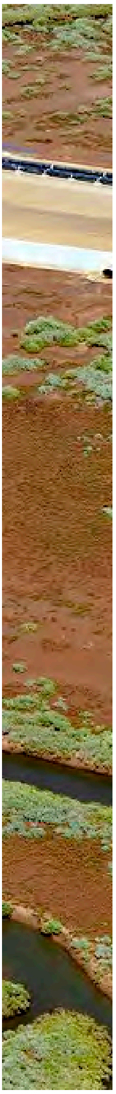

Small Craft Harbour Dredge Management Plan

9 December 2024

CITIC Pacific Mining

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1.0	12/09/2024	O2 Marine	Final for submission
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Acronym Table

Acronyms/ Abbreviations	Description
BCH	Benthic communities and habitat
BCHMP	Benthic communities and habitat monitoring program
BHD	Backhoe dredge
CD	Chart datum
CEMP	Conservation Estate Management Plan
CEO	Chief executive officer
CoA	Commonwealth of Australia
CoK	City of Karratha
CPM	Citic Pacific Mining
CPPC	Cape Preston Port Company
DBCA	Department of Biodiversity Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DLI	Daily light integral
DMP	Dredge management plan
DMPA	Dredge material placement area
DoEE	Department of Environment and Energy
DoT	Department of Transport
DPIRD	Department of Primary Indusrties and Regional Development
DGV	Dredging guideline values
DWER	Department of Water and Environmental Regulation
EMPgm	Environmental management program
EMPs	Environmental management plans
EMS	Environmental Management System
EnSTaR	Enstar Group Limited
EP Act	Environmental Protection Act 1986
EPA	Environmental Protection Agency
EPBC Act	Environmental Protection and Biodiversity Conservation Act 1999
EPOs	Environmental protection outcomes
EQGs	Environmental quality guidelines
EQO	Environmental quality objective
GCS	Geographic coordinate system
GLMM	Generalized linear mixed models

Acronyms/ Abbreviations	Description
GPS	Global positioning system
ILUA	Indigenous land use agreement
IMP	Invasive marine pest
kW	kilo Watt
LEP	Level of ecological protection
MEER	Maritime Environmental Emergency Response
MEPA	Medium ecological protection area
MEQ	Marine environment quality
MFO	Marine fauna observer
MMP	Marine Management Plan
MNES	Matters of national environmental significance
MODIS	Moderate resolution imaging spectroradiometer
MS	Ministerial statement
MT	Management targets
MWQMP	Marine water quality monitoring program
MWQMS	Marine water quality monitoring station
NTU	Nephelometric turbidity units
O2M	O2 Marine
OEMP	Operational Environmental Management Plan
OGV	Ocean going vessels
PAH	Poly-aromatic hydrocarbon
PAR	Photosynthetically active radiation
PEMP	Port Environmental Management Plan
PER	Public Environmental Review
PMST	Project matters search tool
PoCP	Port of Cape Preston
POLREP	Pollution report form
ppt	Parts per thousand
PQL	Practical quantitation limit
PSD	Particle size distribution
PTS	Permanent threshold shift
SER	Supplementary Environmental Review
SHB	Split-hull barge
SIT	Sino Iron Terminal
SQG-High	Sediment quality guideline – high value

Acronyms/ Abbreviations	Description
SSC	Suspended sediment concentration
the Project	Sino Iron Project
TBT	Tributyltin
TSS	Total suspended solids
TTS	Temporary threshold shift
VOC	Verification of competency
WA	Western Australia
WAMSI	Western Australian Marine Science Institution
WAFIC	Western Australian Fishing Industry Council
YM	Yaburara & Mardudhunera People
ZoHI	Zone of high impact
ZoI	Zone of influence
ZoMI	Zone of moderate impact

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1 Executive Summary

<table>
<tr><th>Aspect</th><th>Detail</th></tr>
<tr><td>Proposal Name</td><td>Iron Ore Mine, Downstream Processing (Direct-reduced and Hot-briquette Iron) and Port Construction (including up to 4.5 Mm^3 dredging, disposed offshore), Cape Preston, WA</td></tr>
<tr><td>Proponent Name</td><td>Sino Iron Pty Ltd
Korean Steel Pty Ltd</td></tr>
<tr><td>Ministerial Statement number</td><td>Ministerial Statement 635 (20 October 2003)
Amended by:
Ministerial Statement 822 (23 December 2009)
Ministerial Statement 1066 (20 October 2017)
Ministerial Statement 1169 (10 June 2021)</td></tr>
<tr><td>Purpose of this DMP</td><td>To address the impacts and mitigatory measures specifically pertaining to dredging and disposal activities associated with the Port of Cape Preston.
Satisfy the relevant aspects of MS635 (as amended):
Condition 7-1 (Marine Management Plan).</td></tr>
<tr><td>Key environmental factors, impacts and management targets</td><td>Predicted residual impacts to marine environmental quality (MEQ), benthic communities and habitat (BCH) and marine fauna are minor, and the monitoring and management outlined in this DMP will be used for validation.
<u>Marine Environmental Quality:</u>
Potential Impacts from dredging and disposal activities:
Deterioration of water quality from the disturbance in sediments resulting in increased turbidity
Hydrocarbon release into the marine environment from a vessel spill and/or bunkering
Management Targets for dredging and disposal activities:
Turbidity/Suspended solid concentrations and photosynthetically active radiation (PAR) physical parameters are likely to temporary change during dredging and disposal activities, although they will be monitored to validate that no BCH were not impacted.
Post dredging activities, turbidity, SSC and PAR physical parameters will return to background concentrations.
Chemical Parameters will remain consistent with spatially established areas for moderate and high Level of Ecological Protection (LEP) throughout the dredging program.
No hydrocarbon spills or discarding of waste into the marine environment
<u>Benthic Communities and Habitat:</u>
Potential Impacts from dredging and disposal activities:</td></tr>
</table>

