increase is in total 4.02Ha.
- This site will be reserved to be discussed with DBCA in the event additional space is needed.

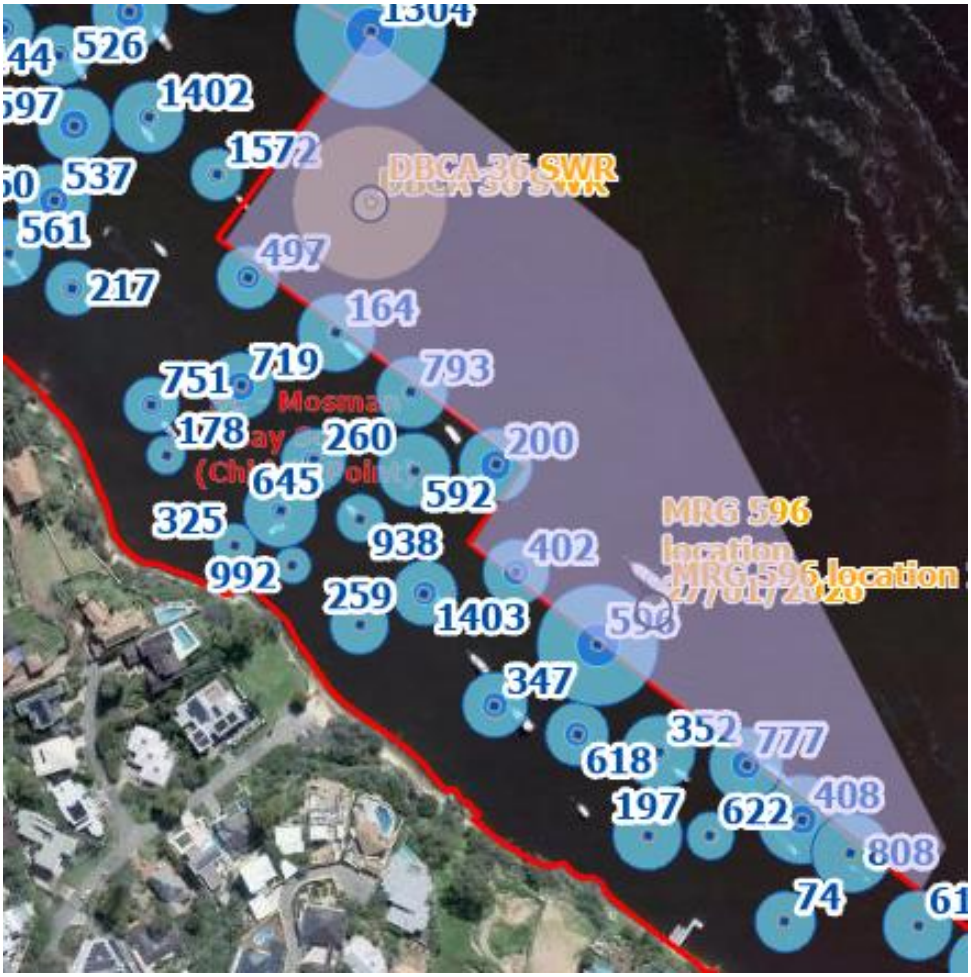
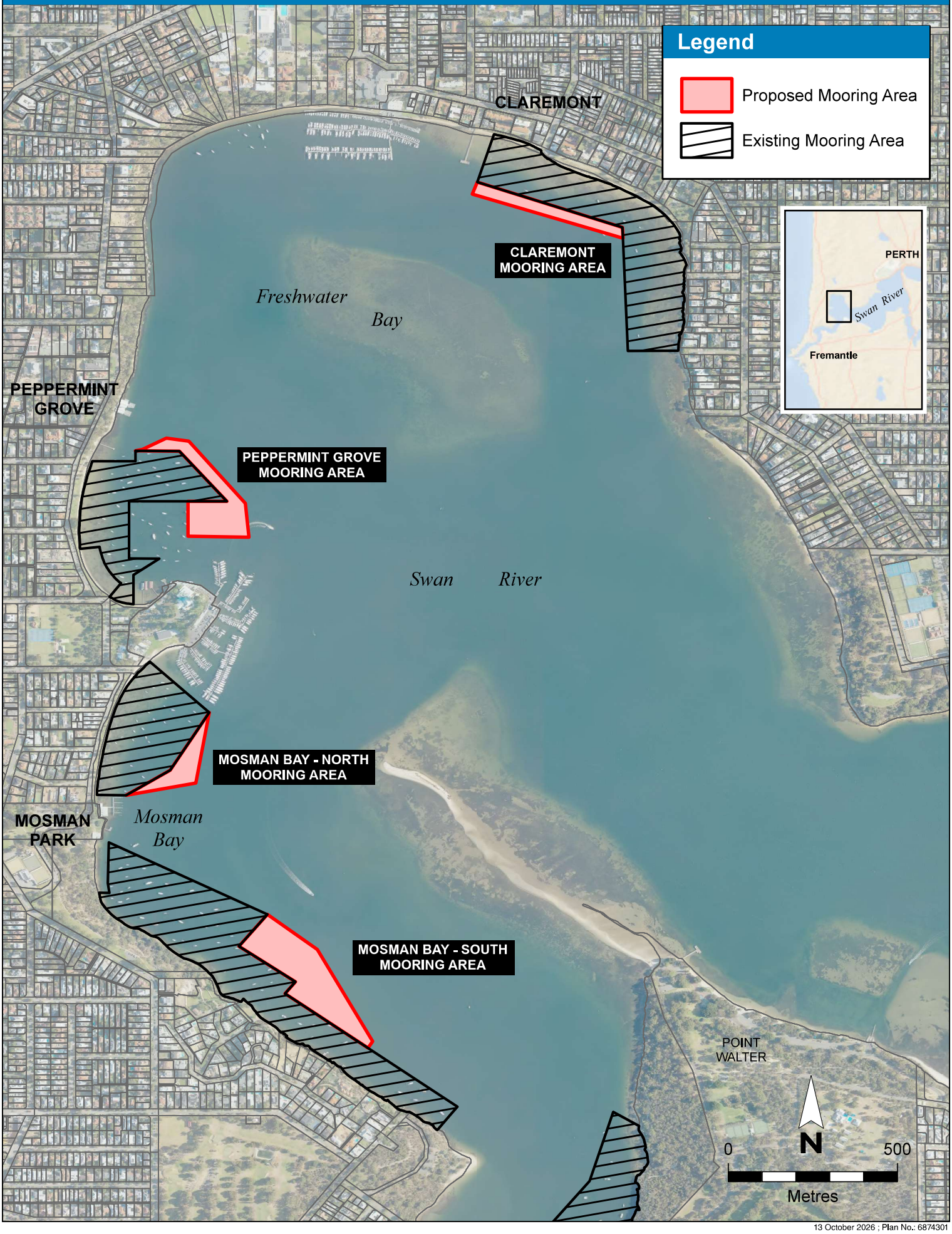


Figure 4 Mosman Bay South

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and Major Infrastructure

Proposed Additions to Existing Mooring Areas

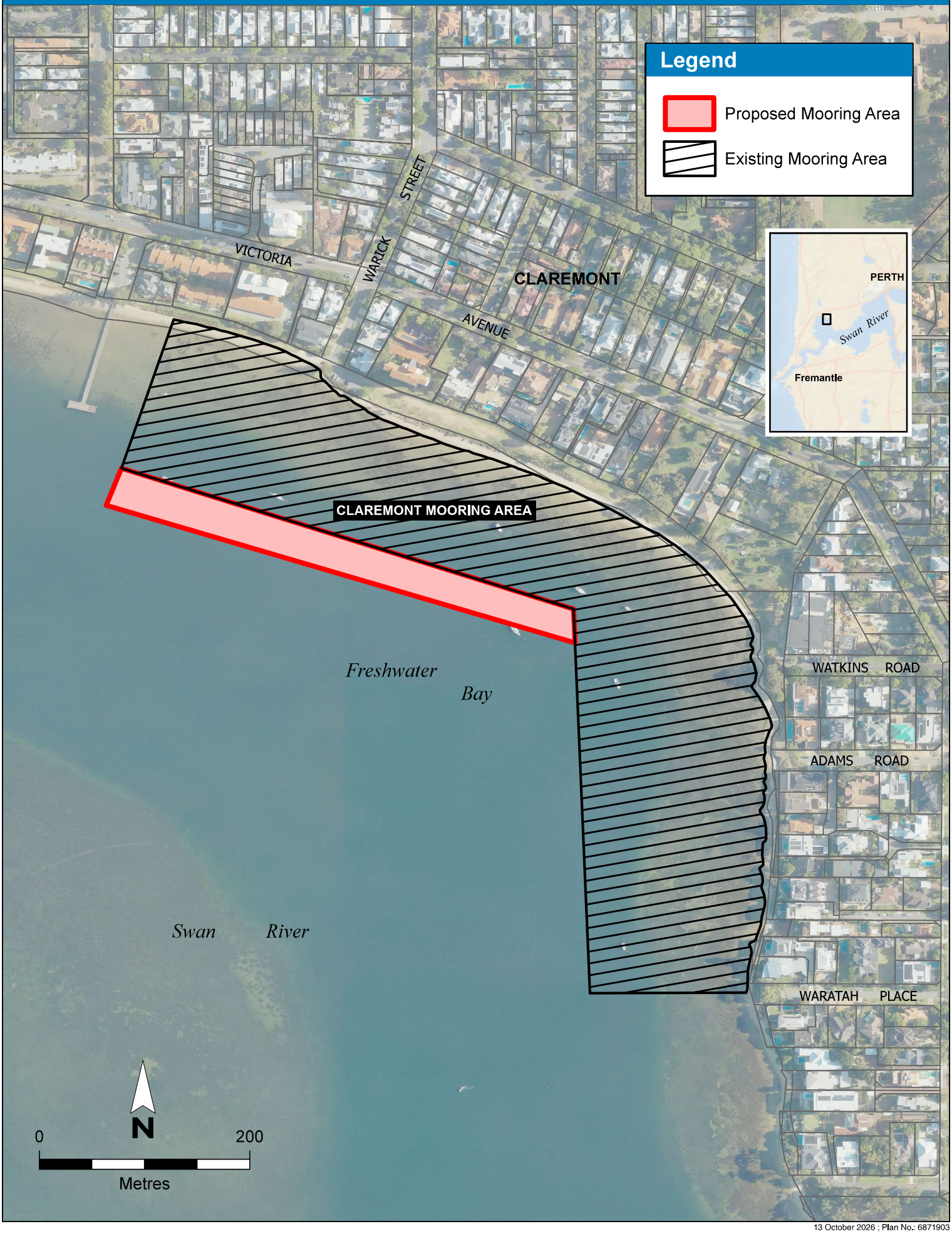
Various Locations



13 October 2026 ; Plan No.: 6874301

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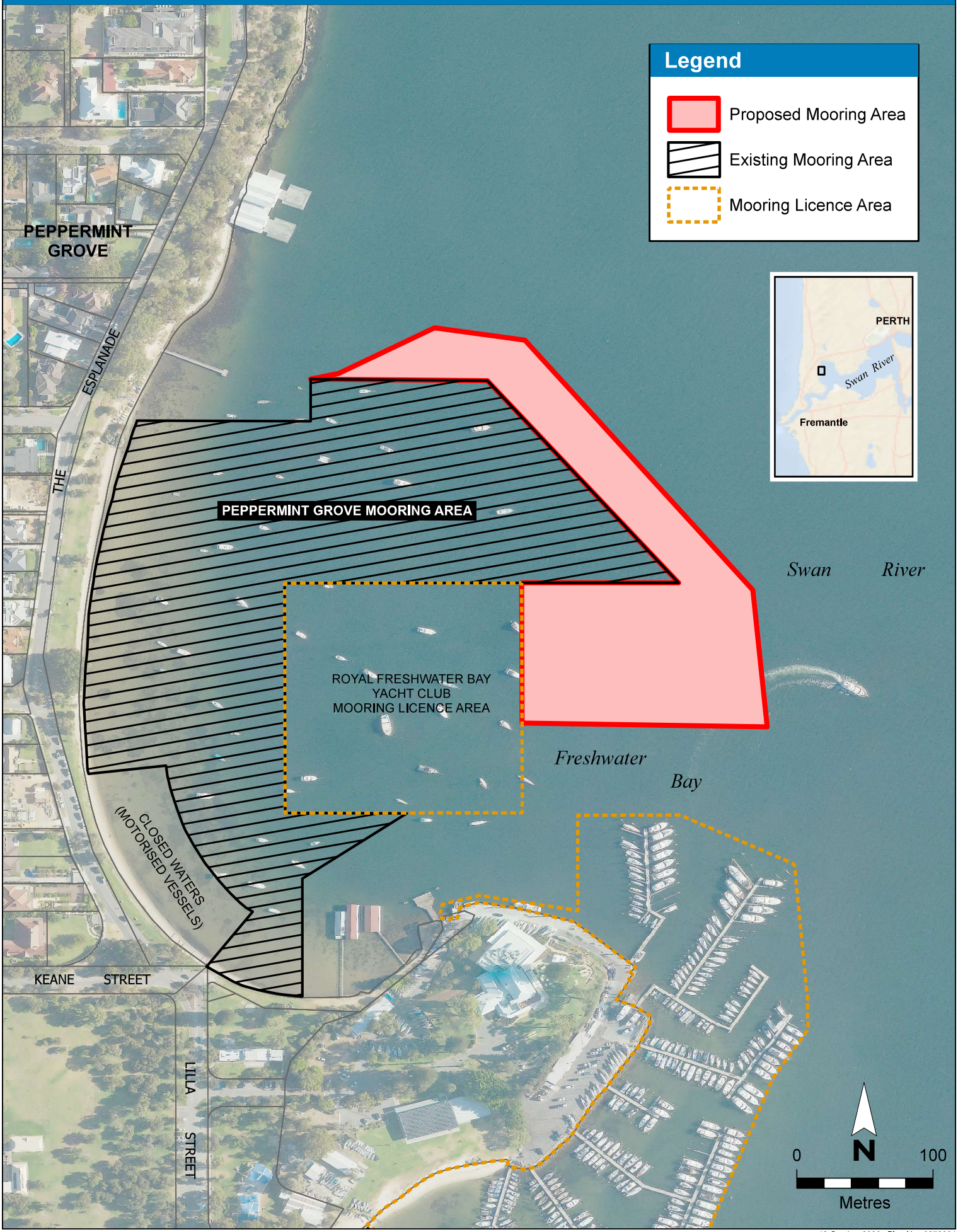
Proposed Mooring Area
Claremont



