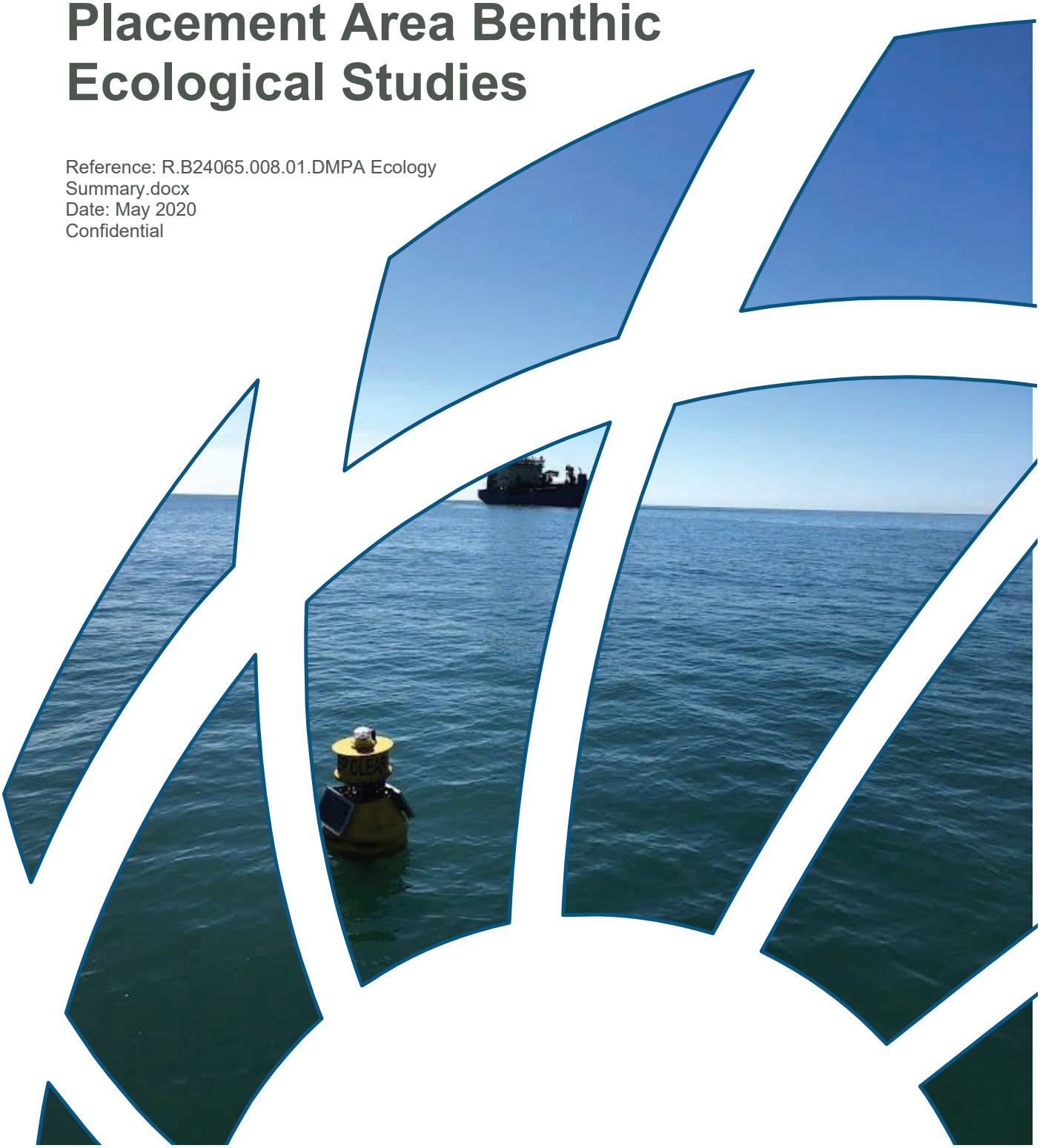
Appendix C Report - Summary of benthic ecological investigations of offshore DMPA areas

Port of Cairns Dredged Material Placement Area Benthic Ecological Studies

Reference: R.B24065.008.01.DMPA Ecology Summary.docx
Date: May 2020
Confidential



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Synopsis: Summary of benthic ecological assessments and studies conducted for the new Port of Cairns marine dredged material placement area

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1 Introduction

The Port of Cairns currently undertake maintenance dredging of the shipping channels, swing basins and berths associated with port operations. This material is placed offshore at a marine dredged material placement area (DMPA). As this area is currently nearing capacity, Ports North, the operators of the Port of Cairns, are investigating the use of a new offshore DMPA. This report presents a summary of the ecological investigations undertaken for to date for new DMPAs, including the most recent (2020) investigations of the preferred location.

This report consists of the following:

- Overview of maintenance dredging requirements and new DMPA options
- General characterisation of marine environment of Trinity Bay
- History of ecological studies conducted at preferred DMPAs
- Characterisation of the preferred DMPA site based on historical and contemporary environmental investigations, and comparison to the existing DMPA
- Conclusions on the likely ecological impact of use.

This report has been prepared to support the development of a long-term maintenance dredging management plan (LMDMP) for the Port of Cairns as well as environmental approvals associated with the new DMPA site. It is intended to provide a general characterisation of the marine environment for the DMPA. For more detailed information, refer to the relevant study reports.

2 Maintenance Dredging and Disposal Needs

2.1 Background

Maintenance dredging material from the Port of Cairns has historically been placed within Trinity Bay a series of different marine DMPAs. A current DMPA is located approximately 14 km north of the Port of Cairns entrance and has been in used since 1991 (BMT, 2020). Assessments of this DMPA have identified that a new long-term DMPA site (life of 30+ years) will be required in the short-to-medium term to allow for ongoing management of material from future maintenance dredging campaigns (BMT, 2020).