Aspect	Detail
	• Direct loss of BCH within the dredge footprint Zone of High Impact (ZoHI) • Changes to water quality (turbidity/SSC and PAR) outside of the ZoHI, but no predicted impact to BCH consistent with a modelled Zone of Influence (ZoI) Management Targets for dredging and disposal activities: • No detectable impact on BCH outside of the ZoHI • Dredging or disposal operations do not occur outside of the defined dredging and Dredge material placement area (DMPA) footprint **Marine Fauna:** Potential impacts from dredging and disposal activities: • Injury or death of marine fauna from entrainment • Injury or death of marine fauna due to vessel strike • Injury or death of marine fauna from the underwater noise • Injury or death of marine fauna from light pollution • Injury or death of marine fauna due to hydrocarbon spill or discarded waste • Introduction of Marine Pest Species. Management Targets for dredging or disposal activities: • No reportable incidences of marine fauna injury or death from entrainment • No reported incidences of vessel strike resulting in injury or death • No direct impacts on marine fauna from underwater noise • No direct impacts to marine fauna due to light emissions • No reportable incidences of marine fauna injury or death because of a hydrocarbon spill or discarded waste • No detection of Introduced Marine Pests (IMPs) on dredging equipment within the Port area
Ministerial Statement Conditions:	Ministerial Statement 635 approves the proposal to construct and operate an iron ore mine, power station, desalination plant, processing plant, accommodation and port facilities (including up to 4.5 Mm^3 dredging, disposed offshore) in the Cape Preston area. Three amendments have been made that have related to changing the conditions of the wastewater outfall, expanding the mine and its processing/export facilities, and requiring all plans and reports to be aligned with contemporary standards/policies and guidelines. Condition 7: requires that the Marine Management Plan includes predicted changes to the marine environment, appropriate management measures and implementation strategies, and prepare significance and changes to habitats associated with dredging and spoil dumping operations.
Related Management Plans	In accordance with Ministerial Statement 635 conditions the following related management plans have been prepared to the requirements of the Minister of Environment on advice of the EPA: • Condition 7: Marine Management Plan (MMP) (as amended); • Condition 9: Port Environmental Management Plan (PEMP) (as amended); and • Condition 2, Schedule 2, Item 2 : Operational Environmental Management Plan (OEMP)

Aspect	Detail
EMP required pre-construction	Yes ☑ No ☐

2 Context, scope, and rationale

2.1 Introduction

CITIC Pacific Mining Pty Ltd (CPM) operates the Sino Iron Project (the Project), a magnetite mining and processing operation at Cape Preston in Western Australia's Pilbara region. The Project includes the Cape Preston Port where magnetite concentrate is exported to customers in Asia. Hong Kong based CITIC Limited established CPM to manage the development and ongoing operation of the Project. In August 2016 Mineralogy's status as proponent of MS635 was revoked and Sino Iron and Korean Steel, (wholly-owned subsidiaries of CITIC Limited), became the proponents of MS635. Sino Iron and Korean Steel are also the proponents of MS1066.

The Project has been assessed by the Environmental Protection Authority (EPA) at Public Environmental Review (PER) level. The PER (Austeel, 2000) was submitted in December 2000 and a Supplementary Environmental Review (SER) (Austeel, 2002) was submitted in February 2002 to address changes to the original proposal. The Minister for the Environment approved the Project under Statement 635 in October 2003.

The PER described dredging activities that incorporated a shipping channel and dredge within the port breakwater structure for a small craft (small craft harbour). Bulletin 1056 details the EPA assessment of the Austeel PER and notes '*an area of about 70 ha will be affected by dredging of the shipping channel for port access and berthing pockets*'. MS635 conditionally approves the Project including port construction with up to 4.5 Mm^3 dredging for small craft harbour and berthing with spoil disposed offshore.

Dredging proposed in this Dredge Management Plan (DMP) is for capital dredging of ~36,000 m^3 for the small craft harbour (inner harbour) and berthing pockets (berth pocket). A Dredge Management Placement Area (DMPA) is proposed in this DMP outside the breakwater within tenement G08/52. A sea dumping permit will be sought under the Environment Protection (Sea Dumping) Act 1981 for the disposal of dredged material in Commonwealth waters.

2.2 Proposal

This proposal is to conduct capital dredging of ~36,000 m^3 for the small craft harbour (inner harbour) and berthing pockets (berth pocket) in the Sino Iron Terminal (SIT). The SIT is located at the Port of Cape Preston (PoCP) approximately 70 km south-west of Karratha (Figure 1). Capital dredging is required to:

- accommodate new vessels with an increased draft
- provide for efficacious vessel access
- decrease the risk for harbour vessels
- aid in manoeuvring harbour vessels.

CPM are responsible for operating the Sino Iron Project for Sino Iron Pty Ltd and Korean Steel Pty Ltd. Cape Preston Port Company (CPPC) provides port operational services to CPM for the Sino Iron Project. It facilitates the Project works at the SIT. The dredging will involve conditioning the existing inner harbour and barge loading pocket.

2.3 Background

Shipping operations at the port commenced in December 2013 with the port used exclusively by the Project to export magnetite ore concentrate through SIT.

The magnetite ore is collected from the stockyard and loaded onto an out-loading circuit, which transfers it via a 3.1 km long causeway/breakwater to the loading berths. The product is loaded either onto a self-contained transhipment shuttle vessel or onto one of four barges that transport the product from the loading berth out to larger ocean-going vessels (OGV) moored offshore.

The SIT exclusively services vessels for the Project and comprises the following infrastructure and operations:

- a causeway/ breakwater including approximately 10,500 Core-Loc units installed around the breakwater to refract wave energy generated by a one-in-100-year cyclone event
- service wharf and hardstand area
- conveyor and loader
- four barges with a carrying capacity of 12,000 to 14,000 tonnes each
- four tugs with a bollard pull of 72 tonnes each
- one transhipper vessel
- one transhipment shuttle vessel
- a fuel farm facility (200,000 L diesel capacity) for refuelling marine vessels.

Visiting OGVs wait at the outer anchorage at the PoCP before being moved to the inner anchorage where they are loaded (Figure 1). Each month between 11 and 17 OGVs arrive at the port to be loaded, more during April to October (due to favourable weather conditions), and less during the cyclone months (November to March).

Figure 1: Location Overview

2.4 Purpose of this plan

Condition 7 of MS635 requires that a Marine Management Plan needs to be developed to predicted changes to the marine environment, provide appropriate management measures and implementation strategies, and prepare significance and changes to habitats associated with dredging and spoil dumping operations. A Marine Management Plan was prepared by CPM for operational risks of the Project which did not consider capital dredging activities described in Section 3 (LeProvost Environmental 2008).

The purpose of this DMP is to address the requirement of Condition 7 of MS 635 and ensure that potential environmental impacts resulting from dredging and disposal are effectively mitigated with appropriate management targets and management actions.

This DMP outlines the framework for the dredging activities including:

- legislation and regulations that apply to the dredging program
- overall management framework
- the areas where dredging is to occur
- type of materials to be dredged
- environmental values to be protected, the risks that dredging may pose, and the mechanisms to be implemented to mediate these risks (management strategies)
- responsible parties
- monitoring and reporting.

2.5 Objectives

The objectives for the following key environmental factors as described in EPA (2023) have been considered for this DMP which are summarised below:

- Marine Environmental Quality: To maintain the quality of water, sediment and biota so that environmental values are protected
- Benthic Communities and Habitat (BCH): To protect BCH so that biological diversity and ecological integrity are maintained
- Marine Fauna: To protect marine fauna so that biological diversity and ecological integrity are maintained.