13 October 2026 ; Plan No.: 6871903

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Department of **Transport**
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Proposed Mooring Area
Peppermint Grove

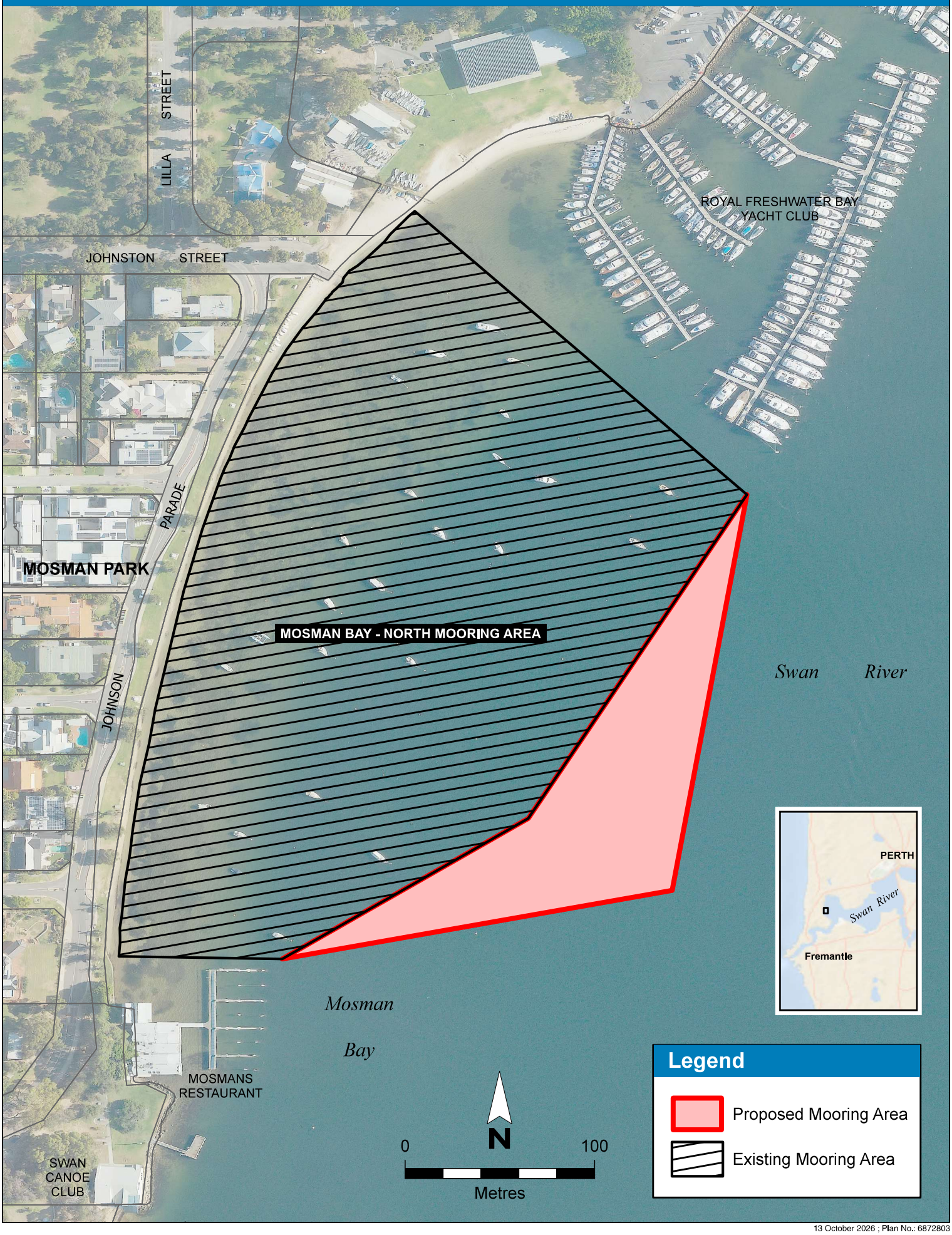


13 October 2026 ; Plan No.: 6873004

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Department of **Transport**
and Major Infrastructure

Proposed Mooring Area

Mosman Bay - North

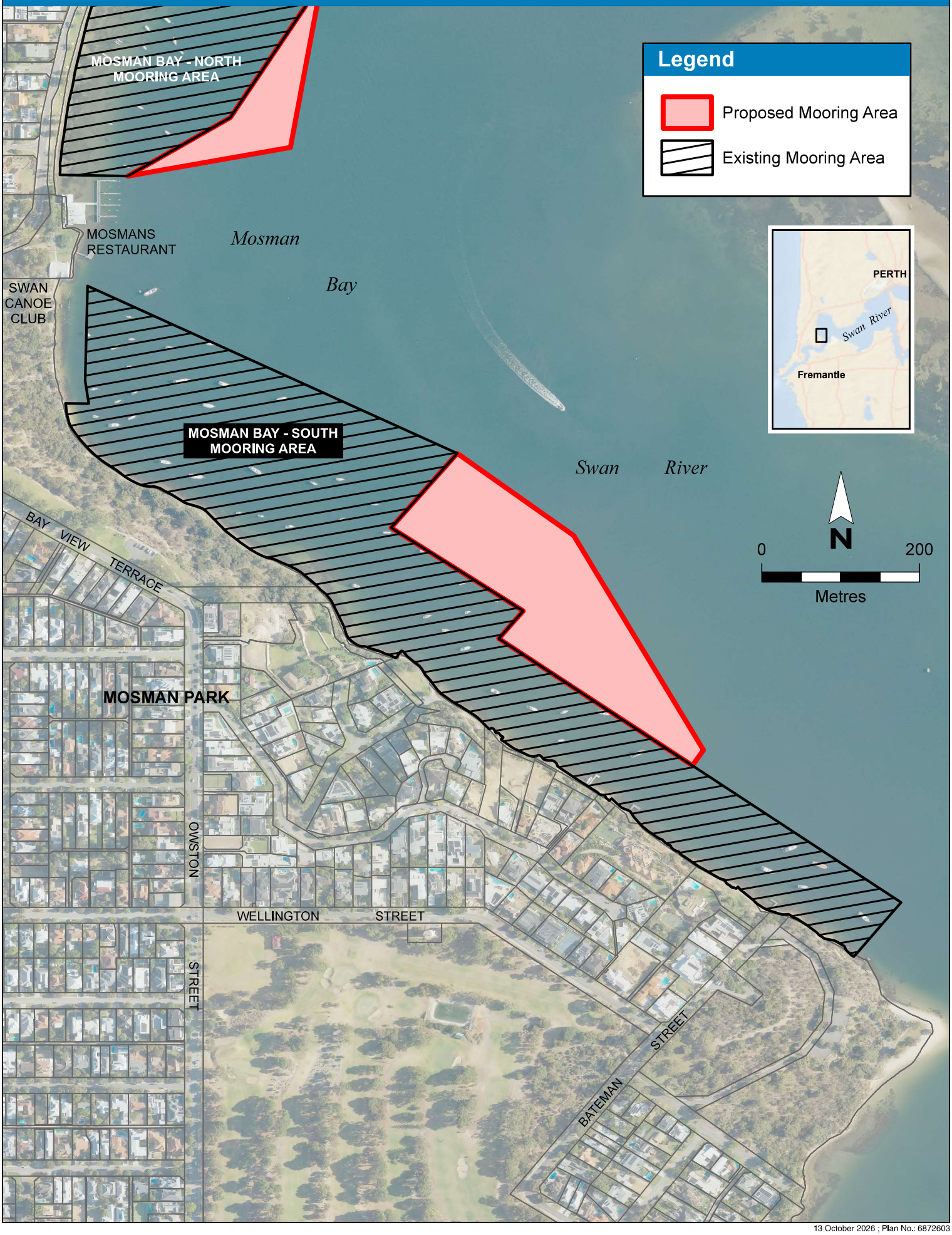


13 October 2026 ; Plan No.: 6872803

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Department of **Transport**
and Major Infrastructure