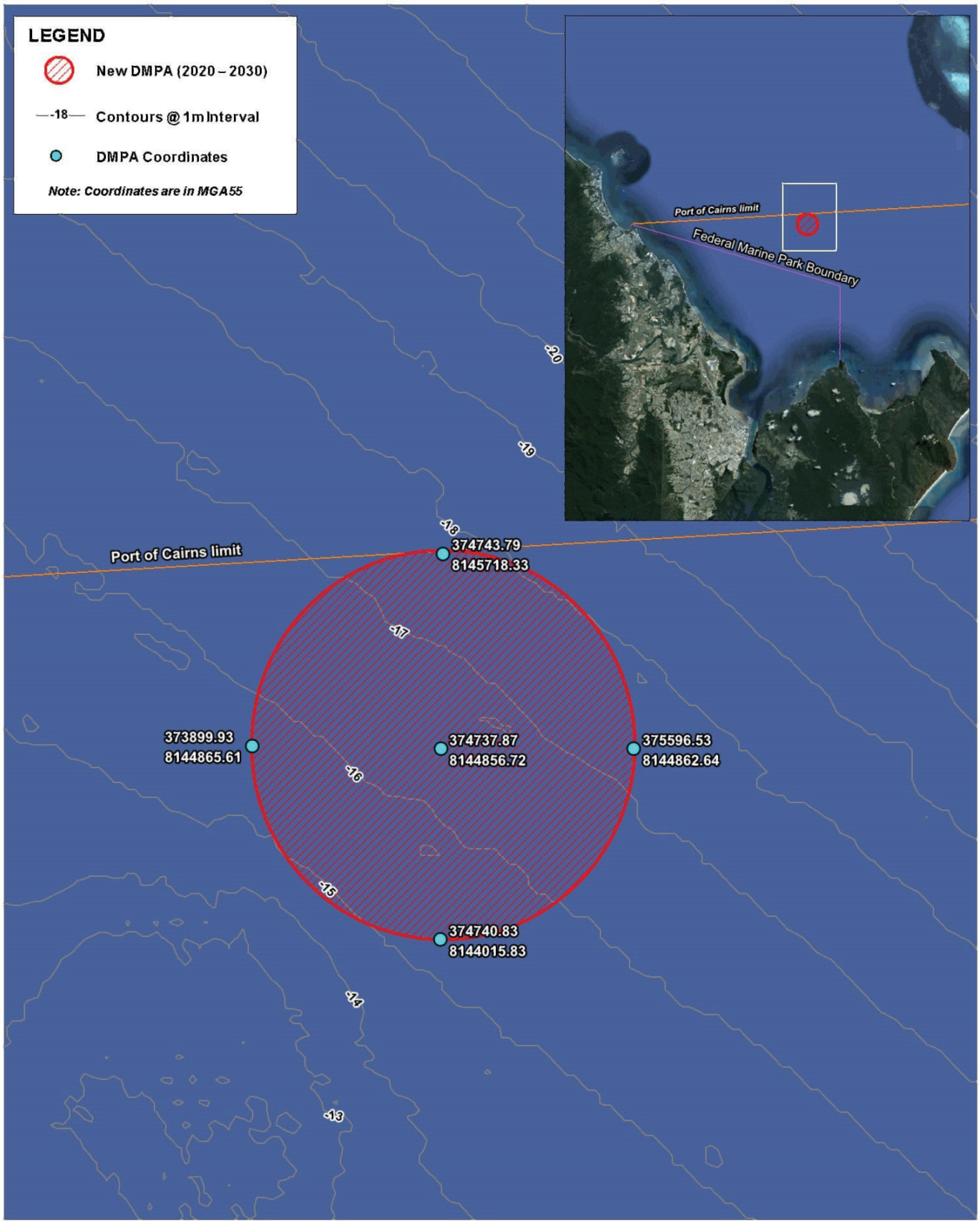
2.2 Options Considered

A series of marine DMPA options have been considered by Ports North, consisting of mid-shore, inshore, far offshore and northern sites. A multi-criteria analysis of the options, including environmental and practical considerations, identified a mid-shore option to be preferred (BMT, 2020). This preferred option is shown in Figure 2-1 and Figure 2-2 and characterised in Table 2-1.

This site was selected as it is within port limits, has sufficient capacity for long-term use, does not result in significant operational changes from present, and can be used with low environmental risk due primarily to a lack of sensitive receptors within the DMPA and low levels of material resuspension.

Table 2-1 Characteristics of preferred new marine DMPA site

Characteristic	Description
Coordinates/ Location	The new DMPA has the coordinates shown in Figure 2-1. It is situated to the northeast of the existing DMPA, sharing a common boundary with the existing site to the south and with the boundary of port limits to the north.
Area	The diameter of the new DMPA is approximately 840m. The surface area of the new DMPA is 2.288 km^2. This is 16% less than the current DMPA which has a 1 km diameter. Owing to the deeper water present at the new site, a 1km diameter is not seen as being required and adopting this smaller area will marginally reduce temporary habitat disturbance as well as aid efforts required in even spreading of dredge material.
Depth	The depth of the new DMPA ranges from -15 m to -18 m LAT with an average depth of -16.5 m below LAT.
Distance to Receptors	In terms of the distance of the new DMPA to notable features and sensitive receptors the following apply: • Buffer distance to Reef Islands and Inner Reef – 14.5 km • Buffer distance to end of the maintained shipping channel – 4.7 km • Distance from the DMPA to the port terminal – 16.4 km • Distance from the DMPA to Crystal swing basin – 16.3 km • Distance from the DMPA to Smiths Creek swing basin – 17.9 km • Distance from the DMPA to Cape Grafton Seagrass – 11.8 km • Distance from the DMPA to Double Island Reef – 14.1 km • Distance from the DMPA to Rocky Island Reef – 13.1 km



Title:

New DMPA location and coordinate

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Approx.Scale

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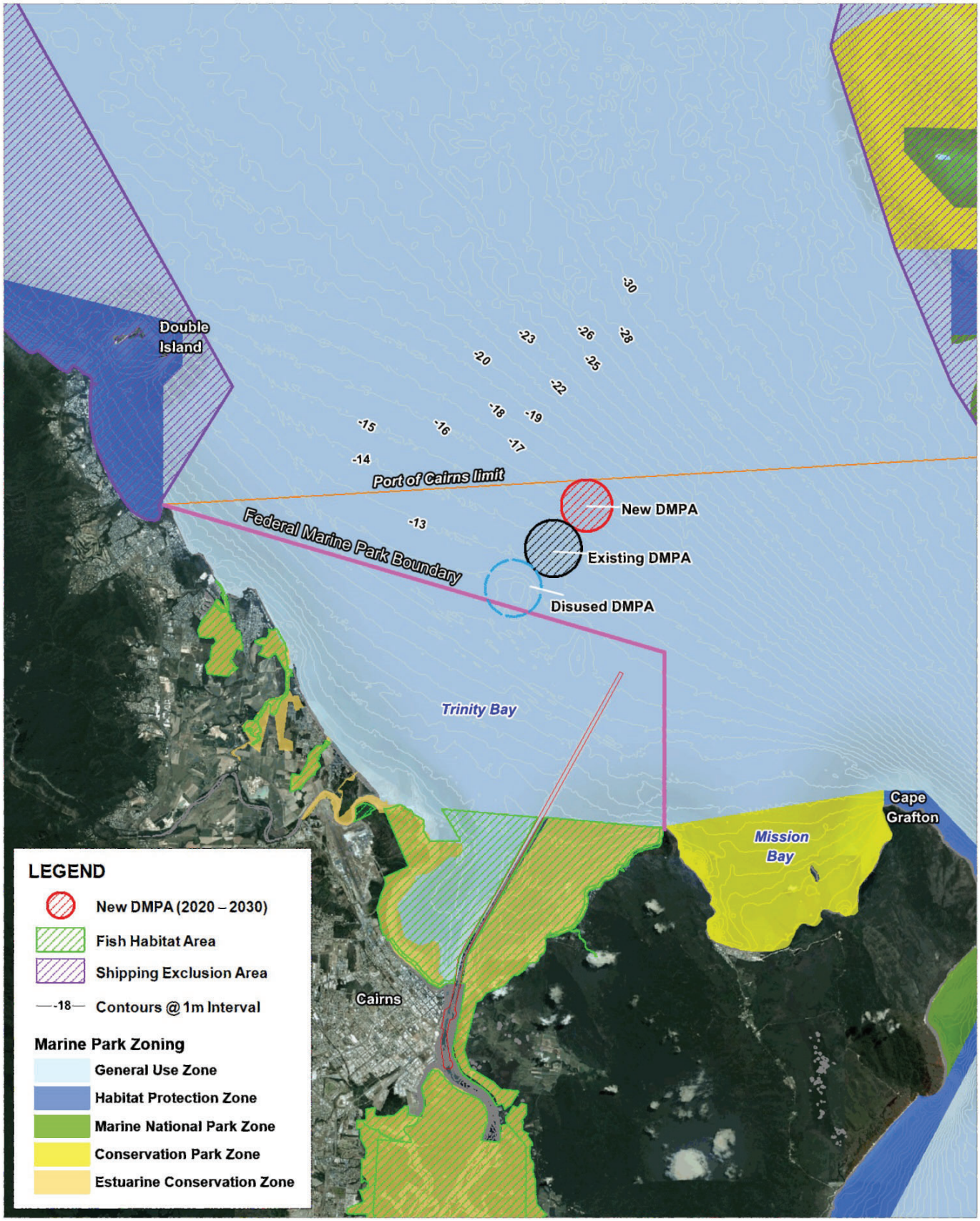

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Location of Disused, Current and Proposed DMPAs

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3 Environment of Trinity Bay

3.1 Overview

Trinity Bay is a north-facing coastal embayment located adjacent to the city of Cairns. The embayment is the receiving environment for Trinity Inlet and the Barron River, as well as smaller coastal drainages, which can provide high volumes of fine terrigenous sediment to the area. the shallow nature of the bay together with this high sediment input leads to high levels of resuspension of sediment from tides, waves and winds (Arup, 2014a; FCG, 2017).