2.6 Management Approach

This DMP has been developed in accordance with technical guidance for environmental impact assessment of marine dredging proposals (EPA 2021). Hydrodynamic modelling has been undertaken to develop a spatially based zonation scheme to describe the predicted extent, severity and duration of impacts associated with dredging. Management zones have been derived based on the pressure-response thresholds to corals outlined in Appendix A of the EPA's guidance. The possible-effects threshold was used to determine the extent of the Zone of Moderate Impact (ZoMI). The extent of the Zone of High Impact (ZoHI) was determined by a 50 m buffer surrounding the dredging and disposal footprints. In accordance with EPA (2021), this DMP assumes areas designated as ZoHI will incur irreversible loss to any BCH and any area designated as ZoMI will incur reversible loss. Hydrodynamic modelling predicts that the ZoMI does not extend beyond the ZoHI for either the dredging or disposal footprints. Therefore, no indirect impact on BCH is predicted beyond the ZoHI for proposed activities.

In accordance with EPA (2021), the predictions of impacts have been integrated into plans for monitoring and management. Details are provided in this plan around proposed monitoring to inform adaptive management and determine if management targets are being achieved, which provides a high degree of confidence that environmental protection outcomes are not compromised. Given the small scale of dredging proposed, a total of six telemetered monitoring sites (three contingency and three reference sites) will be established. A two-tiered management response has been developed as an adaptive management approach which will be applied during dredging and disposal activities. The assessment framework enables linkage between the environmental impact predictions and the data generated through the monitoring and management program.

2.7 Legislation, regulations and guidelines

The potential environmental impacts of the proposal will be assessed at Commonwealth, State and Local Authority levels with each Authority guiding on the level of assessment required. This DMP was developed considering those approvals and with the following legislation and guidelines.

2.7.1 State

- Biodiversity Conservation Act 2016 (BC Act)
- Biodiversity Conservation Regulations 2018
- Environmental Protection Act 1986 (EP Act)
- Environmental Protection Regulations 1987
- Fisheries Resource Management Act 1994 (relevant to Introduced Marine Pests)
- Marine and Harbours Act 1981
- Navigable Waters Regulations 1958
- Pollution of Waters by Oil and Noxious Substances Act 1987
- Port Authorities Act 1999
- Shipping and Pilotage (Port and Harbour) Regulations 1967
- Western Australian Marine Act 1982

2.7.2 Commonwealth

- Biosecurity Act 2015
- Biosecurity Regulations (2016)
- Environment Protection (Sea Dumping) Act 1981
- Environmental Protection and Biodiversity Conservation Act (1999) (EPBC Act)
- Protection of the Seas (Prevention of Pollution from Ships) Act 1983

2.7.3 Supporting Technical Guidelines

This Plan refers to the following State and Commonwealth documents:

- Australian Ballast Water Management Requirements (Version 8) 2020
- Australian National Guidelines for Whale and Dolphin Watching 2017 (Commonwealth of Australia 2017)
- EPBC Act Policy Statement 2.1: Interaction between offshore seismic exploration and whales (DEWHA 2008)
- National Assessment Guidelines for Dredging (Commonwealth of Australia 2009)
- National Light Pollution Guidelines for Wildlife (DCCEEW 2023)
- Instructions on how to prepare Environmental Protection Act 1986 Part IV Environmental Management Plans (EPA, 2024)
- Background quality of the marine sediment of the Pilbara coast (DEC 2006)
- Pilbara Coastal Water Quality Consultation Outcomes: Environmental Values and Environmental Quality Objectives (EPA 2019)
- Environmental Factor Guideline
  - Marine Environmental Quality (EPA 2016a)
  - Benthic Communities and Habitat (EPA 2016b)
  - Marine Fauna (EPA 2016c)
- Technical Guidance
  - Environmental Impact Assessment of Marine Dredging Proposals (EPA, 2021)
  - National Acid Sulfate Soils Guidance: National acid sulfate soils identification and laboratory methods manual (CoA 2018)
  - Protecting the Quality of Western Australia's Marine Environment (EPA, 2016d).
  - Protection of Benthic Communities and Habitats (EPA, 2016e).

2.8 Approvals Background

2.8.1 Condition requirements

Project approvals are pursuant to the following conditions as summarised in Table 1.

2.8.2 Environmental Protection Act 1986 – Ministerial Statement's

The WA EPA, under the EP Act, provided approval for dredging and disposal offshore of up to 4.5 Mm^3 of material, subject to the conditions set out in MS635.

On 23 December 2009 Statement 822 was issued following a s46 application by Mineralogy to remove and amend parts of conditions 7 and 8 of MS635. Statement 822 removes Condition 7-1(5) regarding the Marine Management Plan and Condition 8-1 through 8-4 concerning the Marine Wastewater Outfall of MS635 and replaces them with new conditions of 8-1 to 8-8. Verification of the desalination diffuser performance was achieved in the 2019 calendar year and reported to DWER on 4 June 2020 in accordance with the requirements of Condition 8-7 of

MS822. A s46 submission was lodged concurrent to the verification report on 4 June 2020. On 10 June 2021 MS1169 was issued amending MS822 conditions 8-3 and 8-8.

On 20 October 2017, MS1066 was issued approving an expansion of the project required to accommodate continued operations. MS1066 increased the authorised extent of clearing for the proposal from 2,734 ha to 10,100 ha (within a development envelope of 22,737 ha), increased the pit depth from 220 m to 400 m and increased pit dewatering abstraction and surplus dewater management discharge rates from 2 GL/a to 8 GL/a.

MS1066 replaced Condition 16 of MS635 with a new condition requiring the development of a contemporary Mine Closure Plan and added Condition 17 requiring the proponent to revise all plans, reports, systems or programs approved under MS635 applicable to the Sino Iron Mine Continuation Proposal and to be consistent with contemporary standards, policies, guidelines and procedures.

Post grant of MS1066, the following changes to the specifications of the proposal have been approved under section 45C of the EP Act:

- An increase to pit dewatering authorised extent (from 8 GL/a to 12 GL/a) was approved on 18 July 2018 (Attachment 1 to MS1066); and
- An increase to the surplus dewater management authorised extent (from 8 GL/a to 12 GL/a) was approved on 1 September 2021 (Attachment 2 to MS1066).

Conditions in Ministerial Statement 635 (and amendments 822, 1066 and 1169) relating to the undertaking of the dredging being proposed are presented in Table 1.