Proposed Mooring Area

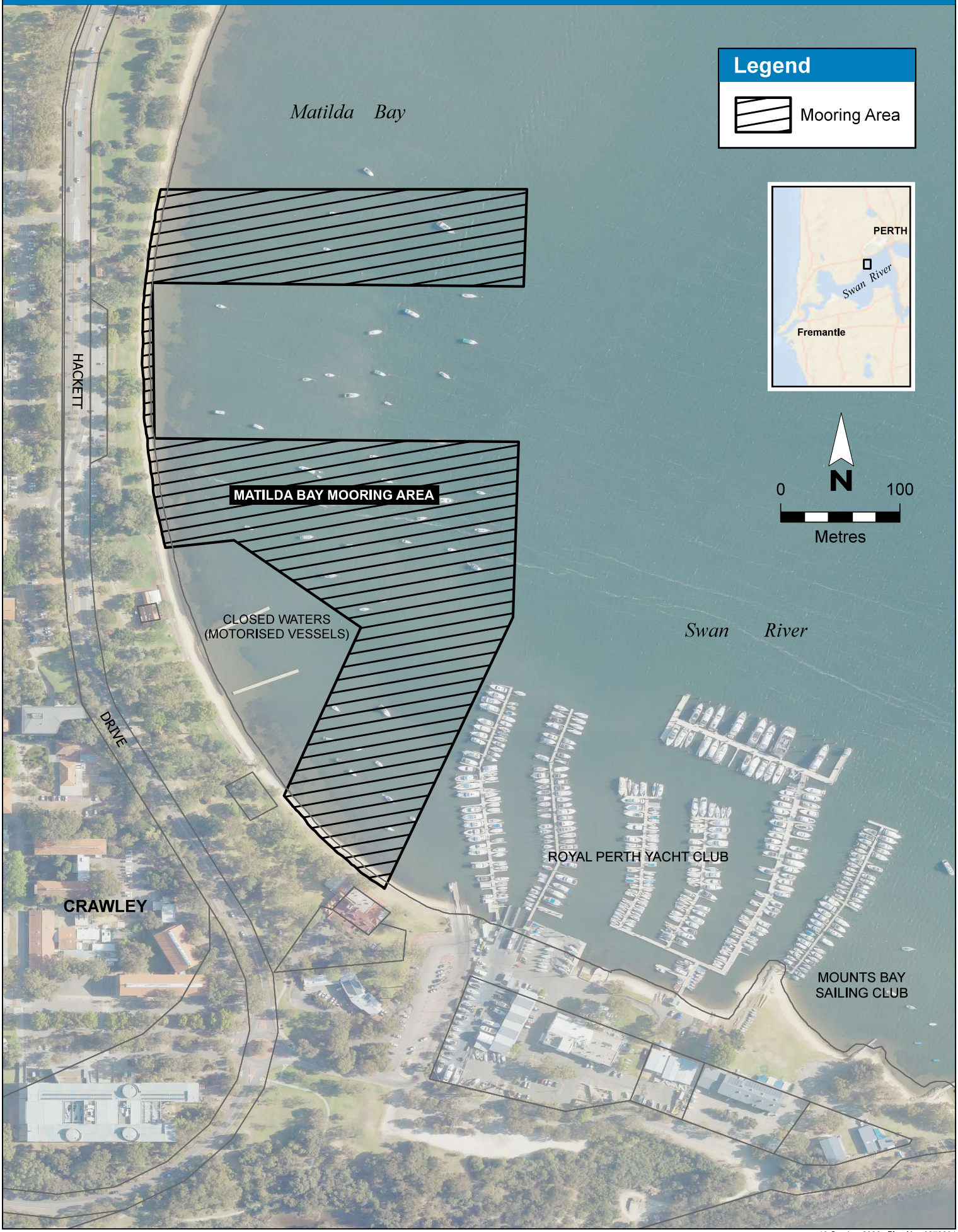
Mosman Bay - South



13 October 2026 ; Plan No.: 6872603

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Mooring Area
Matilda Bay



16 October 2026 ; Plan No.: 6872204

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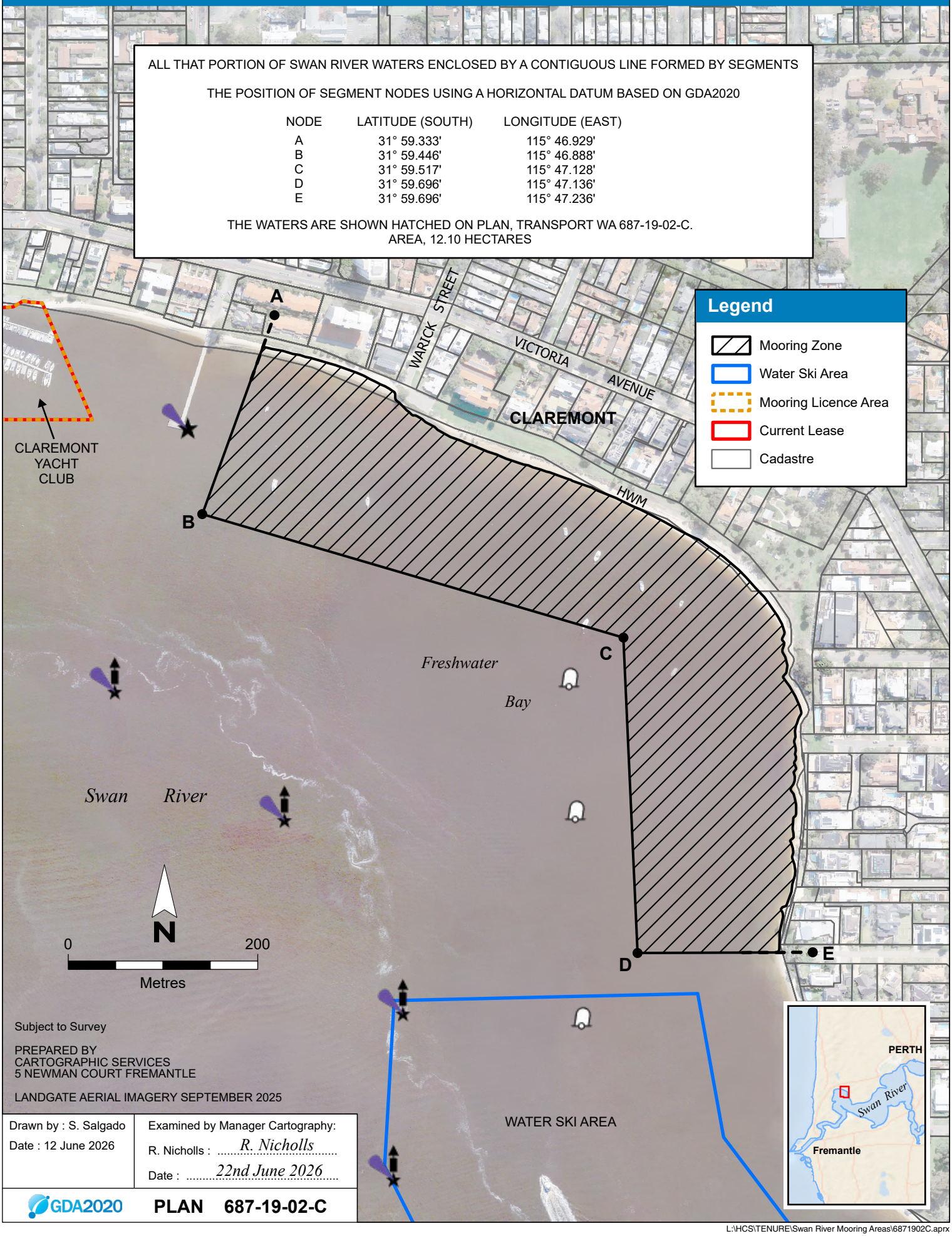
MOORING ZONE SITE PLAN
SWAN RIVER
CLAREMONT

ALL THAT PORTION OF SWAN RIVER WATERS ENCLOSED BY A CONTIGUOUS LINE FORMED BY SEGMENTS

THE POSITION OF SEGMENT NODES USING A HORIZONTAL DATUM BASED ON GDA2020

NODE	LATITUDE (SOUTH)	LONGITUDE (EAST)
A	31° 59.333'	115° 46.929'
B	31° 59.446'	115° 46.888'
C	31° 59.517'	115° 47.128'
D	31° 59.696'	115° 47.136'
E	31° 59.696'	115° 47.236'

THE WATERS ARE SHOWN HATCHED ON PLAN, TRANSPORT WA 687-19-02-C.
AREA, 12.10 HECTARES



Subject to Survey

PREPARED BY
CARTOGRAPHIC SERVICES
5 NEWMAN COURT FREMANTLE

LANDGATE AERIAL IMAGERY SEPTEMBER 2025

Drawn by : S. Salgado Date : 12 June 2026	Examined by Manager Cartography: R. Nicholls : *R. Nicholls* Date : *22nd June 2026*

GDA2020 **PLAN 687-19-02-C**

L:\HCS\TENURE\Swan River Mooring Areas\6871902C.aprx

Government of **Western Australia**
Department of **Transport**
and Major Infrastructure

MOORING ZONE SITE PLAN
SWAN RIVER
PEPPERMINT GROVE

ALL THAT PORTION OF SWAN RIVER WATERS ENCLOSED BY A CONTIGUOUS LINE FORMED BY SEGMENTS

THE POSITION OF SEGMENT NODES USING A HORIZONTAL DATUM BASED ON GDA2020

NODE	LATITUDE (SOUTH)	LONGITUDE (EAST)	NODE	LATITUDE (SOUTH)	LONGITUDE (EAST)
A	31° 59.872'	115° 46.265'	K	31° 59.936'	115° 46.341'
B	31° 59.872'	115° 46.352'	L	32° 00.027'	115° 46.342'
C	31° 59.855'	115° 46.349'	M	32° 00.027'	115° 46.390'
D	31° 59.853'	115° 46.363'	N	32° 00.053'	115° 46.348'
E	31° 59.835'	115° 46.401'	O	32° 00.109'	115° 46.348'
F	31° 59.840'	115° 46.436'	P	32° 00.097'	115° 46.302'
G	31° 59.939'	115° 46.527'	Q	32° 00.066'	115° 46.329'
H	31° 59.993'	115° 46.532'	R	32° 00.008'	115° 46.294'
I	31° 59.991'	115° 46.435'	S	32° 00.013'	115° 46.249'
J	31° 59.936'	115° 46.435'			

THE WATERS ARE SHOWN HATCHED ON PLAN, TRANSPORT WA 687-30-02-B.
AREA, 9.30 HECTARES



WATER SKI AREA

Legend

- Mooring Zone
- Water Ski Area
- Closed Waters (Motorised Vessels)
- Mooring Licence Area
- Current Lease
- Cadastre

PEPPERMINT GROVE
LEAKE STREET
THE ESPLANADE
H.W.M
IRVINE ST
KEANE STREET
ROYAL FRESHWATER BAY YACHT CLUB MOORING LICENCE AREA
Closed Waters (Motorised Vessels)
Freshwater Bay
Swan River
A B C D E F G H I J K L M N O P Q R S
N
0 100
Metres

Drawn by : S. Salgado Date : 12 June 2026	Examined by Manager Cartography: R. Nicholls : *R. Nicholls* Date : *22nd June 2026*
GDA2020	**PLAN 687-30-02-B**

Subject to Survey

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CARTOGRAPHIC SERVICES
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LANDGATE AERIAL IMAGERY
SEPTEMBER 2025

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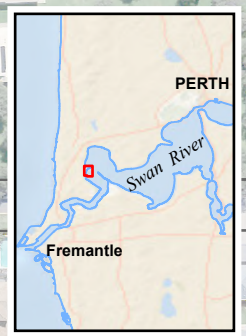
MOORING ZONE SITE PLAN
SWAN RIVER
MOSMAN BAY - NORTH

ALL THAT PORTION OF SWAN RIVER WATERS ENCLOSED BY A CONTIGUOUS LINE FORMED BY SEGMENTS

THE POSITION OF SEGMENT NODES USING A HORIZONTAL DATUM BASED ON GDA2020

NODE	LATITUDE (SOUTH)	LONGITUDE (EAST)
A	32° 0.183'	115° 46.364'
B	32° 0.272'	115° 46.468'
C	32° 0.385'	115° 46.448'
D	32° 0.404'	115° 46.337'
E	32° 0.403'	115° 46.276'

THE WATERS ARE SHOWN HATCHED ON PLAN, TRANSPORT WA 687-28-02-C.
AREA, 7.54 HECTARES



A
B
C
D
E

ROYAL FRESHWATER BAY YACHT CLUB

JOHNSTON STREET

H.W.M

HILL TERRACE

PARADE

MOSMAN PARK

JOHNSON

MOSMAN TERRACE

GLYDE STREET

MOSMANS RESTAURANT

Swan River

N

0 100

Metres

Legend

- Mooring Zone
- Mooring Licence Area
- Current Lease
- Cadastre

Drawn by : S. Salgado
Date : 12 June 2026

Examined by Manager Cartography:
R. Nicholls : *R. Nicholls*
Date : *22nd June 2026*

GDA2020

PLAN 687-28-02-C

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LANDGATE AERIAL IMAGERY
SEPTEMBER 2025

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Government of Western Australia
Department of Transport
and Major Infrastructure

MOORING ZONE SITE PLAN
SWAN RIVER
MOSMAN BAY - SOUTH

ALL THAT PORTION OF SWAN RIVER WATERS ENCLOSED BY A CONTIGUOUS LINE FORMED BY SEGMENTS

THE POSITION OF SEGMENT NODES USING A HORIZONTAL DATUM BASED ON GDA2020

NODE	LATITUDE (SOUTH)	LONGITUDE (EAST)
A	32° 0.559'	115° 46.278'
B	32° 0.560'	115° 46.310'
C	32° 0.544'	115° 46.308'
D	32° 0.459'	115° 46.265'
E	32° 0.593'	115° 46.561'
F	32° 0.648'	115° 46.640'
G	32° 0.796'	115° 46.730'
H	32° 0.806'	115° 46.723'
I	32° 0.900'	115° 46.865'
J	32° 0.956'	115° 46.816'

THE WATERS ARE SHOWN HATCHED ON PLAN, TRANSPORT WA 687-26-02-B.
AREA, 19.26 HECTARES

MOSMANS RESTAURANT

SWAN CANOE CLUB

Swan River

Mosman Bay

Legend
- Mooring Zone
- Mooring Licence Area
- Current Lease
- Cadastre

BAY VIEW TERRACE

H.W.M

OWSTON STREET

MOSMAN PARK

WELLINGTON STREET

BATEMAN STREET

N

0 200
Metres



Drawn by : S. Salgado
Date : 12 June 2026

Examined by Manager Cartography:
R. Nicholls : R. Nicholls
Date : 22nd June 2026

GDA2020

PLAN 687-26-02-B

Subject to Survey

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LANDGATE AERIAL IMAGERY
SEPTEMBER 2025

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BMT Commercial Australia Pty Ltd
Level 2, 150 St Georges Terrace,
Perth, WA 6000
Australia

ABN: 54 010 830 421

Technical note

Project	Swan River Mooring BCH Mapping		
Doc Ref	Tn-4030-1		
Date:	18 March 2026	To:	Amy Kempton, Louise Synnot Department of Transport and Major Infrastructure Public Transport Authority
From:	Sophie Cochrane, Dinesh Tuladhar		
Revision:	RevA – Editorial & Technical Review RevB – Director Review RevC – Client Review	Date:	18 March 2026 30 March 2026 31 March 2026
Subject:	Benthic Communities and Habitat Mapping Technical Note – Alternative Mooring Locations		

1.1 Project description and background

In association with the Public Transport Authority's Swan River Metronet Ferry Expansion, the Department of Transport and Major Infrastructure (DTMI) wish to relocate existing moorings at Matilda Bay to other areas within Swan River to accommodate the development and operation the Matilda Bay ferry terminal. The installation of permanent moorings may cause direct (i.e. removal) and/or indirect (i.e. burial/ smothering) impacts to benthic communities and habitats (BCH) present within the Swan River. DTMI provided seven potential mooring relocation areas and contracted BMT to completed BCH mapping of these areas with the purpose of identifying areas devoid of BCH to place new moorings without impacting BCH. BMT completed a ground truth survey on 3–4 February 2026, and BCH mapping results are presented in this technical note.