The bay supports a wide variety of marine habitats, including sandy beaches, mangroves forests, saltmarshes, intertidal shoals, seagrass meadows, subtidal and soft sediment habitats, rock walls and rocky shores. Seagrass meadows in particular are significant as these meadows within Trinity Bay are one of only two major seagrass areas occurring between Hinchinbrook Island (to the south) and Cooktown (to the north) (Arup, 2014a; FCG, 2017; Rasheed et al. 2019). These habitat values provide significant opportunity for feeding by a diverse range of marine fauna, including marine turtles, dugongs, whales and dolphins.

Trinity Bay is part of the Great Barrier Reef (GBR) World Heritage Area and National Heritage Place, as well as the State GBR Coast Marine Park.[1] Additionally, most of Trinity Bay is also part of the Trinity Inlet Fish Habitat Area (FHA).

3.2 Benthic Ecology

Trinity Bay features two key sensitive benthic receptors: seagrass meadows and coral communities. Both of these receptor types are sensitive to sedimentation and turbidity impacts typically associated with dredged material placement and resuspension.

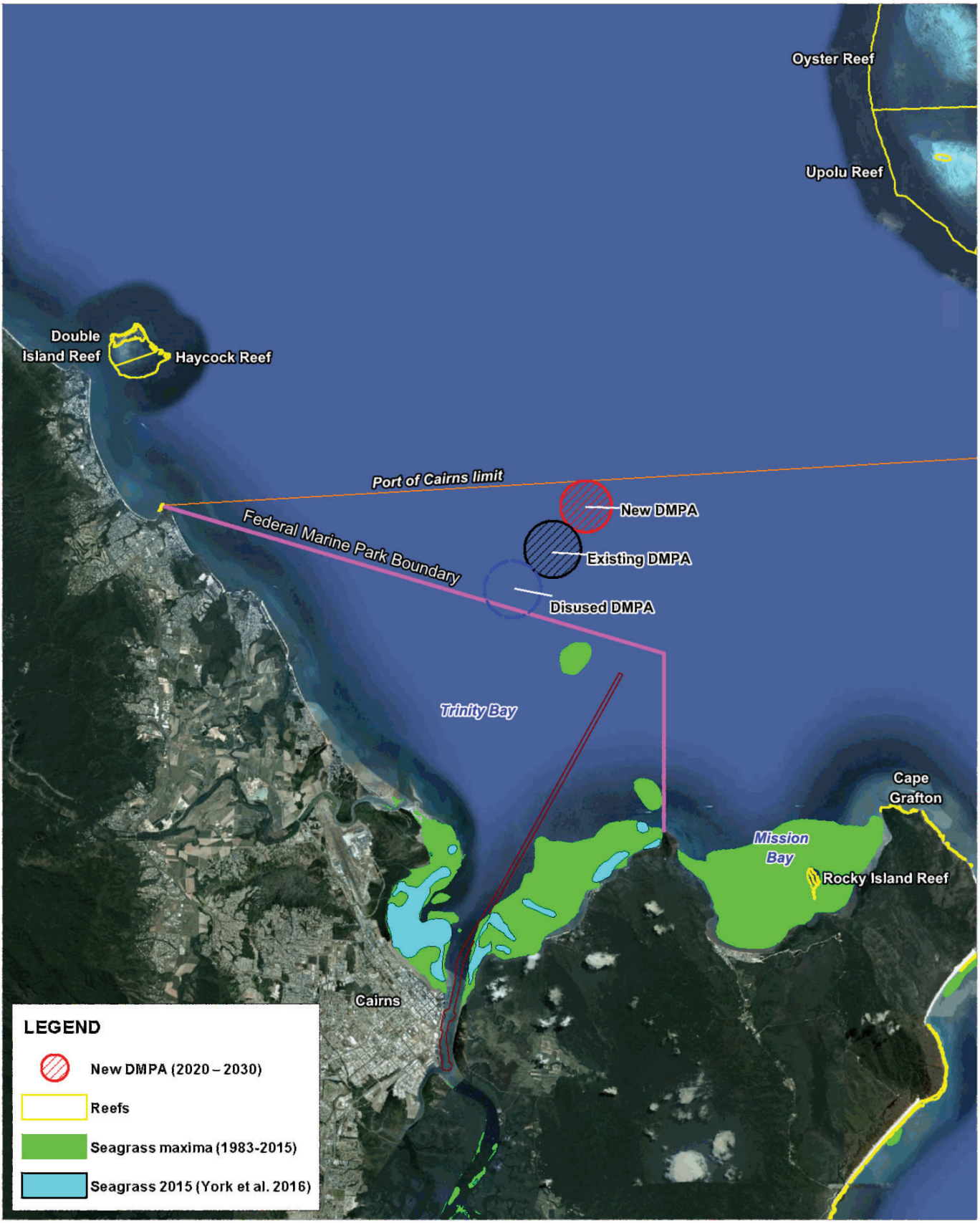
Up to 800 ha of seagrass habitat has been identified in Trinity Bay, consisting of seven different seagrass species (out of the 15 known across the GBR region) (Arup, 2014a; FCG, 2017). These are *Zostera muelleri*, *Halodule uninervis*, *Halophila decipiens*, *Halophila ovalis*, *Cymodocea serrulata*, *C. rotundata* and *Thalassia hemprichii*. Seagrass meadows are denser in intertidal and shallow subtidal areas, including along the foreshores of the bay, and within shallower areas of Trinity Inlet. Isolated strands of *H. uninervis* have been identified in deeper areas of the bay, including near the existing DMPA and within the channel. the distribution, extent, biomass and density of these meadows varies significantly across seasons and years, based on the long-term monitoring undertaken by the James Cook University's TropWATER team (Rasheed et al. 2019). These changes are linked primarily to variability in rainfall and the occurrence of extreme events such as cyclones, with increased rainfall usually leading to a decrease in seagrass extent (due to increased sedimentation from runoff).

Mapping of seagrass extent as of 2018 (last monitoring report published by TropWATER) is shown in Figure 3-1. This includes the maximum seagrass extent observed since 1984.

[1] The Cairns area is excluded from the Commonwealth GBR Marine Park but still forms part of the State marine park.

Coral reef communities occur throughout Trinity Bay, with the key reefs occurring at Double Island, Rocky Island and Mission Bay, eastern Cape Grafton and Fitzroy Island, and the mid-shelf reefs (e.g. Green Island, Arlington Reef) (Arup, 2014a; FCG, 2017). These reefs support well developed fringing reef communities with a coral hard corals, algae and invertebrate communities (e.g. sponges, hydrozoans). Rocky shores along East Trinity and False Cape also support invertebrate communities, macroalgae and limited soft and hard corals.

The areas supporting rocky reefs and potential coral communities are shown in Figure 3-2. This is based on ecological mapping undertaken as part of the Cairns Shipping Development Project Environmental Impact Statement in 2016.