Table 1: Ministerial conditions relevant to the DMP

Ministerial Statement Number	Condition Number	Requirement	Fulfilment/ Relevance
635	2-1	Implement the environmental management commitments documents in Schedule 2. Commitment No. 1: Prepare and implement an Environmental Management System (EMS) for the project, including measurement and evaluation of environmental performance. Commitment No. 2: Prepare, implement and regularly revise an Environmental Management Programme (EMPgm) which contains plans, guidelines and procedures to manage environmental issues associated with the construction and operations of the Project, including: • Marine management plan (see Condition 7) • Spill contingency plan (see Commitment 10) Commitment No. 7: Prepare and implement a Ballast Water Management Plan which contains plans, guidelines and procedures on the methods to be employed to minimise the potential release of exotic organisms. The plan will be provided to all shippers. Commitment No 10: Prepare and implement (as necessary) a Spill Contingency Plan, to contain plans, guidelines and procedures to manage any spill. Commitment No 18: Implement best practice environmental management plans within the project.	<u>Commitment No 1</u> This DMP is developed within the context of CPM's EMS that are provided in the Operations Environmental Management Plan (CPM 2018). <u>Commitment No 2</u> This DMP fulfills the requirement for a management plan for dredging/disposal works, this takes the place of the now superseded marine management plan which was established for the initial construction phase. It establishes an EMPgm by providing details to the monitoring and managing the marine environment through three monitoring programs and procedures: • Marine Water Quality Monitoring Program (Appendix B.1) • Benthic Communities and Habitat Monitoring Program (Appendix B.2) • Marine Fauna Management Procedures (Appendix B.3) <u>Commitment No 7</u> The Ballast Water and Biofouling Management Plan (BW&BFMP) (CPM 2009) has been incorporated into the Marine Fauna management table in Section 8.3. <u>Commitment No. 10</u> CPM's Oil Spill Contingency Plan is incorporated into this DMP in the management actions of both MEQ and Marine Fauna (MF) in 8.1 and 8.3, respectively. <u>Commitment No. 18</u>

Ministerial Statement Number	Condition Number	Requirement	Fulfilment/ Relevance
			The DMP follows implementation of best practice environmental management plans.
	7	Prepare a Marine Management Plan (MMP) that will: • Accurately predict changes in coastal water movements, quality, residence times, bathymetry, sedimentology, beach alignment and habitat cover associated with the project • Allow for appropriate management measures to be identified and implemented • Detailed marine surveys to establish existing regimes of currents, bathymetry, sedimentology, shore alignment and habitat cover, and modelling to predict the changes to those regimes associated with the construction and operation of the causeway between Cape Preston and Preston Island • The significance of, and changes to, habitats associated with dredging and dredge spoil dumping operations, and strategies to manage any associated environmental impacts • The means to avoid significant damage to the high-cover coral community at survey Location 9* to the north of Preston Island, including avoidance of dredging and spoil dumping during coral spawning events, from the construction and operational stages of the Project	This DMP fulfilled the dredging/disposal specific marine management requirements under Condition 7 by providing: • accurate predictions to changes associated with the project (section 6) • appropriate management measures (section 8) • detailed marine studies of Cape Preston and Preston Island (section 5) • significance of, and changes to, habitats (section 6.3) • avoid significant changes to high cover coral communities (8.2) • avoid dredging/disposal during coral spawning events (8.2)
	9	Prepare and implement a Port Environmental Management Plan (PEMP) that will:	Port Environmental Management Plan (CPM 2011) has been incorporated into this DMP by establishing specific EPO's for MEQ,

Ministerial Statement Number	Condition Number	Requirement	Fulfilment/ Relevance
		• Establish Environmental Quality Objectives (EQO) which explicitly identify uses and values and where they will be protected, and the appropriate Environmental Quality Criteria required to sustain each EQO • Ensure light spill is contained to minimise impacts on turtles • Ensure runoff and spills are contained • Incorporate an oil spill contingency plan • Incorporate a ballast water management plan • Include a hull-fouling organisms management plan, which includes a risk assessment and baseline marine survey for benthic and planktonic organisms in the area designated for ship berthing to minimise the risk of introduction of exotic marine organisms from ships' hulls	BCH and marine fauna factors that relate to dredging/disposal works (see section 7). The Oil Spill Contingency Plan and BW&BFMP have been incorporated through management actions for both MEQ and MF (see sections 8.1 and 8.3, respectively).
	15	Prepare and implement a Conservation Estate Management Plan (CEMP), that includes: • The potential effects and mitigatory measures of the port development, including dredging, spoil dumping and causeway/bridging structures on the Cape Preston area, which is a part of the proposed Dampier Archipelago/Cape Preston Marine Conservation Reserve	This DMP details the potential effects and mitigatory measures of dredging and spoil dumping activities on the Cape Preston area.
1066	17	Revise and implement plans, reports, systems or programs required under the Ministerial Statement 635 to be consistent with contemporary standards, policies, guidelines and procedures.	Relevant to all management plans and procedures

Ministerial Statement Number	Condition Number	Requirement	Fulfilment/ Relevance
**Location 9 was first recorded in the Public Environmental Review (Austeel 2000) on the northern side of Preston Island as a high-cover and high-diversity coral community. Subsequent habitat surveys in 2006 and 2007 failed to locate this coral community. Benthic surveys reported evidence that habitats were recovering from two intense cyclones (Glenda in 2005 and Clare in 2006) that passed very close to Cape Preston. It was concluded that Location 9 had been significantly impacted by these natural events (URS 2008).*			

2.8.3 Environment Protection and Biodiversity Conservation Act 1999

The Sino Iron Project (previously known as the Austeel/ Mineralogy Project) was referred under the now-repealed Environment Protection (Impact of Proposals) Act 1974 and given certification pursuant to the Environmental Reform (Consequential Provisions) Act 1999. This certification means that the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) does not apply to the Austeel/ Mineralogy proposal.

The Sino Iron Mine Continuation Proposal (which included provisions for dredging up to 4.5 Mm^3 of material) was referred to under the EPBC Act on 19 January 2017 (EPBC 2017/7862) and the Proposal was determined on 29 March 2017 as 'not a controlled action'.

2.8.4 Environment Protection (Sea Dumping) Act 1981

A sea dumping permit will be sought under the Environment Protection (Sea Dumping) Act 1981 (Sea Dumping Act) to satisfy Commonwealth legislative requirements for the disposal of dredged material in Commonwealth waters.

A geochemical assessment supports this DMP and the sea dumping permit application (AECOM, 2018a) that was undertaken in accordance with the National Assessment Guidelines for Dredging (NAGD, CoA, 2009). The geochemical assessment informs the assessment of potential environmental impacts that may be associated with dredging for the Project.

It should also be noted that the proposed dredged material placement location in this plan falls within the current marine lease boundaries (G08/52) and is within Commonwealth waters, as per advisory communications from DoEE to CPM (dated 28/11/2017).

3 Description of Works

3.1 Dredging

The proposed dredging works (Figure 1;Table 2) comprise dredging the berth pocket and inner harbour to a depth of –12.0 m CD (berth pocket) and-9.5 m CD (inner harbour), with each section requiring an additional 0.5 m of over-dredge. The total volume is approximately 35,649 m^3 (Table 1).

Table 2: Planned CPM Dredging Campaign Details

Reference Area	Dredged Depth (m CD)			Dredge Volumes (m^3)		
	Nominal (Target)	Actual (Over Dredge)	Mean Dredge Depth Face	Target	Over Dredge	Total
Berth pocket	**-12**	**-12.5**	1.73	14,095	7,048	21,143
Inner harbour	**-9.5**	**-10**	0.8	4,612	9,894	14,506
Total				**18,707**	**16,942**	**35,649**

3.2 Disposal

Dredged material will be placed in an offshore Dredge Material Placement Area (DMPA) of ~50,000 m^2. The material will be transferred to the DMPA using a Split-Hull Barge, however, provisions for alternative transfer methods have been considered, including the utilisation of a hopper barge or for material to be pumped directly from the dredge to the DMPA. The proposed DMPA is shown in Figure 1, the boundary points are presented in Table 3.