1.2 Ground truthing survey

1.2.1 Survey design

DTMI provided seven proposed mooring relocation areas in the middle-Swan River covering at total of 26.7 ha (hereafter collectively; Survey Areas; Figure 1.1):

- Attadale
- Claremont
- Dalkeith
- Mosman Bay North
- Mosman Bay South
- Nedlands
- Peppermint Grove

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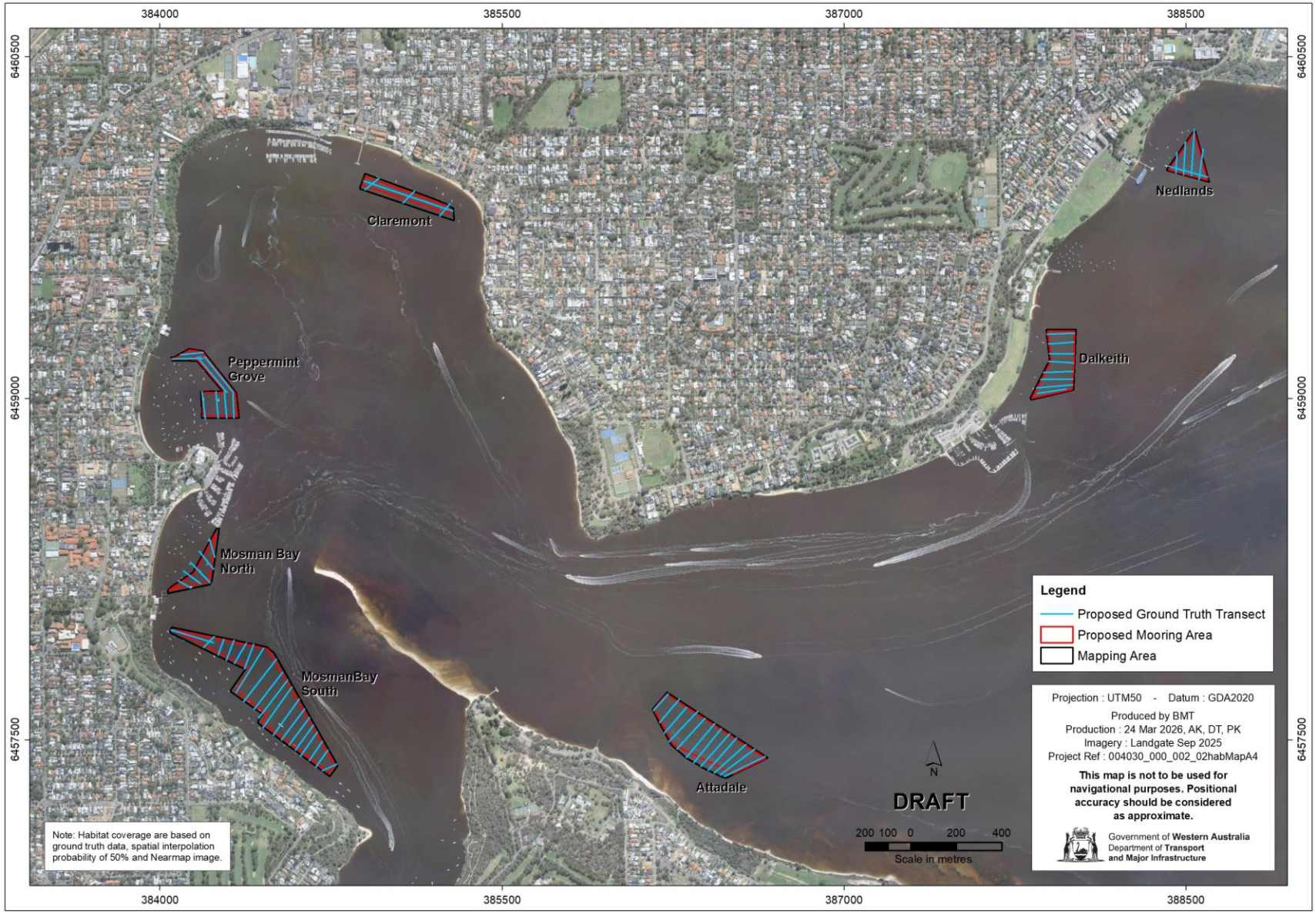


Figure 1.1 Proposed mooring relocation survey areas and ground truth transects for benthic community and habitat mapping

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A preliminary desktop assessment of existing habitat data, reports and satellite imagery and bathymetry datasets was completed to identify potential areas of interest and the optimal layout for ground truth towed video transects within BCH Survey Areas (Figure 1.1). Datasets included Nearmap and WorldView satellite imagery and multibeam echosounder (MBES) bathymetry datasets (DTMI 2025). The MBES bathymetry data (DTMI 2025) was determined one of the primary data sources, therefore BCH mapping is conducted within the full area of the MBES survey, which includes ~5 to 20 m additional buffer around the provided Survey Areas (Mapping Areas; Figure 1.1).

The review of available high-resolution satellite imagery indicated that classification of seabed features via remote sensing techniques was not feasible for majority of the Survey Areas due to lack of water clarity (tannins) and depth, resulting in low benthic feature visibility. Ground truth data would be required to identify and map BCH as a primary data source. A total of 61 ground truth towed video transects were positioned to spatially represent each Survey Area (Table 1.1 and Figure 1.1). The transects ranged from ~60 m to 400 m long, depending on the shape and orientation of the Survey Area, covering a total length of ~8.7 km (Table 1.1) and depths between ~1–19 m.

Table 1.1 Number and length of ground truth towed video transects in each Survey Area

Survey Area	Number of transects	Length (~m)
Attadale	12	2 093
Claremont	4	636
Dalkeith	8	1 013
Mosman Bay North	5	469
Mosman Bay South	19	2 796
Nedlands	5	757
Peppermint Grove	8	968
Total	**61**	**8 731**

1.2.2 Collection of towed video data

The BCH field survey was completed in late summer during peak growth periods for seasonal and ephemeral benthic flora. Three field personnel conducted the BCH field survey between 3 and 4 February 2026. Weather conditions during the BCH field survey were relatively calm with moderate winds (9–30 km/h), minimal wind swell and a high and low tide of ~1.1 m and 0.5 m respectively. Ground truth videos were collected topside from 6.5 m vessel '*Assassin*' along all 61 of the predefined towed video transects. Visibility was generally limited across transects due to background turbidity experienced in the Swan River; however, BCH were able to be characterised in the footage collected.

High-definition towed video data was collected using Spot X Real–Time Underwater Video System. The video system was lowered topside from the side of the vessel (mid-vessel) to ~0.5 m above the seabed to record seabed features. The height of the camera above the seabed was monitored by the field personnel to provide a field of view containing a 2–3 m wide band of the seabed and ensure hight above seabed remained at ~0.5 m. Video footage was recorded using the primary downward–facing camera while the secondary (~30–40 degree angle) camera was used to navigate the transect path (i.e., avoiding unnecessary damage to benthic habitat or avoid obstacles along the transect). Live footage was relayed to the vessel via an umbilical cord during deployment to navigate/fly the system and allow for semi qualitative analysis, as required. The vessel travelled at a speed of 1–5 knots to ensure the best quality footage was captured. A waypoint at the start and end of each transect was recorded using a handheld Global Positioning System (GPS), and a tracklog was recorded using an echomap with inbuilt GPS. Any

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positional offset experienced by the cameras position in relation to the vessel is within the positional accuracy of the GPS (<5 m) and is considered insignificant for the purposes of habitat mapping. The time was recorded by the camera at the start of each transect to provide an accurate definition of start and end time to match with the tracklog. The recorded tracklog contained date, time, latitude, longitude and heading information. Video footage was backed up each day onto an external storage device.

1.2.3 Classification of video footage

The video footage was analysed and classified according to the categories listed in Table 1.2 by a trained marine ecologist using Transect Measure (SeaGIS 2013). The software allows a single benthic habitat type to be assigned to each frame of video footage. The BCH was classified by identifying the dominant habitat category and minor categories, where possible (Table 1.2). A percent (%) cover category was also applied to each frame of the video where BCH was present (Table 1.2).

The BCH classifications were cumulative of all categories present within the frame of video footage including mixed assemblage (i.e., there was no single dominant habitat; Table 1.2). Following classification, the time/classification log was merged with the time/position log to provide a single file with a classification of every position where valid footage was obtained, resulting in a shapefile of classified ground truth transects (Section 1.4.2).

Table 1.2 Benthic communities and habitat classes and percent cover classifications

Major class	Minor class	Cover
Seagrass	*Halophila ovalis* *Halophila spinulosa* Mixed *Halophila* spp. Other sp.	Very sparse (<5%) Sparse (5-35%) Moderate (35-70%) Dense (70-100%)
Mixed	Mixed seagrass and macroalgae	
Macroalgae	Macroalgae	
Filter feeders	Sponges/hydroids/other	
Sand	Bare sand Shell debris, rocky rubble	None

1.3 Mapping of benthic communities and habitat mapping

1.3.1 Classification and mapping procedures

Spatial distribution of major BCH categories were predominately mapped based on the classified ground truth transect data. In addition to the ground truth data collected, the MBES bathymetry dataset (DTMI 2025) and available Nearmap imagery (in shallow <1 m nearshore areas) were also utilised to map the BCH. Ground truth information representing presence/absence of the major BCH categories (Table 1.2) in the survey areas derived from classified towed video data were used to interpolate habitat using the regression kriging method with python scripting. Kriging is a geostatistical method that estimates/ predicts the value of an attribute (e.g. benthic habitat) at unobserved locations based on its observed value at nearby locations. The regression kriging allowed integrating seabed depth and slope to predict the probability of benthic habitat occurrence within the Mapping Areas (Figure 1.1). Results of prediction models representing presence likelihood of each of the major BCH categories (Table 1.2) as well as the substrate types were produced in 2 x 2 m grids over the Survey Areas.

Based on the review of the percentage probability distribution results, composite maps of major BCH categories (Table 1.2) and the substrate types were prepared combining areas with 50% occurrence

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likelihood. A larger number of ground truth points confirming presence of a particular BCH category increases the likelihood of it being represented by the prediction map whereas sparse and small number of ground truth points showing the presence may result in the probability being reduced. There were some spatial overlaps between the likelihood areas of benthic habitat categories. These combined categories are representative of the natural co habitats. Some of the small and discrete patches may not have been delineated on the maps due to scale. The post-processing of the prediction result raster and shapefiles were completed in ArcGIS version 10.8 (ESRI 2020).

Nearmap images with good through-water visibility and temporally representative were selected to assess the extent of vegetated areas in shallow (<1 m) areas with the Survey Areas. Small areas of additional seagrass visible in the shallow areas were manually digitised based on the Nearmap image (21 Jan 2026) within Attadale, Nedlands and Dalkeith Survey Areas, which were later integrated with the composite BCH map.

1.3.2 Validation of benthic communities and habitat interpolation results

The BCH mapping result were validated against the classified ground truth video tracklog dataset by cross checking the actual classification of the video transect data with the final BCH mapped layer. Accuracy assessment results are presented below as user's accuracy, producer's accuracy (Table 1.3) and overall accuracy. User's accuracy indicates the probability that image pixel classified in the habitat layer is representative of classifications from the ground truth data, therefore indicating the reliability of the map from a user's point of view. Producer's accuracy is the proportion of validation points that are classified into the correct classifications in the mapped layer. Overall accuracy reports the proportion of correctly classified points by the total points used for validation.

User's accuracy of the final dataset is calculated by dividing the total number of correct pixels in a classification by the total number of pixels that were classified. The commission error, which represents the overestimation of a BCH class, is derived by subtracting the user's accuracy from 100 and indicates the proportion of validation points assigned to incorrect class. Producer's accuracy is calculated by dividing total number of correctly classified validation points by total number of points in the validation type. Omission error, representing underestimation of a BCH class, is derived by subtracting producer's accuracy from 100 and indicates proportion of validation points left out by the map classes.

Overall accuracy of the BCH results not presented in Table 1.3, however is 91.5%. Seagrass and macroalgae areas have the user's accuracy of above 92% and 85% respectively (Table 1.3). Areas with mixed seagrass and macroalgae habitat have a user's accuracy of 98%. A relatively lower user's accuracy of 75% for filter feeder areas can be associated to the underestimation of filter feeders occurring in isolated locations surrounded by larger number of ground truth points classified as bare sand. Producer's accuracy is not a useful form of accuracy for the map user; however, it is summarised in Table 1.3 below.

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Table 1.3 Summary of accuracy assessment of the BCH map

	Mapped categories							
Ground truth categories	Benthic communities and habitats	Seagrass	Mixed[1]	Macroalgae	Filter feeders	Bare sand	Total	Producer's accuracy (%)
	Seagrass	403	3		2	12	420	96.7
	Mixed[1]	5	92	2		5	104	95.2
	Macroalgae	7	3	249	3	71	333	75.7
	Filter feeders			5	664	350	1019	65.2
	Sand	27	2	39	215	6497	6780	95.8
	Total	442	100	295	884	6935	8656	-
	User's accuracy[2] (%)	92.3	98.0	85.1	75.1	93.7	-	-

Notes:

1. **"Mixed" = Mixed seagrass and macroalgae, see Table 1.2 for further detail.**
2. **User's accuracy indicates the probability that classified areas in the habitat layer actually represents that class on the ground, therefore indicating the reliability of the map from a user's point of view. Overall accuracy reports the proportion of correctly classified points by the total points used for validation.**
3. **Non-percentage values in the table represent the number of ground truth points overlapping the mapped areas.**
4. **"-" = No data**

1.3.3 Mapping limitations

Due to the dominance of ephemeral species in these survey areas, and the typical seasonal changes in biomass and extent of ephemeral species the mapped BCH coverage may not represent extent of the coverage of BCH in other seasons and years. The mapped BCH coverage is considered a representative "snap-shot" in temporal scale.