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Seagrass Meadow Extents And Rocky Reef Sites In Trinity Inlet Comparative to DMPA Sites

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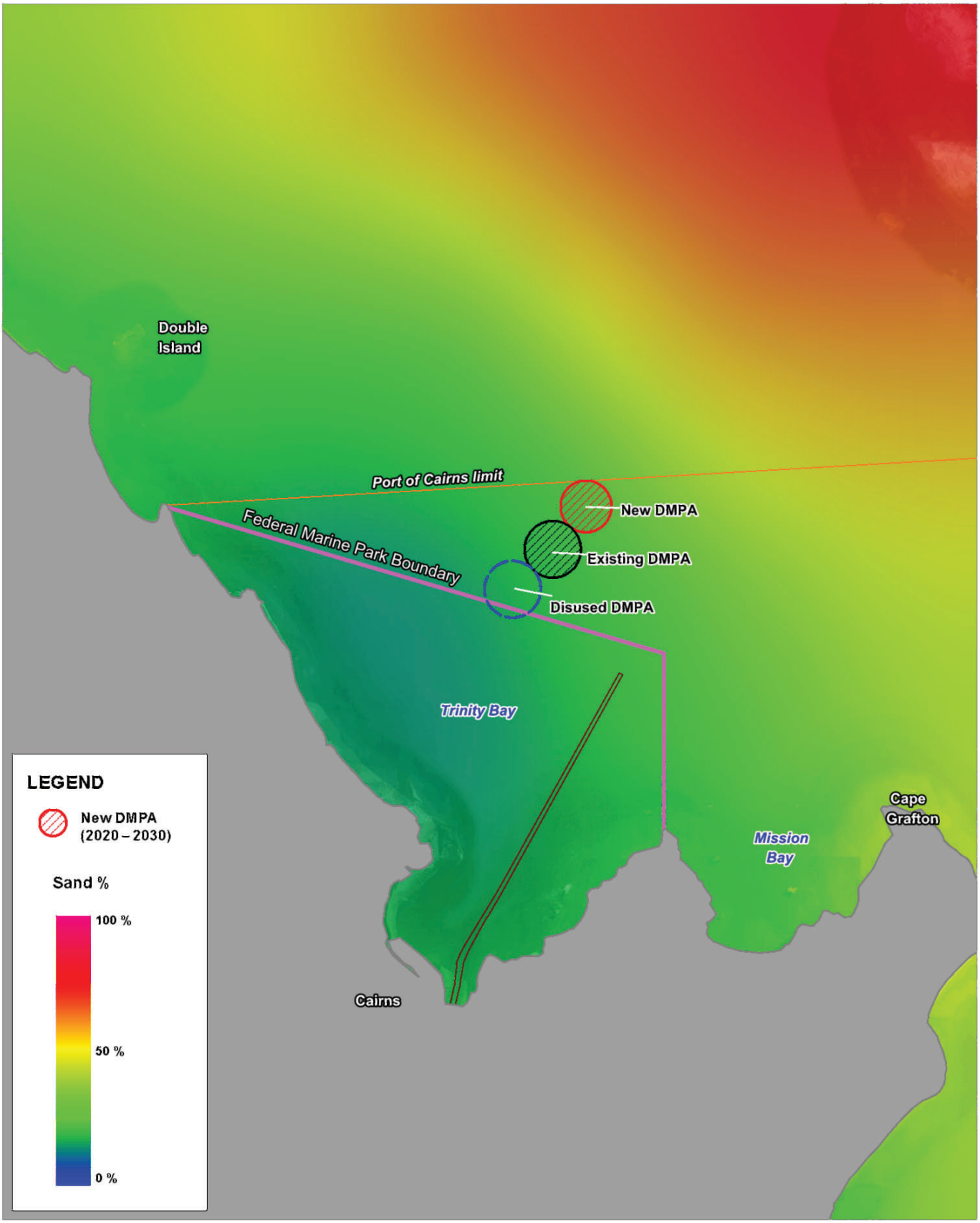

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Benthic Sediment Types In Trinity Inlet Comparative To DMPA Sites

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4 Environmental Characterisation

4.1 Historical Studies

Mid-shore DMPA sites have been investigated as part of two key studies:

- Marine environmental assessments undertaken as part of the Draft EIS for the Cairns Shipping Development Project when capital material was originally to be placed at a new standalone marine DMPA. The relevant site investigated, Site 1A, is immediately adjacent to the new DMPA. Ecological studies for this area were conducted in 2013 by BMT WBM and included acoustic habitat mapping of part of the DMPA together with drop camera, macroinvertebrate sampling and collection of marine sediment for particle size distribution (PSD) analysis). The results are recorded primarily in Chapter B7 of the Draft EIS (Arup, 2014b) and Appendix D.13 (BMT WBM, 2014b).
- Updated marine environmental assessments undertaken in early 2020 focused on updating the data from 2013 and conducting specific data collection at two alternative DMPA sites. These include the proposed new DMPA site (DMPA 4) and an adjacent site (DMPA 3A). These studies were undertaken by BMT, Ports North and James Cook University and included acoustic habitat mapping, drop camera and macroinvertebrate sampling. Technical reports on the results are pending (BMT, 2020). This surveys also collected benthic macroinvertebrate data for the existing DMPA, as part of a close out of the current 10-year disposal period for the site (BMT, 2020).

Note that while these studies focused on different areas, as mid-shore marine areas within close proximity, they all share similar characteristics and provide a suitable basis for generally characterising the new DMPA site.

Additionally, seasonal seagrass surveys have been continually conducted in Trinity Inlet by TropWATER for the past 20 years (since 2001). While these have no specifically targeted the mid-shore DMPA sites, that provide

Appendix A provides figures from the above studies showing the sampling areas/methods relevant to the new DMPA.