Table 3: Location coordinates of the DMPA

Eastings	Northings
416279	7698080
416529	7698081
416530	7697881
416280	7697880

(spatial reference: GCS_ GDA_1994_ZONE 50)

3.3 Schedule and Sequencing of Works

Preliminary Schedule

Once all relevant permits and approvals have been granted; dredging and associated works will be prepared for and carried out under agreed conditions. Dredging will be undertaken opportunistically to avoid mobilisation of crew and vessel(s). It is expected that dredging works, including downtime, will take six weeks with works occurring 24/7 (Table 4).

The ecological windows for coral spawning will be avoided to comply with MS635 Condition 7.1 (4). Additional mitigation and management measures will be implemented if dredging takes place during any key marine fauna ecological windows (i.e. southern humpback whale migration) (see Appendix B.3).

Table 4: Sequence and Estimated Timeframes of Operational Activities

Action	Estimated Time Requirement (weeks)
Mobilisation of works crews and operational briefings	1.00
Inner harbour and berth pocket dredging	
Berth pocket	4.20
Inner harbour	1.70
Total	**5.90**
Demobilisation and debrief	1.00

3.4 Equipment

It is expected that the proposed dredge material in both the berth pocket and inner harbour can be dredged with a backhoe dredge (BHD). Due to the small scale of this dredging campaign, CPM proposes to source vessel/equipment locally by opportunistically engaging a BHD that has mobilised to a nearby port. It is expected that a BHD with ~1,120 kW and a bucket size of 8 m^3, or similar, will be able to achieve the scope of this dredging program (for example the Nulla Nulla BHD, Hall Contracting 2021). A typical BHD with these specifications is shown in Figure 2.

Mobilisation of equipment and crew will be avoided by engaging vessels/equipment locally. All the relevant environmental compliance requirements associated with incoming vessels and equipment will be adhered to in accordance with the Port Environmental Management Plan (PEMP). For example, vessels will be required to comply with CPM's Invasive Marine Pests Management procedures outlined in section 6.4 of the Ballast Water and Biofouling Management Plan (GHD 2009).

Dredged material may be transported to the DMPA (offshore spoil ground) via a split hull barge (SHB). The barge's capacity would be approximately 1,500 tonnes with an estimated 1,300 tonne capacity utilised per load. It is estimated that it would take 29 cycles to dispose of all the dredged material.

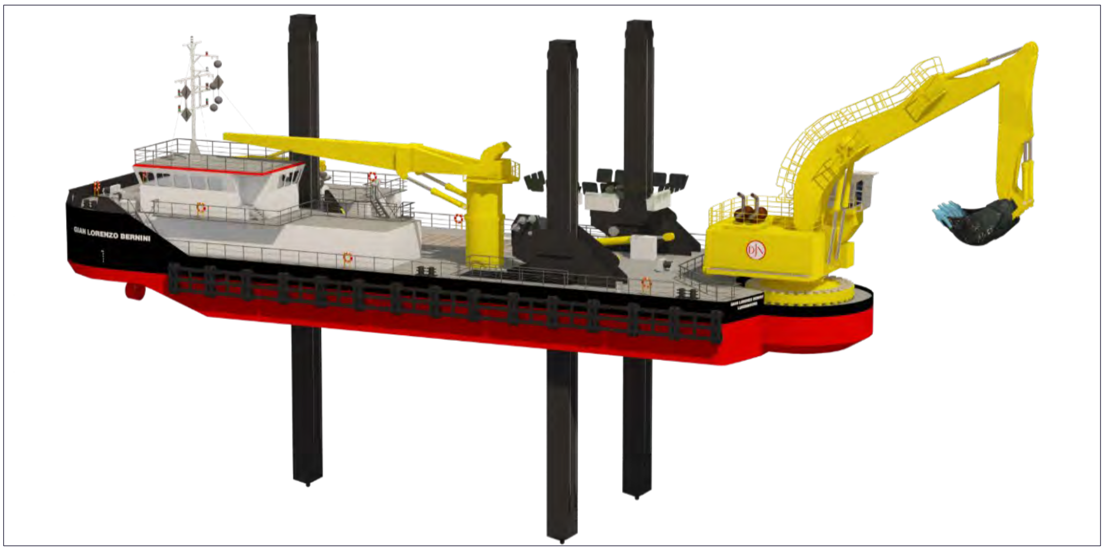

Figure 2: Typical Backhoe Dredge

Support Vessels

A variety of support vessels will be required. These may include, but may not be limited to:

- small tender vessel
- crew transfer vessels
- work barges
- small tugs
- small bathymetric survey vessel.

4 Existing Environment

The marine environment within the Project area is described in detail in the existing MMP (LeProvost, 2008). This section of the DMP provides a brief overview of those existing environment components that are relevant to the consideration of impacts from dredging and dredged material placement.

4.1 General Environmental Setting

Cape Preston is a rocky headland, comprised of a basalt outcrop that forms the Cape and a limestone shore platform that extends around the Cape and adjacent beaches. Cape Preston is separated from the mainland by a network of mangrove-fringed tidal creeks, extensive intertidal zones and a rocky reef inhabited by coral communities (URS, 2008). A shallow nearshore platform extends to the southwest for a few kilometres and to the northeast for 30 km towards the vicinity of Eaglehawk Island.

Two rivers drain into the Indian Ocean in the vicinity of Cape Preston; these are the Maitland River which meets the ocean approximately 34 km north-east of Cape Preston and the Fortescue River approximately 21 km south-west of Cape Preston. The Maitland River extends for 88 km and has a basin size of 2,123 km^2. The Fortescue River extends for 63 km and has a basin size of 49,759 km^2.

To the west of Cape Preston lies a shallow embayment known as Fortescue Roads. The Fortescue River discharges at the base of this embayment. Both the Maitland and Fortescue Rivers discharge large volumes of fresh and highly turbid silty waters. The rivers drain large areas of hinterland but only flow occasionally in response to cyclonic downpours (LeProvost, 2008).

The Cape Preston region occurs between the Pilbara Offshore and Pilbara Nearshore mesoscale bioregions, as per the Integrated Marine and Coastal Regionalisation of Australia (Commonwealth of Australia, 2006). The Pilbara Nearshore region comprises intertidal and shallow subtidal habitats supporting a high diversity of infauna on mudflats and sandflats associated with fringing mangals in bays and lagoons. Fringing coral reefs occur around some of the islands. The Pilbara Offshore region is less turbid and includes coral reef ecosystems with Indonesian and Pacific affinities. Subtidal coral reef communities occur either as small, isolated patches adjacent to offshore islands or as a long semi-continuous fringe to the mudflat habitat stretching away from the north-western tip of Cape Preston to the south-west.