1.4 Results

1.4.1 Ground truthing benthic communities and habitat

Transects were classified and mapped to understand preliminary BCH assemblages, distribution and extent in the survey areas. Percent cover was also assessed during the video analysis classifications for each BCH category to assign an overall cover (Table 1.2). The BCH classifications assigned during the video analysis were detailed to the lowest taxonomic level, where possible, and majority of BCH transects included classification to seagrass genera or species level. However, for the purposes of mapping validation, seven major BCH categories were assigned to classification of the ground truth video analysis (Table 1.1). Example images of the habitat classifications identified during the Transect Measure processing and analysis (Section 1.2.3) are provided in Annex A.

Classified ground truth video analysis from within the Survey Areas identified predominantly bare sand commonly interspersed with filter feeders (anemones), along with isolated patches of seagrass (*Halophila* spp.) and macroalgae (Figure 4.1). A summary of the classified ground truth towed video transects is listed below for each Survey Area:

- In the Attadale Survey Area, isolated patches of seagrass were observed in three out of 12 transects (Figure 1.2). The observed seagrass comprised *Halophila ovalis* ranging from very

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sparse (<5%)–moderate (35-70%) coverage. Filter feeders and macroalgae were observed across the majority of transects (Figure 1.2).

- In the Claremont Survey Area, predominantly bare sand was observed with minor patches of macroalgae and filter feeders in the western and eastern extents of the transects (Figure 1.3).
- In the Dalkeith Survey Area, very sparse–dense *H. ovalis* was observed predominantly in the nearshore area of the southern transects (Figure 1.4). Isolated patches of macroalgae and mixed assemblages (*H. ovalis* and macroalgae) were observed throughout transects. Filter feeders were observed in deeper areas of the Dalkeith transects (Figure 1.4).
- In the Mosman Bay North Survey Area transects comprised predominantly bare sand with isolated patches of filter feeders (Figure 1.5). In the Mosman Bay South Survey Area transects predominantly comprised isolated filter feeders with minor patches of macroalgae (Figure 1.6).
- In the Nedlands Survey Area transects comprised predominantly seagrass or seagrass and macroalgal assemblages (Figure 1.7). Seagrass in the Nedlands Survey Area comprised large patches (up to ~150 m) of *H. ovalis, H. spinulosa* and mixed *Halophila* spp. In the southern extent of transects, predominantly bare sand with isolated patches of macroalgae were observed (Figure 1.7).
- In the Peppermint Grove Survey Area predominantly bare sand was observed with isolated patches of filter feeders, and macroalgae in the northern transects (Figure 1.8).

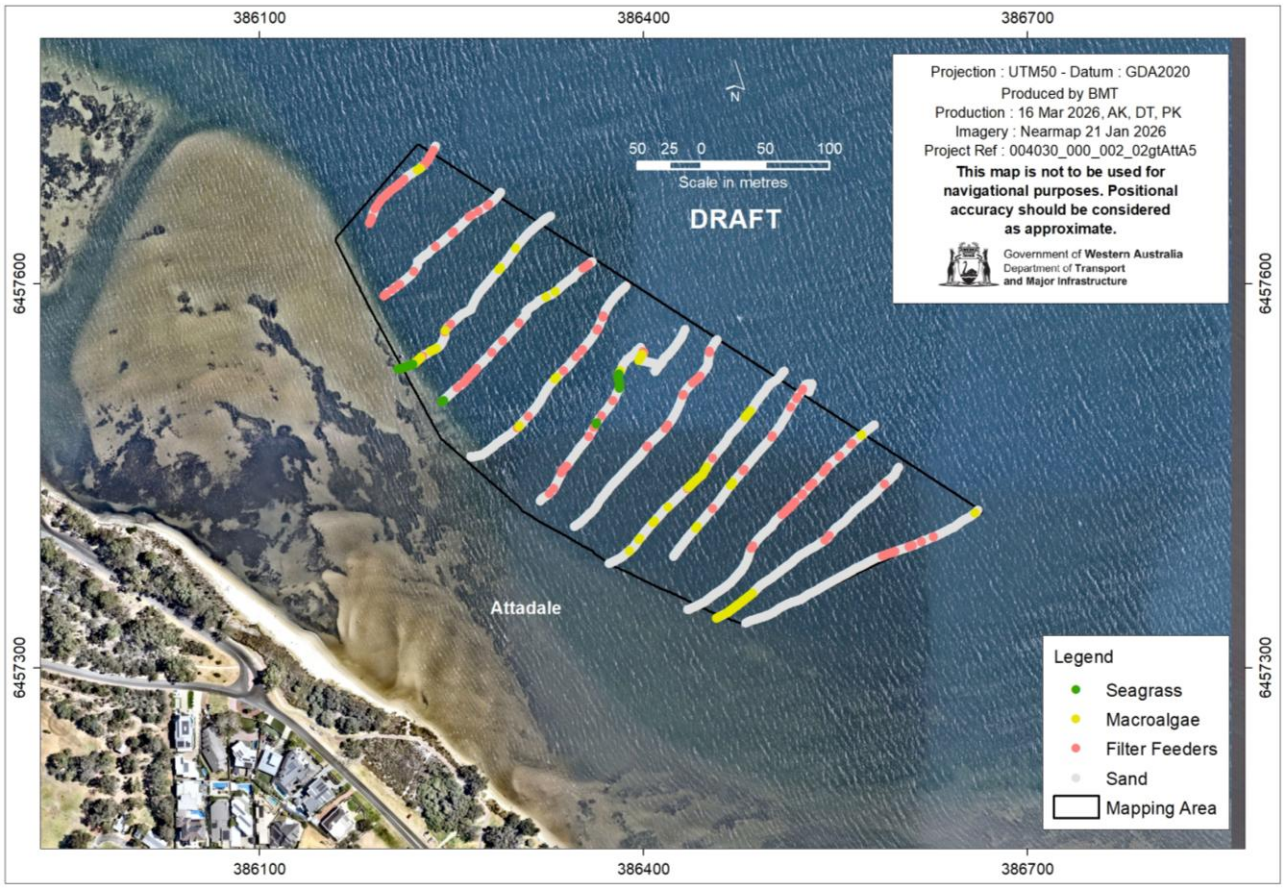


Figure 1.2 Classified ground truth video transects within the Attadale Survey Area

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Figure 1.3 Classified ground truth video transects within the Claremont Survey Area

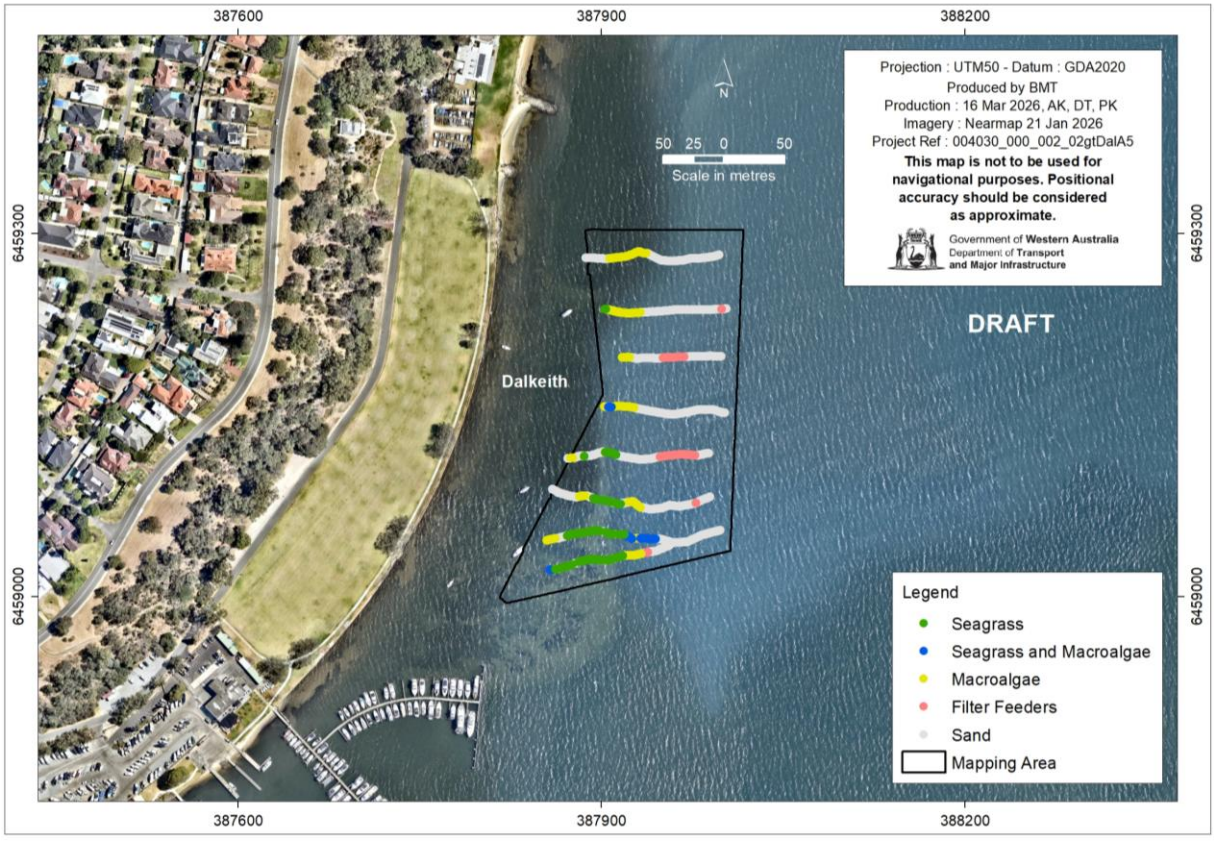


Figure 1.4 Classified ground truth video transects within the Dalkeith Survey Area

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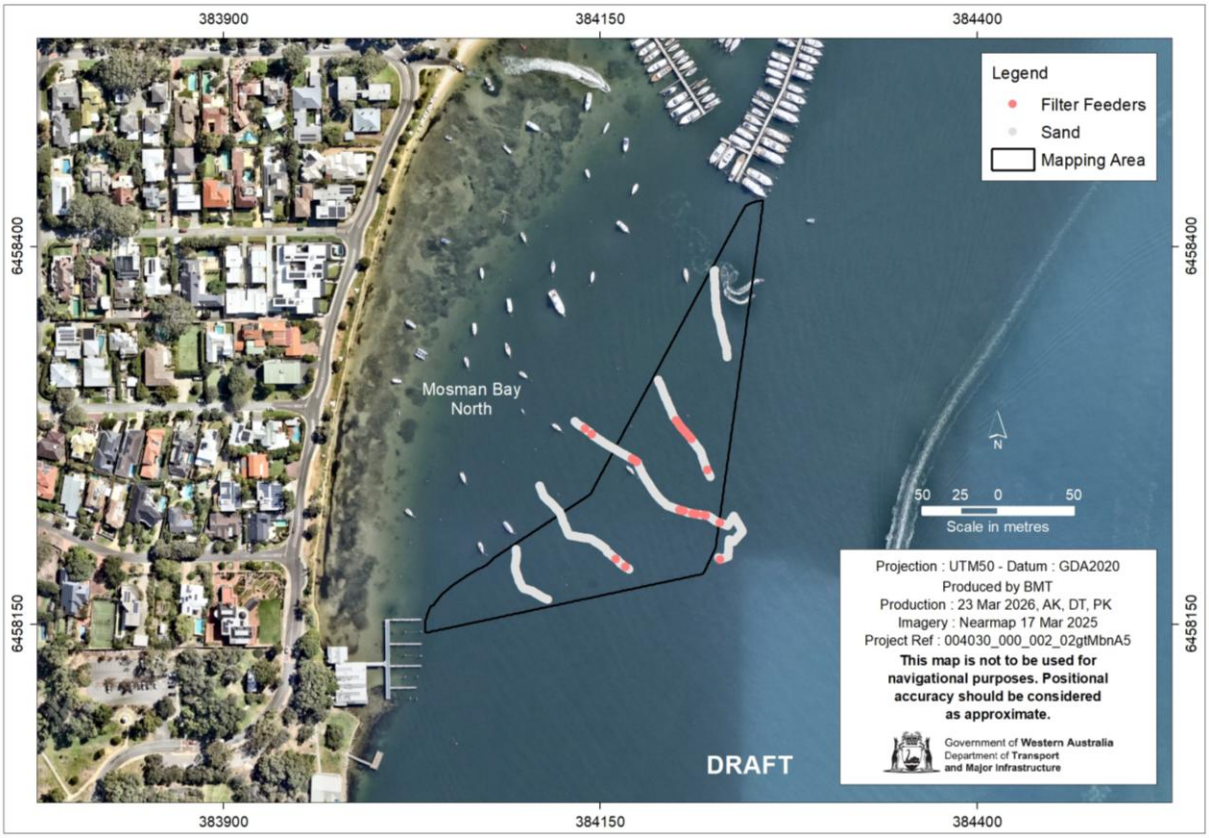


Figure 1.5 Classified ground truth video transects within the Mosman Bay North Survey Area



Figure 1.6 Classified ground truth video transects within the Mosman Bay South Survey Area