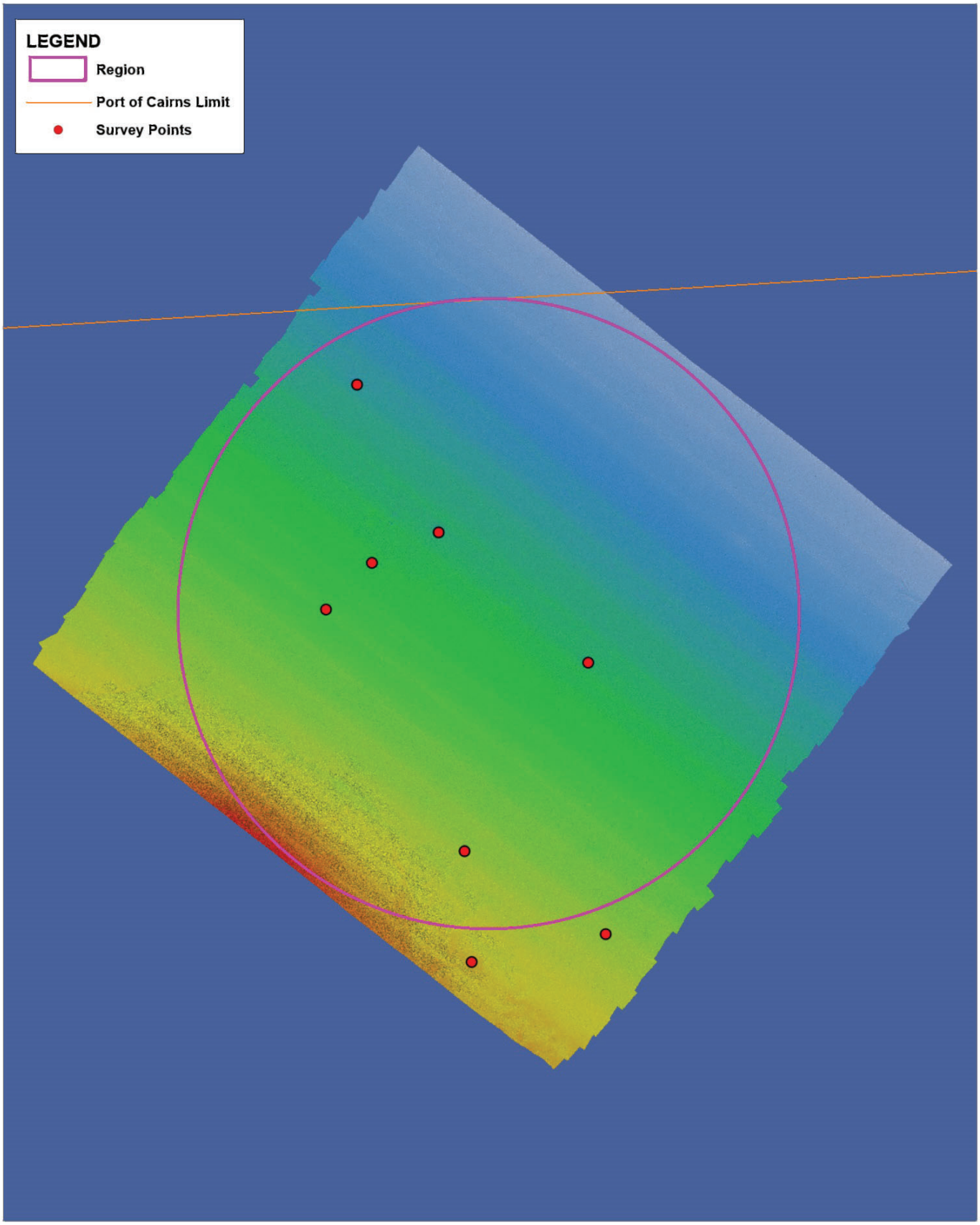
4.2 Characterisation of New DMPA Site

4.2.1 Benthic Habitat

The DMPA is located within a sediment zone classified as mid-shore mud (Arup, 2014b). This is the dominant broad soft sediment habitat type within Trinity Bay. Within the DMPA itself, the sediment is dominated by silts and muds, although sand becomes more dominant in the northern part of the area (Arup, 2014b; BMT WBM, 2014b; BMT in prep 2).

Rocky reef structures and boulders are atypical within the mid-shore mud area, although isolated features may occur. Figure 4-1 shows the results of the April 2020 side scan of the area, confirming that there are no rocky structures.

Sparse benthic macroalgae occurs sporadically throughout the mid-shore region, including in parts of the DMPA (BMT in prep 1).



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455 kHz SSS Mosaic of DMPA Option 4 - Survey Investigation Points

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4.2.2 Benthos and Macroinvertebrates

The most abundant sessile taxa in the new DMPA area are small sea pens, together with burrowing gobies (Arup, 2014b; BMT WBM, 2014b; BMT, 2020). Sediment with higher sand proportion, such as that in the northern part of the DMPA, also have the potential for occasional echinoderms and soft coral, although these are sparse. There are no high density benthic communities in the area and epibenthic invertebrates typically occur as isolated individuals. Bioturbation also occurs across the DMPA, likely caused by a combination of polychaete and crustacean species (Arup, 2014b).

4.3 Similarities to Existing DMPA

The new DMPA occurs near the outer extent of the mid-shore mud sediment region and therefore occurs on the boundary of a transition to sandy sediment. This represents an area of decreasing influence of terrigenous silt derived from the coastal drainages into Trinity Bay. As a result, the sediment characterisation features a higher proportion of sands towards the northern end of the DMPA comparative to the existing DMPA. Despite this, the majority of the sediment remains silts and muds with a very similar PSD composition to the existing DMPA (Arup, 2014b; BMT 2020).

As part of the 2013 marine ecology studies, it was identified that the communities at DMPA options closest to the existing DMPA were the most similar to this DMPA (Arup, 2014b; BMT WBM, 2014b). This indicates that the new DMPA area is likely to have a similar benthic composition to the current DMPA. This is confirmed by the 2020 marine ecology studies which have identified a similar distribution of epibenthos and infauna communities.

As the areas are proximate and have similar habitat values, the occurrence of marine fauna activity, including both local foraging and over-swimming, is expected to be similar between both the existing and the new DMPA sites.

5 Potential Impacts on Benthic Ecology

5.1 Direct Impacts at New DMPA

As noted in Chapter 4, the benthic ecology of the new DMPA is similar to that of the existing (and historical) DMPAs. The direct impacts experienced at the existing DMPA, therefore, provide a suitable surrogate for anticipated impacts at the new DMPA.

Several benthic ecology studies have been undertaken of the existing DMPA since commencement of use. The most recent and relevant is the 2016 study undertaken by Advisian (see Appendix A for locations). The study was undertaken as per the Cairns Port Long Term Management Plan for dredging and Dredge Spoil Management (WorleyParsons, 2010) (LTMP) with the intention of understanding both the nature of the impact at the DMPA compared to other areas and the spatial extent over which this impact occurred.

The key conclusions from the assessment were:

- The DMPA infauna assemblage is significantly different to that of the north and south axes; however, this appears to reflect a higher abundance and higher taxa richness in the DMPA, not lower abundance and richness as might be expected as a result of deposition impact.
- There is some overlap between the DMPA infauna assemblage and that of the innermost sampling locations along the north and south axes. This is considered not likely driven by drift of sediments from the DMPA given the homogeneity of sediment particle size distributions across all sampling sites. It is most likely a reflection of geographical proximity.

The 2020 studies of the existing DMPA confirmed these results, showing ongoing support of infauna taxa throughout the DMPA site (BMT, 2020).

Thus, despite successive placement of material at this DMPA over several years, there has been minimal net impact to local benthic ecology. The low dispersive capacity of the existing DMPA means that the only disturbance events experience for local taxa is during actual placement. As this is limited by the number of dredging campaigns, there is sufficient time for local taxa to recolonise. This is further aided by the high tolerance of these species to periodic disturbance.

This same pattern of impact is expected to occur for the new DMPA site. No cumulative impacts are expected as only one DMPA will be used at a time.

5.2 Resuspension Impacts

Results of numerical modelling for the new DMPA site is indicate that the chance of resuspension of sediment is similar to that identified for the existing DMPA. Thus, as with direct impacts, the regional resuspension impacts of the existing DMPA can be treated as a model of expected impacts at the new DMPA.

TropWATER's seagrass monitoring program indicates that changes in seagrass health within Trinity Bay is linked primarily to rainfall and extreme weather patterns, with no indication that dispersal of sediment from the DMPA has caused any impact since commencement of operation (Rasheed et al. 2019). This is consistent with numerical modelling of water quality impacts from the DMPA undertaken as part of the Draft EIS (BMT WBM, 2014a). This modelling also shows no impact to

coral reefs from resuspension. Considering the above, it is expected that the use of the new DMPA will have negligible impacts on regional ecology.

6 References

Advisian (2016), *Cairns Port Dredge Material Placement Area: Benthic Macro-Invertebrate Infauna Monitoring Survey 2016*, ref. 301310-01394-00-EN-REP-0005, prepared for Far North Queensland Ports Corporation

Arup (2014a), *Dredge Material Placement Options*, Chapter A2 in Cairns Shipping Development Project Environmental Impact Statement, prepared for Far North Queensland Ports Corporation

Arup (2014b), *Marine Ecology*, Chapter B7 in Volume 2 of Cairns Shipping Development Project Draft Environmental Impact Statement, prepared for Far North Queensland Ports Corporation

BMT WBM (2014a), *Water Quality Model Development and Calibration Report*, Appendix D.4 of Cairns Shipping Development Project Draft Environmental Impact Statement, prepared for Far North Queensland Ports Corporation

BMT WBM (2014b), *Marine Ecology Supporting Information*, Appendix D.13 of Cairns Shipping Development Project Draft Environmental Impact Statement, prepared for Far North Queensland Ports Corporation

BMT (2020), *Marine Dredge Material Placement Area*, ref. R.B24065.003.00, prepared for Far North Queensland Ports Corporation

Flanagan Consulting Group (2017), *Marine Ecology*, Chapter B7 in Cairns Shipping Development Project Revised Draft Environmental Impact Statement, prepared for Far North Queensland Ports Corporation

Rasheed, MA, Reason, C and Wells, J (2019), *Seagrass Habitat of Cairns Harbour and Trinity Inlet: Annual Monitoring Report 2018*, ref. 19/13, TropWATER James Cook University, prepared for Far North Queensland Ports Corporation