The climate is characterised by two seasons with short transitional seasons between these main seasons. The dry season extends from April to November and the wet season from December to March. The nearest Bureau of Meteorology weather station with comprehensive rainfall data is Karratha Aero (004083), approximately 80 km northeast of Cape Preston. Most rainfall occurs between January and March corresponding with the tropical monsoon period.

Currents around Cape Preston are dominated by tides and regional winds, to a lesser extent (URS 2008). Spring tides can generate surface currents of 0.75 m/s and neap tides typically generate 0.25 m/s (GEMS 2008). Strong tidal currents and episodic strong winds are also the dominant mixing and dispersion mechanisms off Cape Preston (URS 2008). Wave energy in the area is typically relatively low, typically coming from the west to northwest from September to February, east to northeast from May to July, and calm mild wave conditions in the transitional months.

4.2 Water Quality

Water quality measures are spatially and temporally variable along the Pilbara coastline (WAMSI 2017).

Salinity in the nearshore waters around Cape Preston ranges from 35.5 to 37.1 ppt (CALM 2005). Seasonal temperature and salinity gradients are known to produce density currents which can be equal in magnitude to neap tide current flow. However, depth profiles showed relatively consistent salinity (<1 ppt) indicating high water column mixing (Halpern, Glick and Maunsell 2006).

Water quality near Cape Preston is generally highly turbid due to the episodic high-volume river flows, strong currents, regular wind-driven wave energy, and dominant marine sediment types (Halpern, Glick and Maunsell, 2006). Previous surveys have highlighted that turbidity varies greatly depending on weather conditions and the time of collection with ambient concentrations of total suspended solids (TSS) ranging from 2 to 3 mg/l in 2000, 2.1 to 25.1 mg/l in 2002, less than 5 mg/L to 48.1 mg/L in 2004 and 2 to 10 mg/L in 2007 (Halpern, Glick and Maunsell, 2006; URS, 2008).

4.2.1 Turbidity baseline

Turbidity is likely to increase with dredging and associated activities, including the disposal of sediments into the water column. Turbidity is a measure of suspended sediment concentrations which area known to affect coral and other benthic photosynthetic communities at elevated concentrations through the depravation of light, as well as providing an indicator for levels of suspended sediment deposition and potential smothering of benthic organisms (EPA 2021). Therefore, changes in turbidity are a good indicator of whether the benthic communities may be affected. Baseline turbidity in surface waters was estimated through the analysis of TSS from aerial imagery between 2002 – 2018 (EnSTaR 2019). The average of the monthly median values is presented in Table 5. January recorded the highest average monthly median TSS values, as well as the greatest variability indicated by the standard deviation. TSS values were typically lower between April and August, while variability was lowest between April and May.

Table 5: The average of the monthly median TSS (mg/L) values at Cape Preston between 2002 - 2018

Year	J	F	M	A	M	J	J	A	S	O	N	D
Mean	1.68	1.51	1.56	1.42	1.44	1.39	1.34	1.40	1.51	1.60	1.62	1.54
St. Dev	0.73	0.47	0.51	0.28	0.31	0.35	0.35	0.37	0.39	0.37	0.46	0.44

4.2.2 Aesthetic water observations

Observations of surface waters at moderate ecological protection area (MEPA) sites indicated generally good aesthetic water quality, except for three sites at the southern tip of the inner harbour where there was a greater than 20% reduction in water clarity relative to the 2011 baseline survey and a change in water colour observed compared to the 2011 assessments (O2 Marine 2023).

4.3 Sediment Quality

The marine sediments in the nearshore area around Cape Preston comprise:

- uncemented deposits of siliceous carbonate sand and gravel. Shell and coral fragments were observed in some areas, interbedded with layers of coral fragments down to approximately 3 m depth.
- sedimentary (calcareous) rock of siliceous limestone, siliceous calcarenite, calcarenite, detrital limestone, coral fragments, calcilutite and conglomeritic calcirudite
- igneous rock of basalt and basaltic andesite of the Medina Formation – fine-grained, grey and dark grey andesite.

Historically, levels of arsenic have been above the environmental quality guideline (EQG) values derived from default guideline values (DGV) in ANZG (2018) (GHD 2011, GHD 2014, AECOM 2018a, O2 Marine 2023). However, arsenic levels were higher at the reference sites, providing evidence of 'naturally' elevated background arsenic concentrations (O2 Marine 2023). These high arsenic levels have been attributed to local geological influence (e.g. weathering of bedrock in the catchment). All other parameters measured (Tributyltin, Polycyclic aromatic hydrocarbons and total metals) are all below the EQG values (O2 Marine 2023).

Sediment movement around Cape Preston is driven by a mixture of wind, tides and currents. Net transport is generally towards the cape. There is a significant difference in sediment transport patterns between seasons, with winds mainly from the west in the wet season (December – March) and from the east in the dry season (April – November).

4.4 Benthic Communities and Habitat

Marine habitats in the Cape Preston region consist of predominantly bare sand or sand-veneered low-profile pavement. A comprehensive mapping of the BCH of the region was completed in 2006/2007 (URS 2008) (Table 6, Figure 3). BCH has been monitored throughout the development and operation of the SIT (AECOM 2019, O2 Marine 2022). The BCH surrounding Cape Preston can be characterised by:

- Deep Sand/Silt: Benthic habitat characterised by sand is dominant in the Cape Preston area, particularly in areas deeper than 10 m. Sand is also dominant in the intertidal zone associated with limestone veneered pavement.
- Limestone Veneered Pavement: Dominating the intertidal very shallow (<1 m depth) limestone veneered pavement is also associated with sand and/or algal communities.
- Algae: Expansive macroalgal communities occur to the west and eastern sides of Cape Preston along the vast intertidal and subtidal areas along the fringing limestone pavement that extends from south of Preston Spit, up around Cape Preston and eastwards into Regnard Bay (URS 2008). Algal communities are the most common benthic component generally occupying up to 50% of cover including dominant species *Sargassum, Padina* and *Asparagopsis* spp. Algal cover has been in decline since 2012 (AECOM 2018b).

- Seagrass: Limited and patchy seagrass beds have been found in the vicinity of Cape Preston (LeProvost 2008). The closest bed containing 18.35 hectares of patchy seagrass is 3.4 km to the east of the spoil ground.
- Coral: Coral communities form a band associated with bathymetry contours that span to the southwest and east of the port. A thin band of dense and moderate coral coverage occurs directly south, approximately 500 m away from the spoil ground. Dense, moderate and low coral coverage communities can be found within the port, the closest habitat is approximately 40 m from the inner harbour dredging footprint. Where dense coral coverage is associated with more than 25% coverage, moderate coral coverage is associated with between 10-25% coverage, and low coverage is below 10% coverage. Dominating species include *Porites*, *Goniastrea* and *Lobophyllia* spp., which are typical of nearshore mixed assemblages of the Pilbara with intermediate levels of exposure, turbidity and current flow (Blakeway & Radford 2004). The SIT's core-loc breakwater has also created suitable habitat for coral settlement and substantial coral growth has established since installation outside of the harbour.
- Fan/Sponges: Fans and sponges have been identified in the Cape Preston area but have not been mapped within the marine management unit. LeProvost (2008) mapped fans and sponges further offshore around the inner anchorage sites. Coverage is between 2 – 3.5% (URS 2008).