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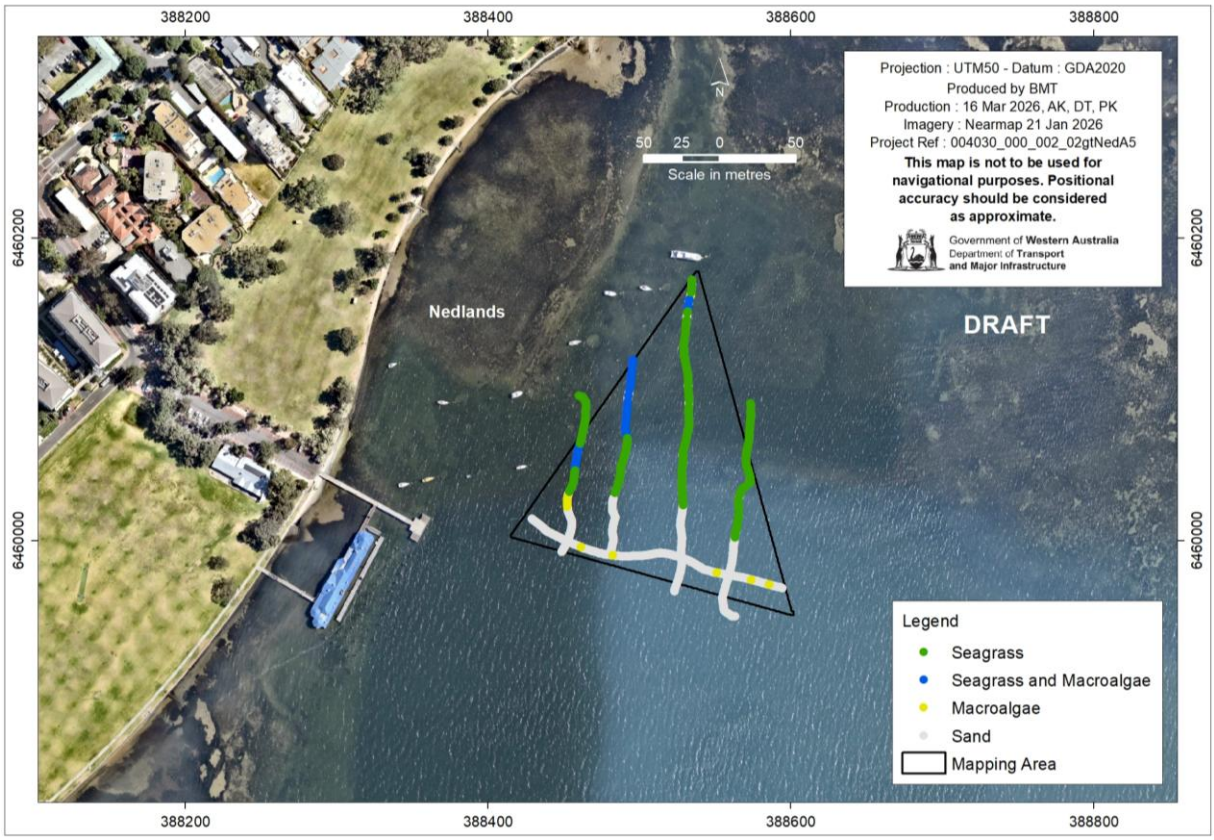


Figure 1.7 Classified ground truth video transects within the Nedlands Survey Area

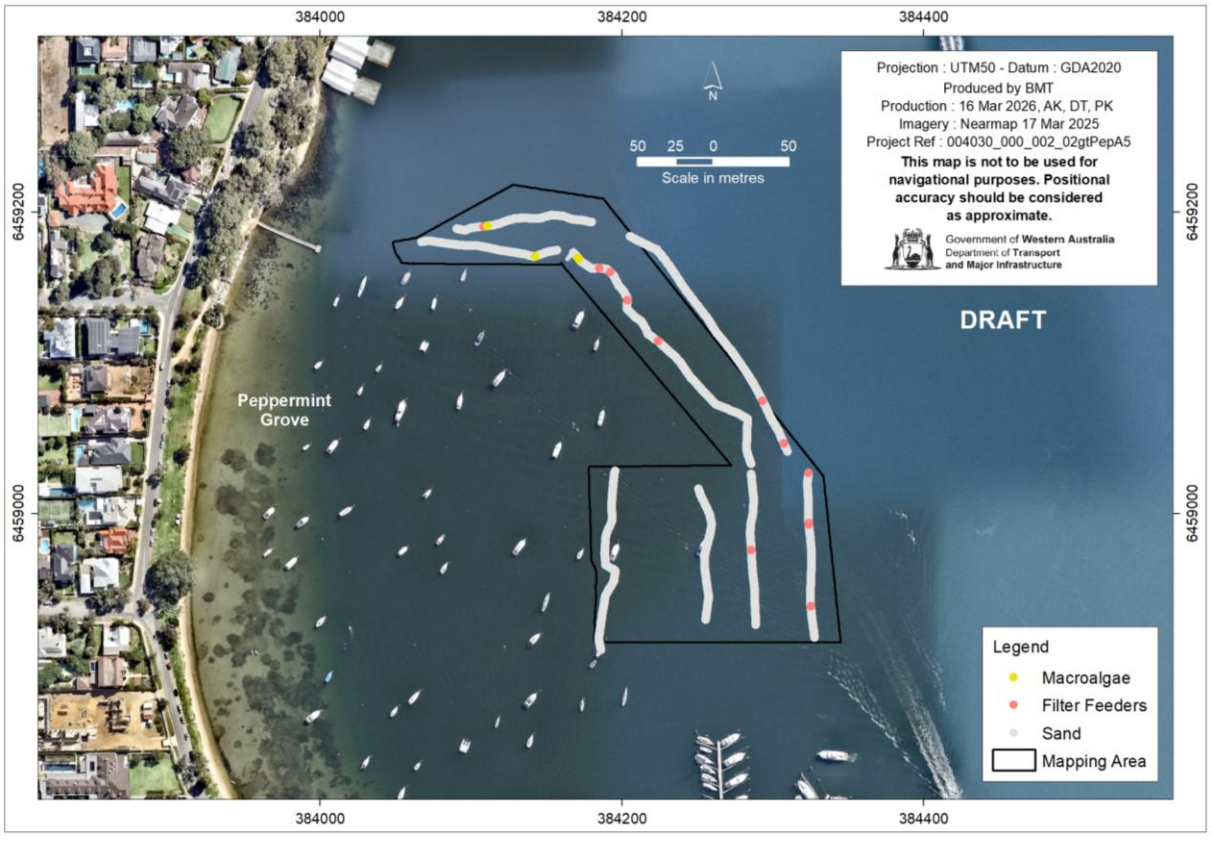


Figure 1.8 Classified ground truth video transects within the Peppermint Grove Survey Area

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1.4.2 Mapped benthic communities and habitat

Prediction model results with 50% likelihood (Section 1.3) as well as ground truth video classification notes and Nearmap imagery showing temporal changes in habitat distribution were compared and reviewed. Results of the Kriging 50% likelihood were considered to most accurately represent the BCH coverage and were chosen for discussion. Results of the mapped BCH are summarise below for each of the Survey Area, described as "Mapping Area" relating to the total area mapped, and "Mooring Area" relating to the Survey Areas provide by DTMI.

- Based on the final BCH map, approximately 9% of the Attadale Mapping Area is covered by seagrass, macroalgae and filter feeders (Table 1.4). However, the percentage of seagrass and macroalgae within the Mooring Area is 6.9% as majority of the seagrass and macroalgae are present at the north-eastern bank of the Mapping Area outside the proposed Mooring Area (Table 1.4, Figure 1.9). The remaining proportion of the Attadale Mooring Area is bare sand (Table 1.4, Figure 1.9).
- The Claremont Mooring Area predominantly consists of bare sand, apart from few small areas (<1%) mapped as macroalgae (Table 1.4, Figure 1.10).
- Shallow parts of Dalkeith Mapping Area (south-west) consist of seagrass and macroalgae habitat whereas filter feeders are present in few isolated areas of the deeper section (east). Seagrass and macroalgae area cover 27.6% of the proposed Mooring Area (Table 1.4, Figure 1.11).
- The Mapping Area at Mosman Bay North is mostly bare sand and only 6.2% of the area within the proposed Mooring Area showed the presence of filter feeders (Table 1.4, Figure 1.12). There are no areas of seagrass and macroalgae identified within the Mosman Bay North Mooring Area.
- Filter feeders are estimated to cover about approximately 17.8% and 17.6% of the Mapping and Mooring Areas respectively, at Mosman Bay South (Table 1.4, Figure 1.13). No seagrass of macroalgae was observed.
- Approximately half of the Mapping (48.6%) and Mooring Areas (52.6%) at Nedlands, mostly in the shallow parts, is estimated to contain ephemeral species of seagrass. Mix of seagrass and macroalgae cover another 8.5% of the proposed mooring area (Table 1.4, Figure 1.14).
- Based on the 50% likelihood BCH map, Peppermint Grove mapping area consists of bare sand only (Table 1.4, Figure 1.15). However, it should be noted that in the towed video transects, isolated filter feeders and macroalgae was observed (Figure 1.8).

Table 1.4 Summary of benthic communities and habitat coverage in Survey and Mooring Areas

Classified BCH[1]	Mapping Area[2] (ha)	Mapping Area[2] (% of area)	Mooring Area[2,4] (ha)	Mooring Area[2,4] (% of area)
Attadale	8.3	100	6.9	100
Seagrass	0.2	2.2	0.1	0.8
Macroalgae	0.2	1.9	0.1	1.3
Filter Feeders	0.4	5.0	0.3	4.9
Sand	7.6	91.0	6.4	93.1
Claremont	2.6	100	1.3	100

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Classified BCH[1]	Mapping Area[2] (ha)	Mapping Area[2] (% of area)	Mooring Area[2,4] (ha)	Mooring Area[2,4] (% of area)
Macroalgae	0.0	0.9	0.0	0.2
Sand	2.6	99.1	1.3	99.8
Dalkeith	3.9	100	3.3	100
Seagrass	0.4	10.8	0.3	9.9
Mixed	0.1	2.6	0.1	2.8
Macroalgae	0.6	15.7	0.5	14.9
Filter Feeders	0.1	3.5	0.1	4.0
Sand	2.6	67.5	2.3	68.4
Mosman Bay North	1.9	100	1.2	100
Filter Feeders	0.1	4.8	0.1	6.2
Sand	1.8	95.2	1.1	93.8
Mosman Bay South	12.7	100	9.9	100
Macroalgae	0.0	0.1	0.0	0.1
Filter Feeders	2.3	17.8	1.7	17.6
Sand	10.4	82.1	8.1	82.3
Nedlands	2.0	100	1.6	100
Seagrass	1.0	48.6	0.9	52.6
Mixed	0.2	9.2	0.1	8.6
Macroalgae	0.0	0.3	0.0	0.3
Sand	0.8	41.9	0.6	38.5
Peppermint Grove	3.2	100	2.5	100
Sand	3.2	100.0	2.5	100.0
Grand Total	34.7		26.7	

Notes:

1. "BCH" = Benthic communities and habitat
2. The BCH coverage is based on prediction map with 50% occurrence likelihood and digitised Nearmap imagery.
3. **Blue text** signifies the predominant BCH within each survey area.
4. "Mooring Area" can be used interchangeably with Survey Area.

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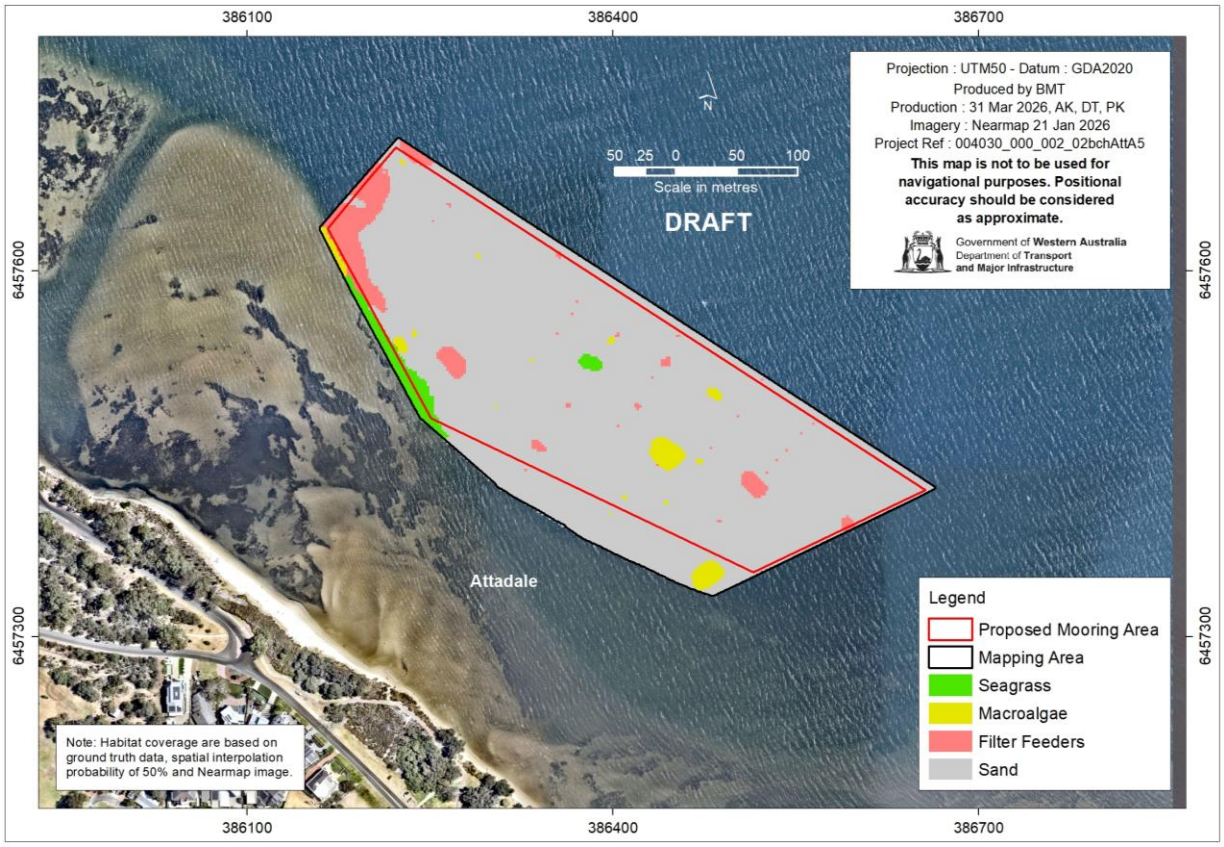