WorleyParsons (2010), *Cairns Port Long Term Management Plan Dredging and Dredge Spoil Management*, ref. 301001-00680-00-EN-REP-0001, prepared for Far North Queensland Ports Corporation

Appendix A Survey Plans from Previous DMPA Studies

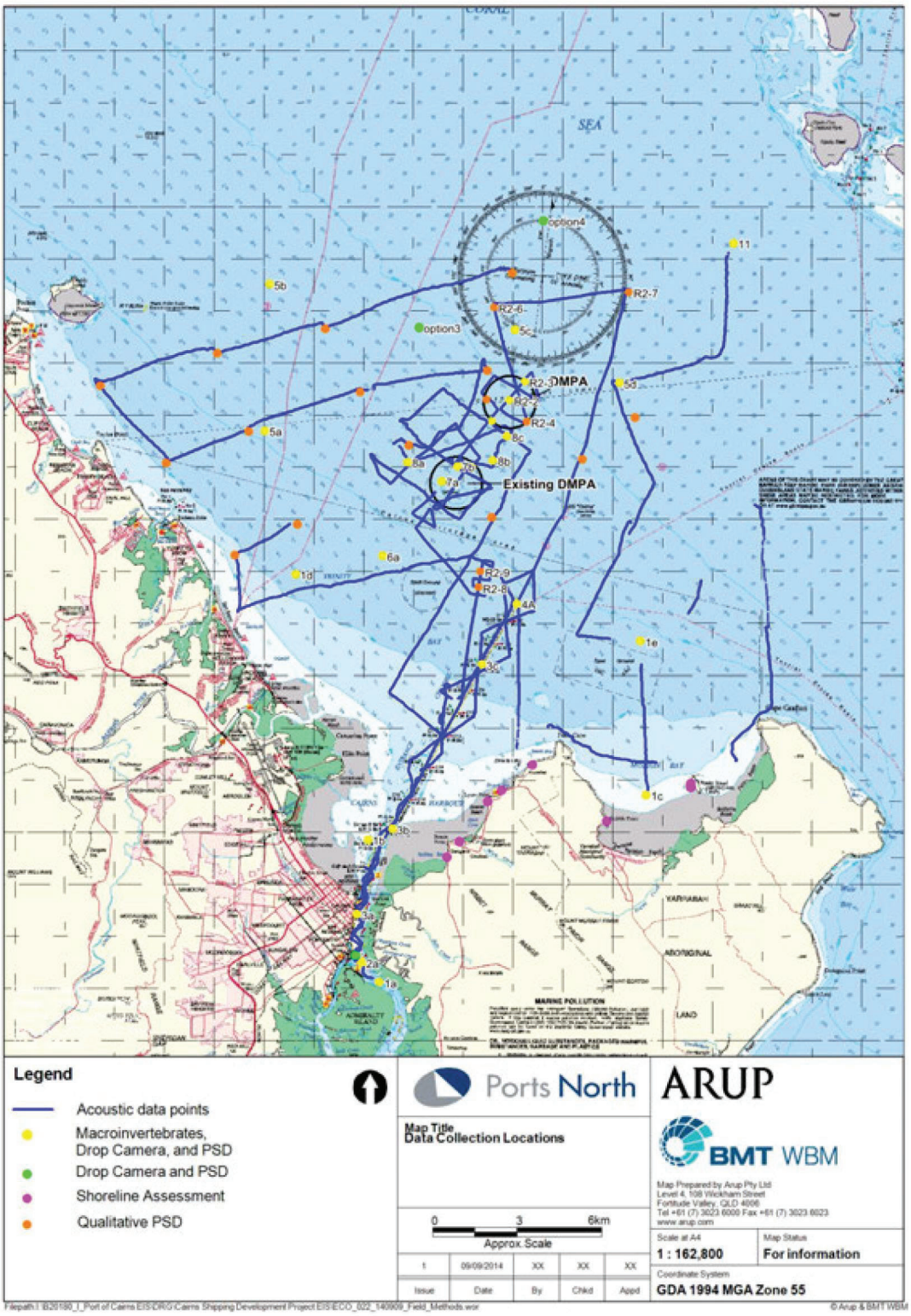


Figure A-1 2013 marine ecology data collection locations for CSDP Draft EIS (BMT WBM, 2014a)