A study undertaken by AECOM (2024a, 2024b) for the DMPA identified filter feeder communities on sand or sand veneered pavement between the 11-14 m bathymetry to the south and east of the DMPA. While sparse filter feeders may be found throughout the area at these depths, the communities described recorded >10% cover comprising mostly of sponges, Zoanthids and soft corals. The survey area and mapping results have been overlaid onto the map in Figure 3. It is likely this habitat may be found north-east and south-west along the bathymetry contour where sand veneered pavement is present. More details of the BCH survey undertaken at the DMPA by AECOM (2014a, 2024b) is provided in Section 5.3.

Table 6: Benthic communities and habitat within the Marine Management Unit

Habitat Type	Area within Marine Management Unit	
	Hectares	Proportion (%)
Deep sand/silt	1,773.18	27.37
Algae/limestone pavement	961.65	14.85
Sand/limestone pavement	2,926.83	45.28
Seagrass	18.35	0.28
Dense coral coverage	71.69	1.11
Moderate coral coverage	188.99	2.92
Low coral coverage	536.79	8.29
Fan/ sponge	0.00	0.00

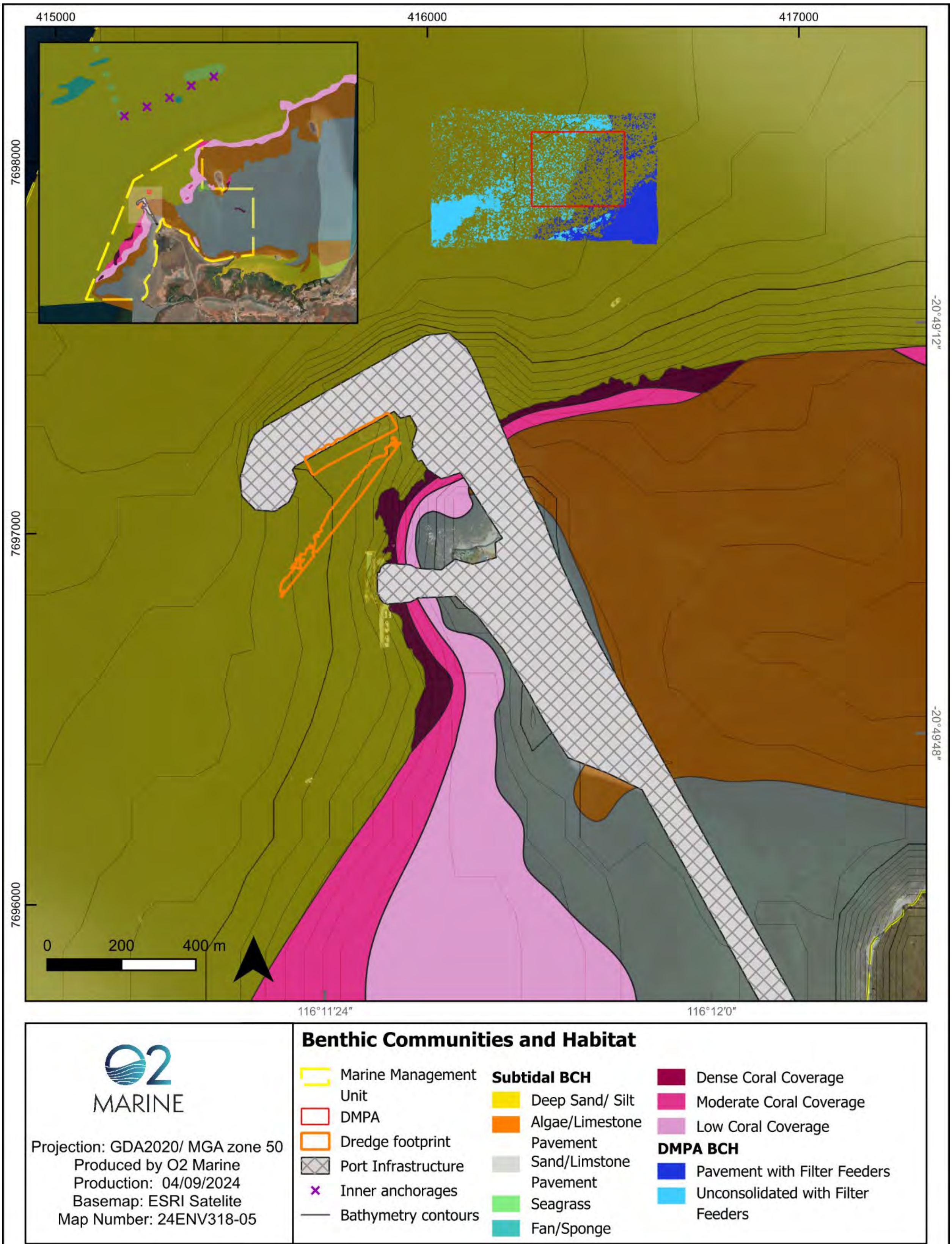

Figure 3: Benthic Communities and Habitat

4.5 Marine Fauna

Several species that have the potential to occur in the proposed Project footprint are protected under both the Commonwealth EPBC Act and the State Biodiversity Conservation Act 2016 (BC Act).

A marine fauna desktop search was conducted to identify conservation-significant fauna with the potential to be present in and around the PoCP that are either listed as Matters of National Environmental Significance (MNES) under the EPBC Act, or WA-protected species listed under Part 2 of the BC Act. A 10 km radial buffer was applied to the dredging and disposal footprints. The terrestrial area was removed from the PMST search to remove any terrestrial-only MNES. Key species are those that were categorised as 'known' or 'likely' to occur in the vicinity of the PoCP. The key significant marine fauna relevant to the dredging of the project include:

Mammals:

'Likely'

- Humpback whale (*Metaptera novaeangliae*) – Migratory
- Dugong (*Dugong dugong*) – Migratory
- Australian humpback dolphin (*Sousa sahulensis*) – Migratory
- Spotted bottlenose dolphin (*Tursiops aduncus* – Arafura/Timor Sea populations) – Migratory

Reptiles:

'Known'

- Leaf-scaled seasnake (*Aipysurus foliosquama*) – Critically Endangered

'Likely'

- Short-nosed seasnake (*Aipysurus apraefrontalis*) – Critically Endangered
- Loggerhead turtle (*Caretta caretta*) – Endangered, Migratory
- Green turtle (*Chelonia mydas*) – Vulnerable, Migratory
- Hawksbill turtle (*Eretmochelys imbricata*) – Vulnerable, Migratory
- Flatback turtle (*Natator depressus*) – Vulnerable, Migratory

Fish:

'Likely'

- Dwarf sawfish (*Pristis clavata*) – Vulnerable, Migratory
- Green sawfish (*Pristis zijsron*) – Vulnerable, Migratory
- Narrow sawfish (*Anoxypristis cuspidata*)– Migratory
- Reef manta ray (*Manta alfredi*) – Migratory

- Scalloped hammerhead (*Sphyrna lewini*) – Conservation Dependent
- Southern bluefin tuna (*Thunnus maccoyii*) – Conservation Dependent

Ecological windows for the above key species are presented in Table 7.