Figure 1.9 Mapped benthic communities and habitats within the Attadale Survey Area



Figure 1.10 Mapped benthic communities and habitats within the Claremont Survey Area

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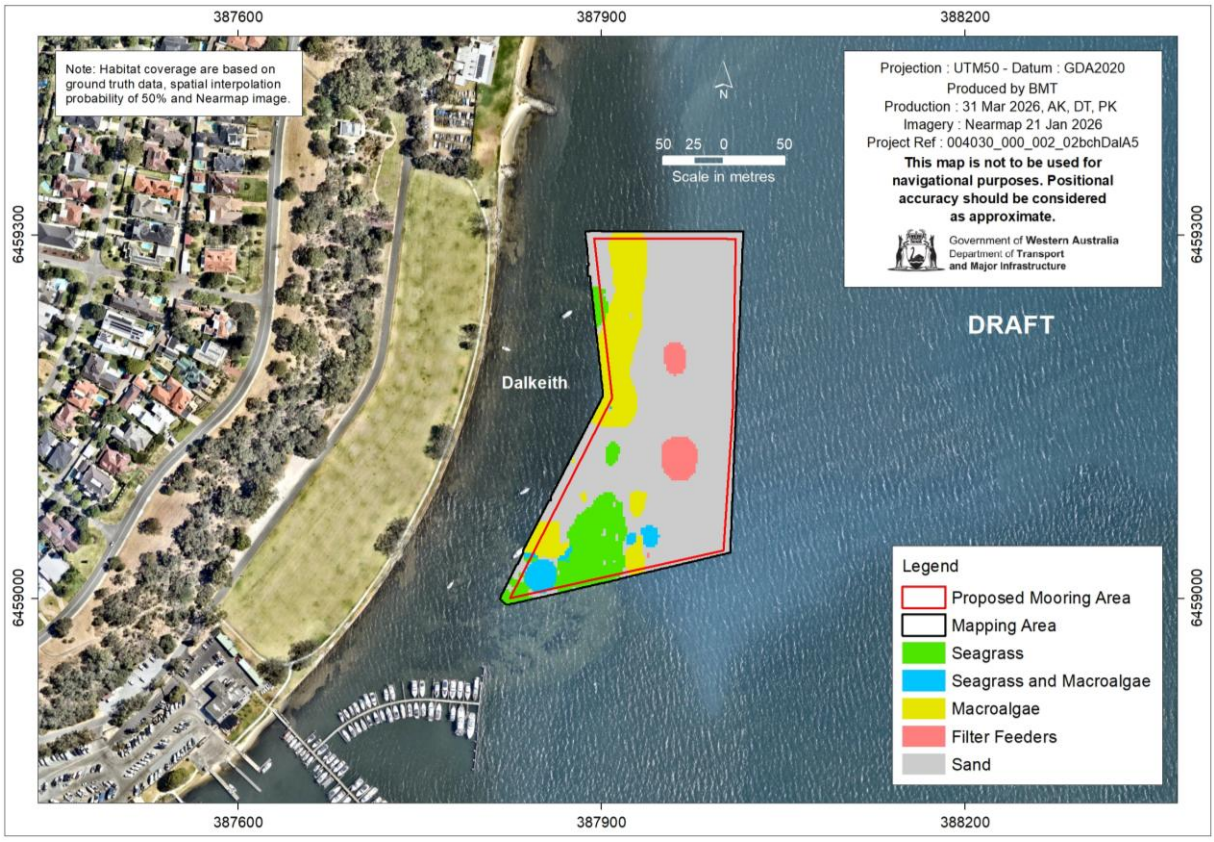


Figure 1.11 Mapped benthic communities and habitats within the Dalkeith Survey Area

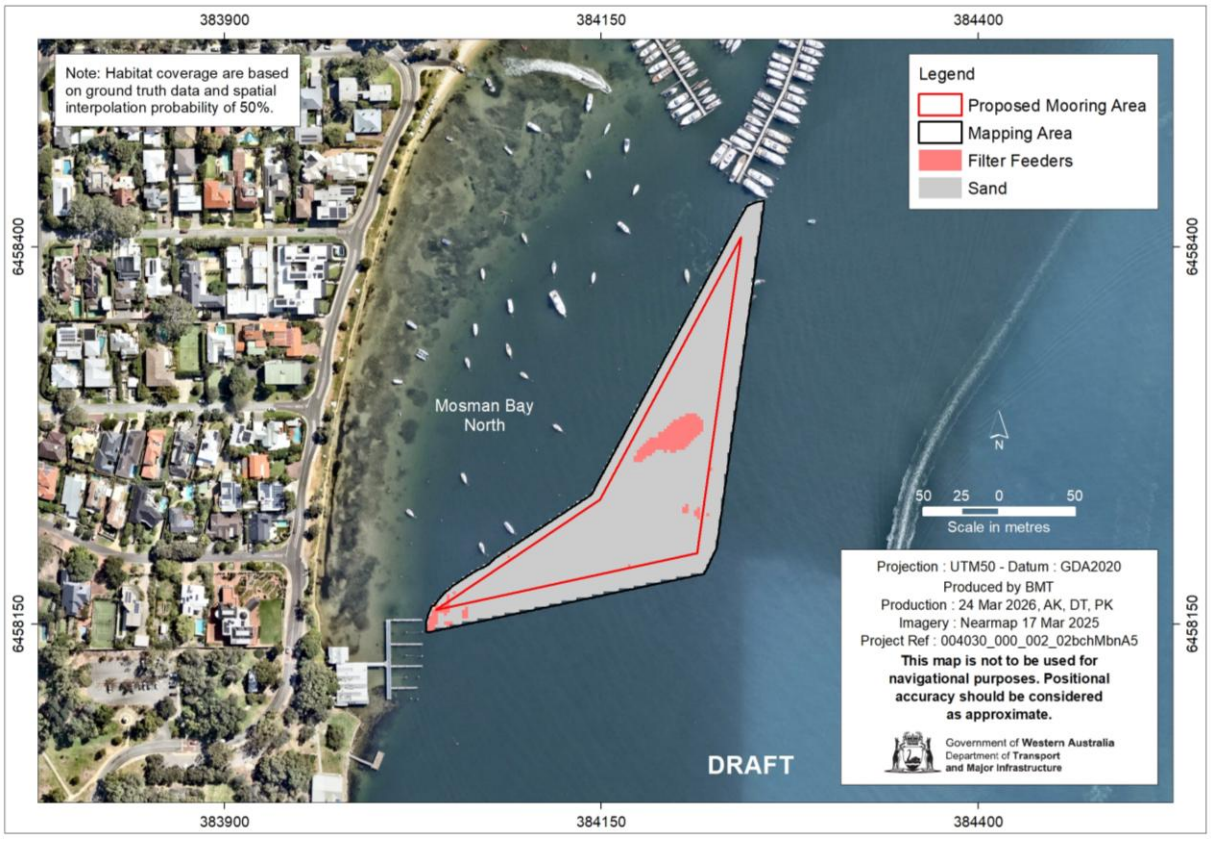


Figure 1.12 Mapped benthic communities and habitats within the Mosman Bay North Survey Area

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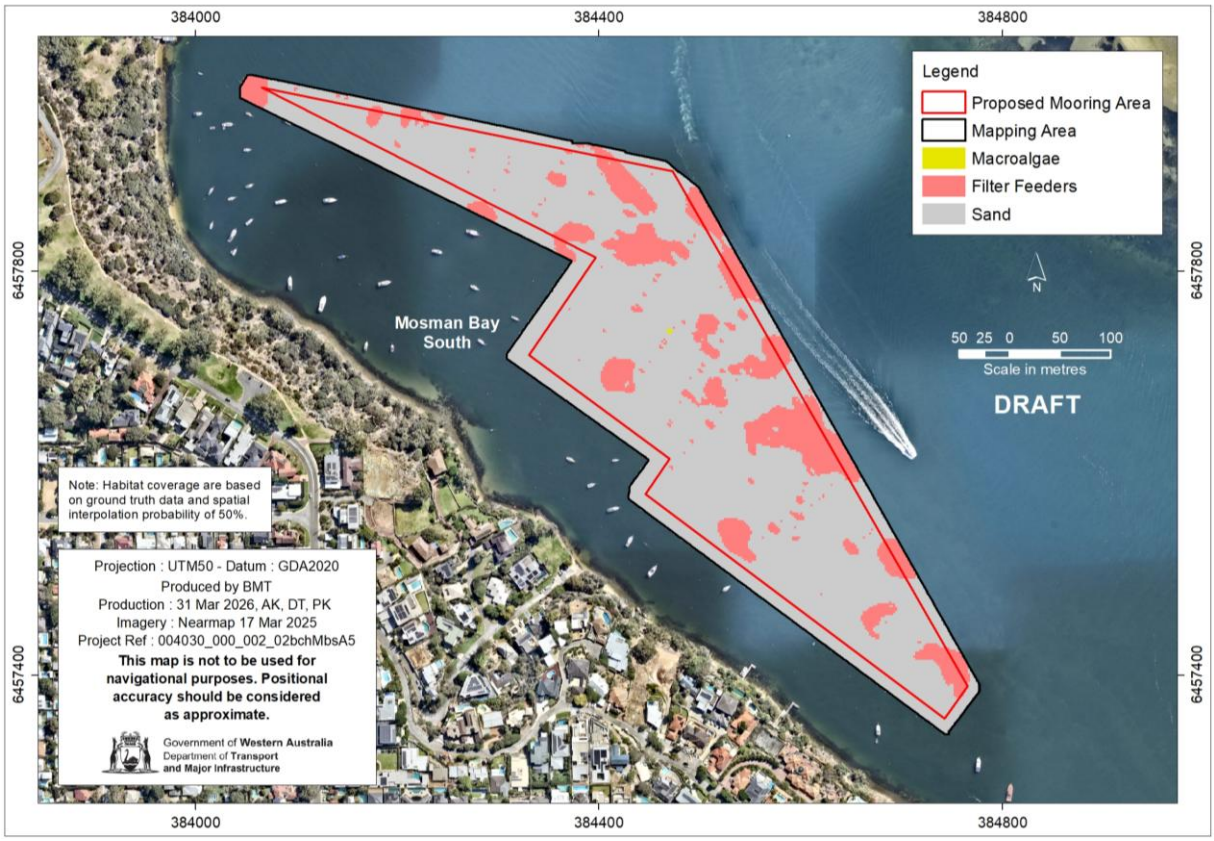


Figure 1.13 Mapped benthic communities and habitats within the Mosman Bay South Survey Area