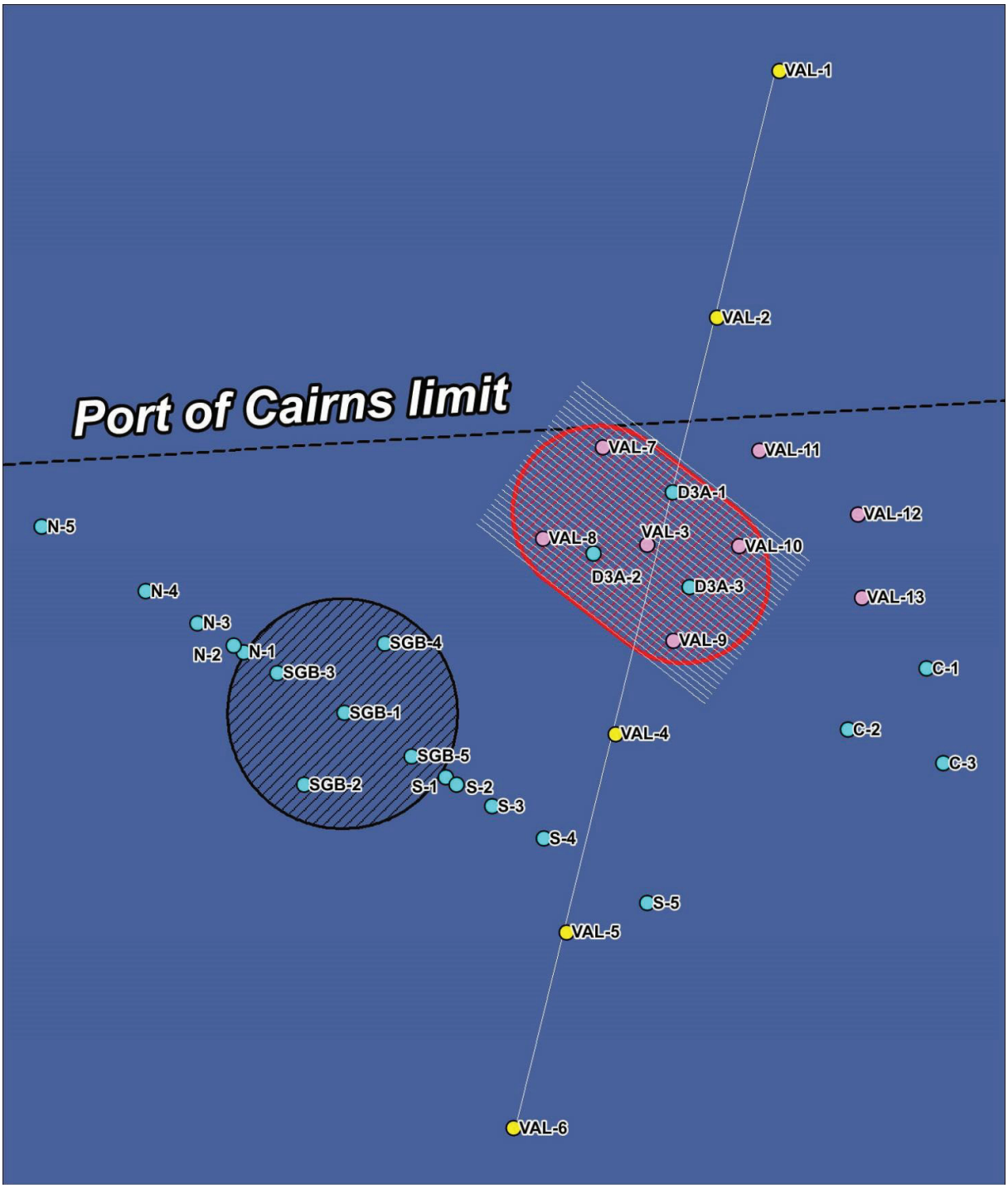
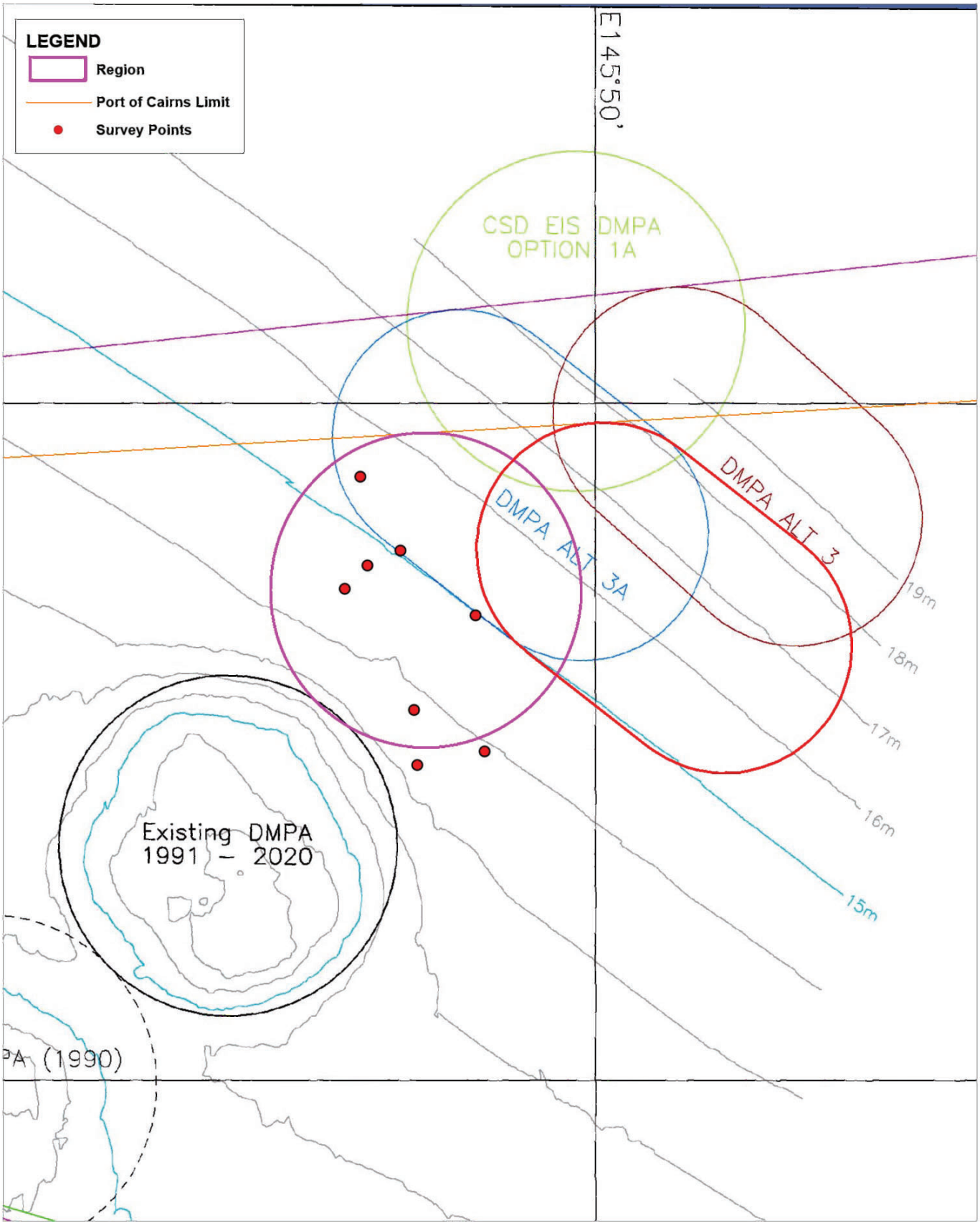


Figure A-2 2020 marine ecology data collection locations for mid-shore DMPA investigations, including existing DMPA (BMT, in prep)



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455 kHz SSS Mosaic of DMPA Option 4 - Survey Investigation Points

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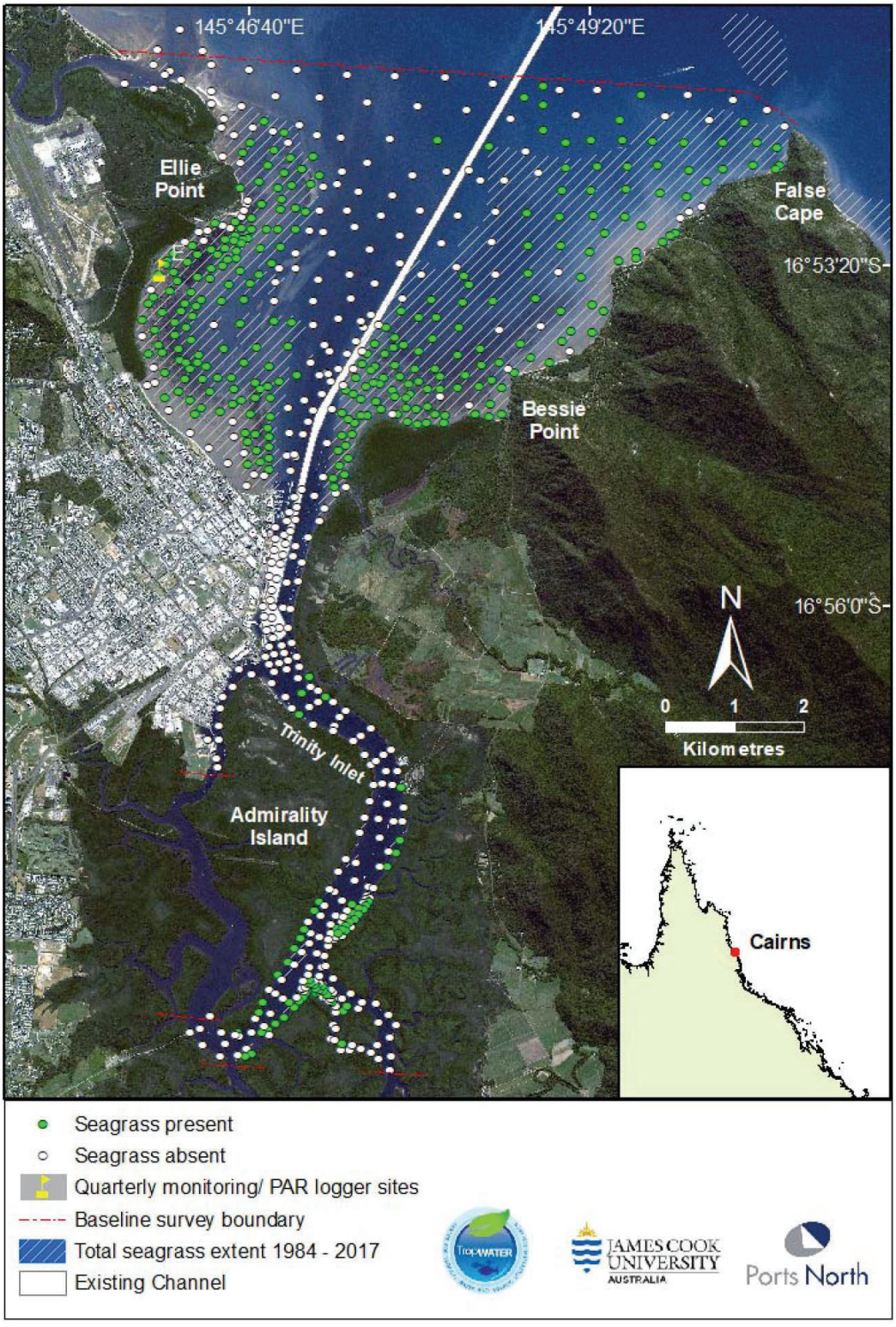

Figure A-4 TropWATER long-term seagrass monitoring locations in Trinity Inlet (Rasheed et al., 2019)

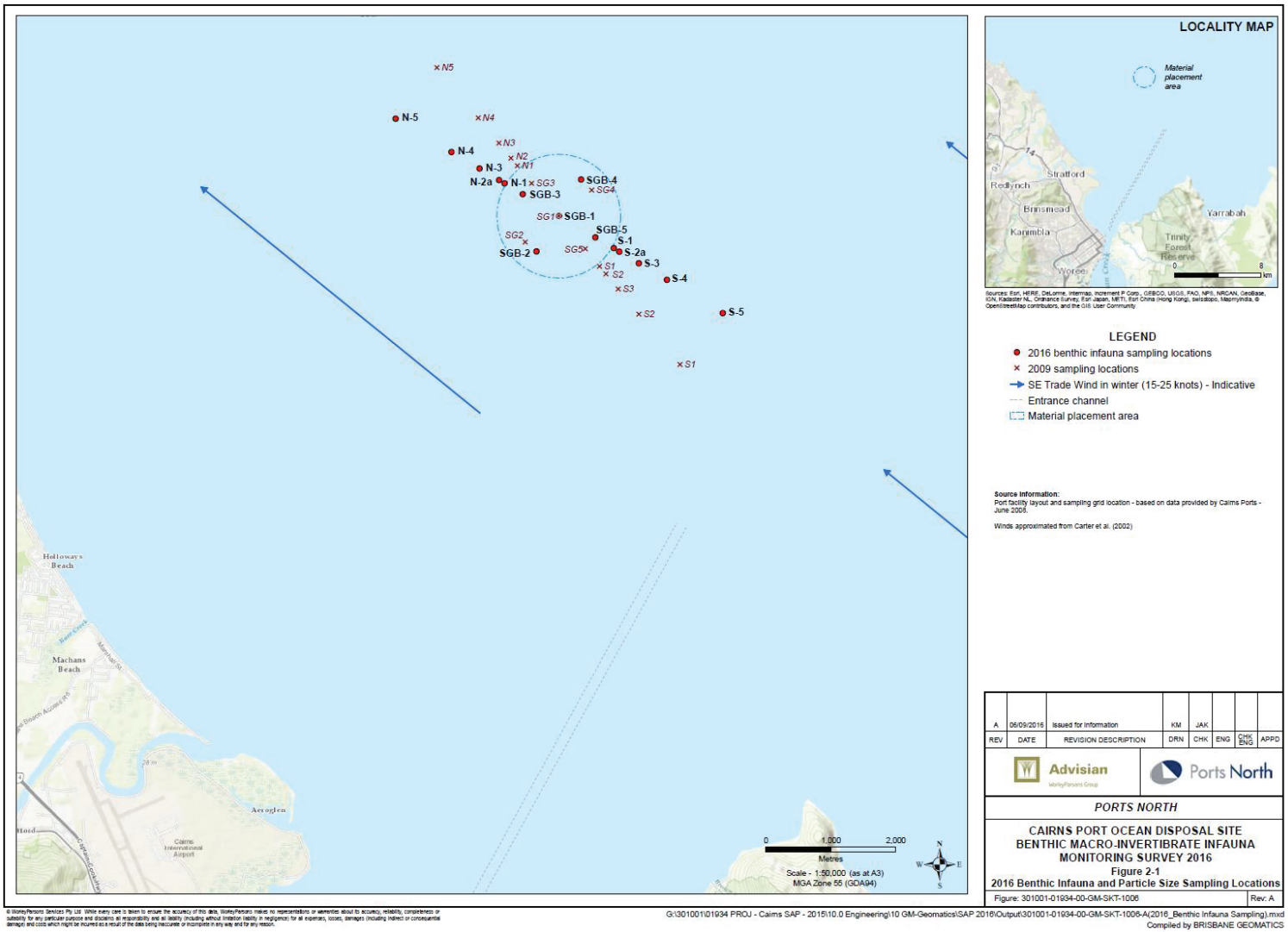

Figure A-5 2016 marine ecology data collection locations for existing DMPA investigations (Advisian, 2016)

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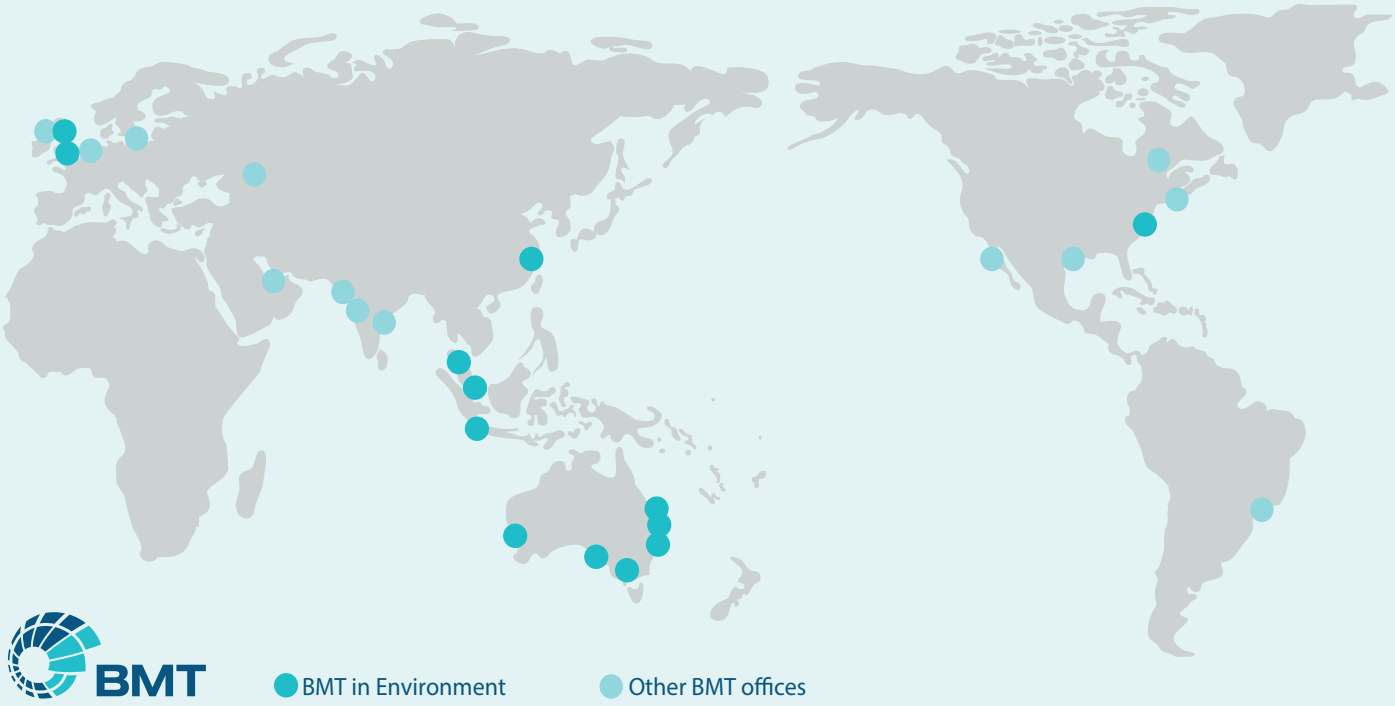

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