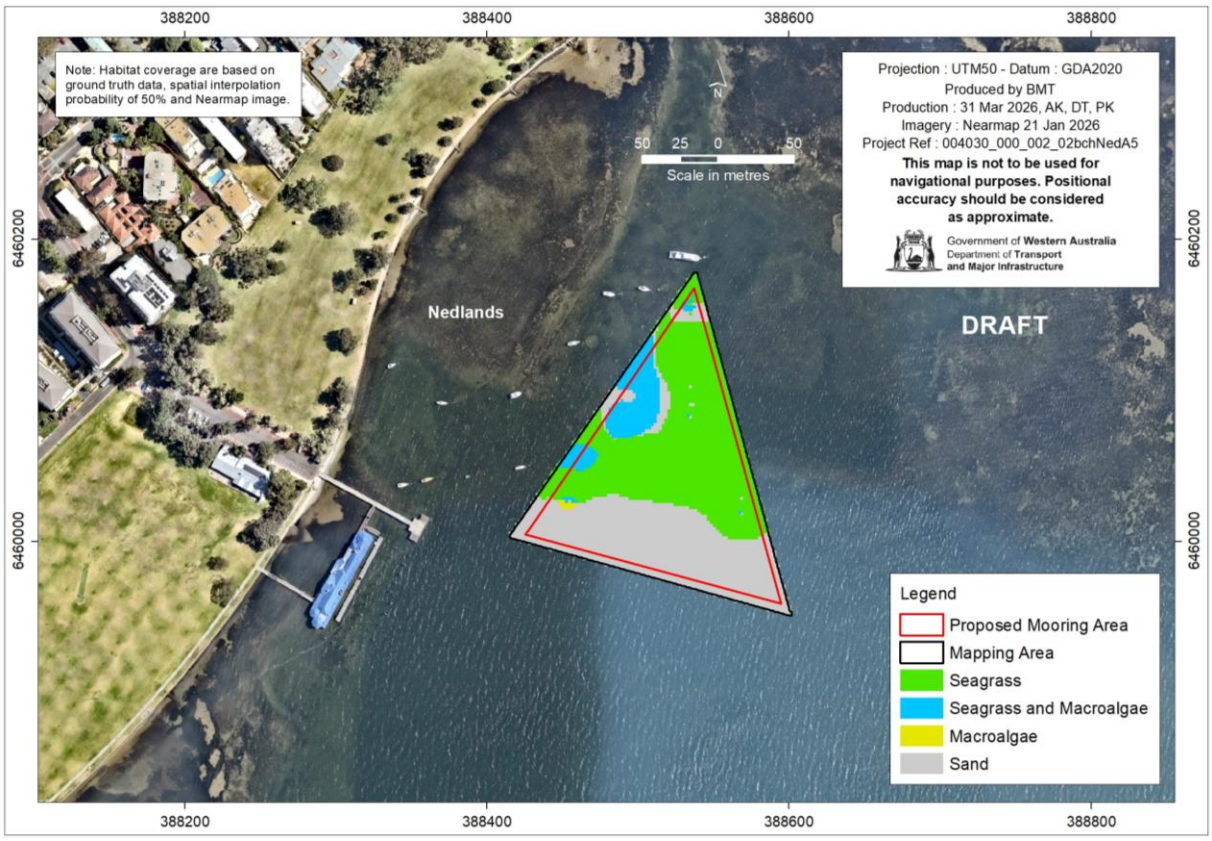


Figure 1.14 Mapped benthic communities and habitats within the Nedlands Survey Area

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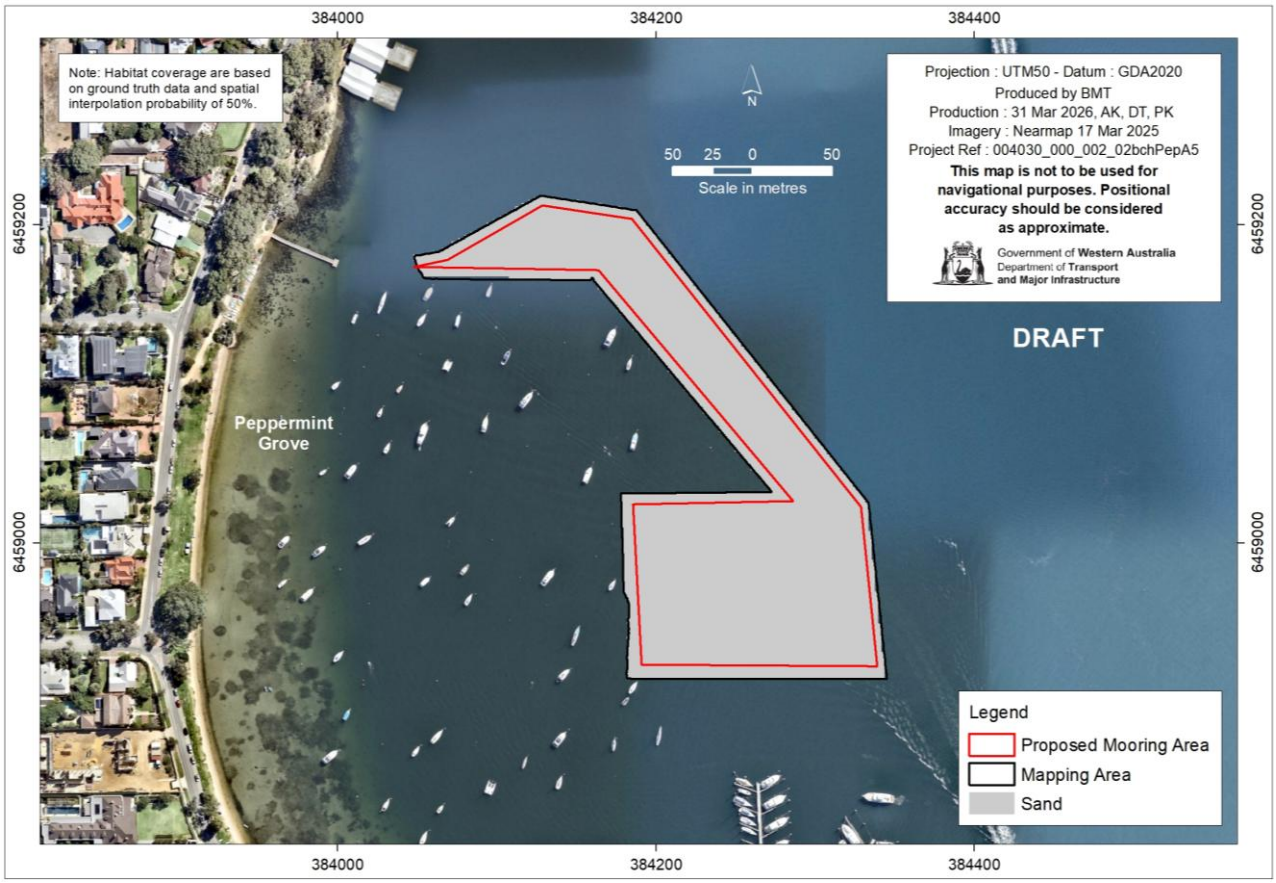


Figure 1.15 Mapped benthic communities and habitats within the Peppermint Grove Survey Area

1.5 Summary

BCH mapping was completed utilising ground truth data collected in February 2026, Nearmap imagery and bathymetry data within the Survey. The final BCH map reflects an interpolated raster predicted by regression kriging method at 50% likelihood. This method predicts values where they are not observed (i.e. between ground truth towed video transects) and the likelihood applied may result in probability being reduced for sparse and small number of ground truth points showing. Within the seven Survey Areas bare sand was the dominant BCH category for all except Nedlands. Seagrass (*Halophila* spp.) patches were mapped in Attadale, Dalkeith and Nedlands Survey Areas. Macroalgae patches were mapped in Attadale, Claremont, Dalkeith, Mosman Bay North and Nedlands. Isolated filter feeders (anemones) were observed in all Survey Areas. For the purposes of relocating moorings it is considered the Claremont, Mosman Bay North and South, and Peppermint Grove proposed mooring areas would be the most suitable.

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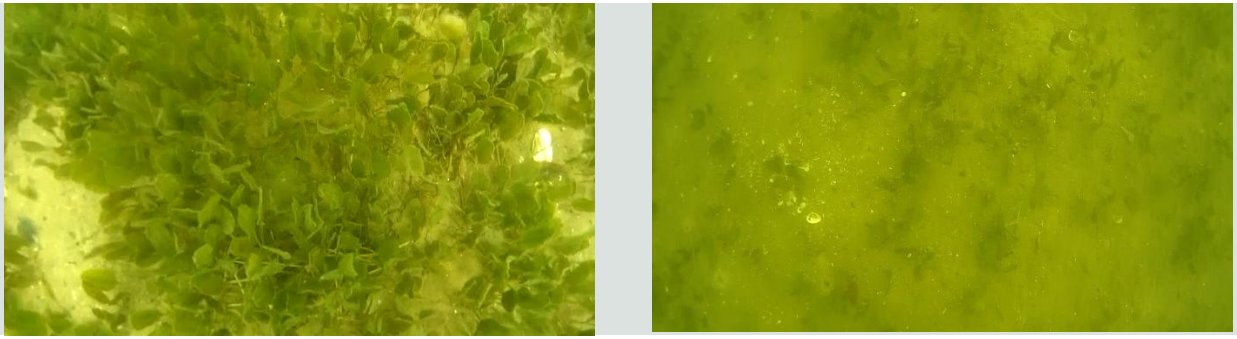
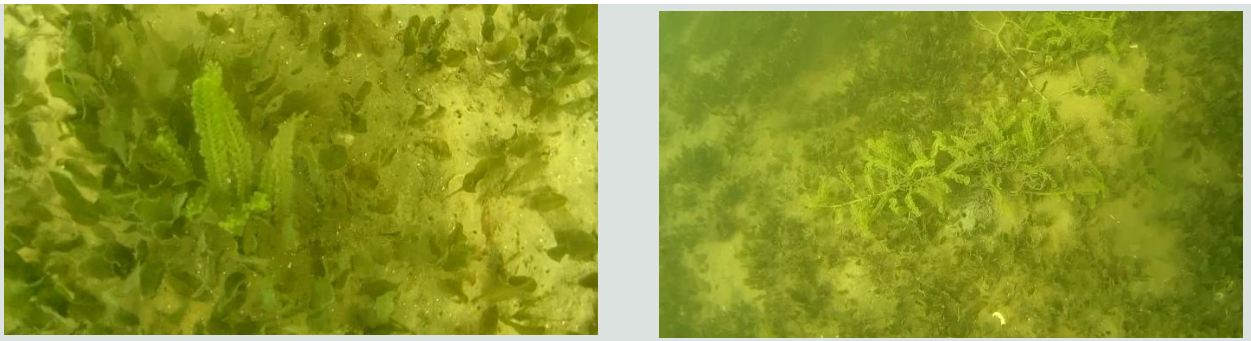
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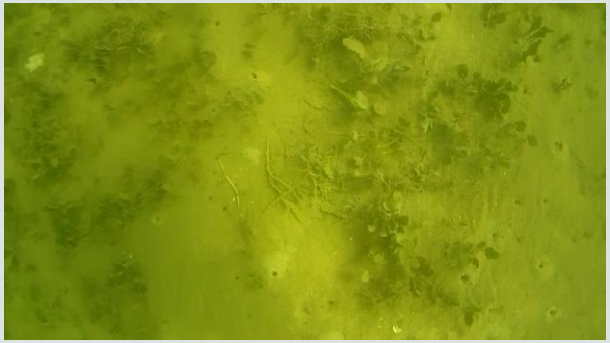
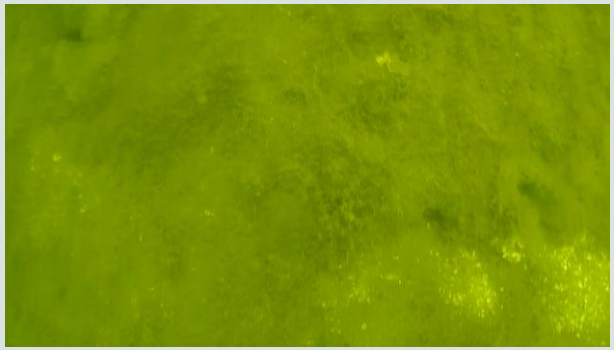
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Annex A Habitat classification images from the towed video ground truth survey, February 2026

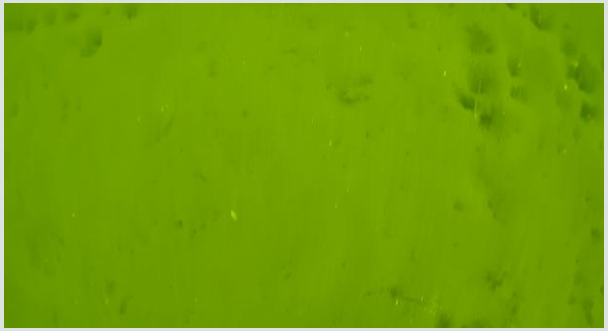
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Major and minor habitat classes	Example images
Seagrass – *Halophila ovalis*	
Seagrass – *Halophila spinulosa*	
Seagrass – Mixed *Halophila* spp.	

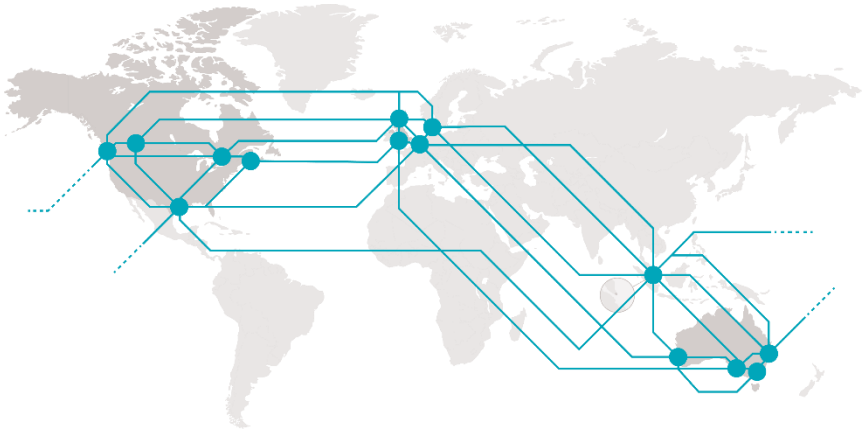
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Major and minor habitat classes	Example images	
Mixed – Mixed seagrass and macroalgae		
Macroalgae - macroalgae		
Filter feeders – sponges/hydroids/other		

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Major and minor habitat classes	Example images
Bare sand – bare sand	 

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