Table 7: Ecological windows for Cape Preston. Light blue indicates the timeframe when species are present and dark blue indicates timeframe for biologically important activities.

Species presence	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**	**Data Source**
Mammals													
Humpback Whale													Irvine et al. (2018), Jenner et al. (2010)
- *Northward migration*													Dawbin (1997), Jenner et al. (2010)
- *Southward migration*													Jenner et al. (2010); Bejder et al. (2019)
-*Southward peak calves*													Irvine et al. (2018); Irvine and Salgado Kent (2019); Bejder et al. (2019)
Dugong													Bayliss et al. (2019); DSEWPac (2012)
Australian Humpback Dolphin													Hanf et al. (2022)
Spotted Bottlenose Dolphin													Hanf et al. (2022)
Reptiles													
Leaf-scaled Seasnake													Udyawer et al. (2016)
Short-nosed Seasnake													Sanders et al. (2015)
Green Turtle													DoEE (2017)
- *Nesting and inter-nesting*													DoEE (2017)
Loggerhead Turtle													DoEE (2017)
- *Nesting and inter-nesting*													DoEE (2017)
Hawksbill Turtle													DoEE (2017)
- *Nesting and inter-nesting (peak)*													DoEE (2017)
-*Hatching (peak)*													DoEE (2017)
Flatback Turtle													DoEE (2017)
- *Nesting and inter-nesting*													DoEE (2017)
Fish													

Species presence	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**	**Data Source**
Mammals													
Green Sawfish													Morgan et al. (2015); Morgan et al. (2017)
Reef Manta Ray													Armstrong et al. (2020)
Scalloped Hammerhead Shark													Heupel et al. (2020)
Southern Bluefin Tuna													Commonwealth of Australia (2024)

5 Pre-dredging Environmental Assessments

5.1 Sediment Geochemical Assessment

A geochemical assessment of sediments within the proposed dredging footprint (inner harbour and berth pocket) and the DMPA was completed by AECOM (2024b) in late 2023 in accordance with guidance within the NAGD (CoA 2009). The assessment analysed sediment for metals, hydrocarbons, and organotins. These parameters were assessed as they include pollutants commonly found in port areas including a now superseded antifoulant that can be potentially present in port environments. Iron is often included as one of the metal parameters tested (CoA 2009) which is particularly relevant as the transfer of iron is a major component of operations at CoCP.

Sediment sampling was conducted in both the proposed dredge footprint and the proposed DMPA with the number of samples determined in accordance with Appendix D of the NAGD based on the proposed dredge volume of less than 37,000 m^3. A total of 24 locations were sampled, three sites within the berth pocket, seven sites within the inner harbour, 10 sites within the DMPA, and four reference sites outside the DMPA boundary (Table 8; Figure 4).

Table 8: Sediment sampling locations

	Area Description	Number of Sampling Locations
Dredging footprint	Berth pocket	3
	Inner harbour	7
Disposal area	DMPA	10
Reference		4

5.1.1 Dredging Footprint

Testing indicates sediments are suitable for unconfined offshore disposal.

Particle size distribution (PSD) results indicated the sediment within the dredging footprint comprised mostly sand (mean= 79.3%), with laboratory descriptions including 'sand', 'shell' and 'fines'. The remaining sediment composition was characterised by relatively uniform proportions of clay, silt and gravel, averaging between 6.7% and 7.2% although composition was variable between all locations. Samples from the berth pocket recorded a higher composition of gravel (mean= 19.3%) compared to the inner harbour (mean= 4.4%), resulting in comparably lower proportions of sand (75.3%) and fines (mean= 5.7%) than the inner harbour (means= 80.2% and 15.7%, respectively).Arsenic concentrations were above the NAGD (CoA 2009) screening level of 20 mg/kg in eight of the 10 locations sampled within the proposed dredging footprint, which included one of three locations within the berth pocket and all seven locations within the inner harbour. This resulted in median and 95% UCL values for arsenic within dredge footprint samples above the NAGD (CoA 2009) screening level, although no results from any location exceeded the ANZG (2018) sediment quality guideline high (SQG-High) value of 70 mg/kg. However, as explained in Section 4.3, elevated arsenic has been consistently recorded historically during previous sediment surveys attributed to local geological influence (GHD 2011, GHD 2014, AECOM 2018a, O2 Marine 2023). NAGD (CoA 2009) does not provide a screening level for Manganese, although the 95% UCL of 212.6 mg/kg was recorded slightly above the 80th percentile of reference sites at 183.8 mg/kg. This result is comparable to the range in concentrations recorded in the central Great Barrier Reef lagoon of between 99-496 mg/kg (Alongi et al. 1993), indicating natural levels which do not represent a potential toxic concern. The maximum value recorded from reference locations was a similar concentration at 203 mg/kg, although results suggest manganese concentrations are typically higher within the harbour than sampled at the DMPA and reference locations. Manganese in sediments and porewaters flux naturally with redox cycling, changes in pH and organic matter.

The 95% UCL for the remaining metal concentrations was below either the NAGD (CoA 2009) screening levels or the 80th percentile of reference sites. Testing of poly-aromatic hydrocarbons (PAHs) and tributyltin (TBT) were not detected above the Practical Quantitation Limit (PQL) used for tests and were below screening levels.

5.1.2 Disposal Area and Reference Sites

Sediment sampling indicate the proposed DMPA is comprised of clean natural sediment, consistent with an undisturbed area which has not been used previously for disposal of dredge material. The results provide a benchmark for future comparison following use as a DMPA.

The PSD indicated sediment at the proposed DMPA is predominantly comprised of sand (mean= 68.5%) and gravel (mean= 29.0%). Fines recorded an average of ~3% dominated by clay size particles, with silt concentrations from all samples <1%. PSD sampling of four reference locations outside the DMPA found comparably low proportions of gravel (mean= 1%), resulting in comparably higher composition of sand (mean= 86.6%) and fines (mean= 12.5%). The PSD of sediment across the DMPA locations closely represent that from the berth pocket, while results from the reference locations are more closely aligned with the inner harbour.

Metal concentrations in sediment across all DMPA and reference locations were recorded below NAGD (CoA 2009) screening levels, including arsenic, which was slightly higher across reference sites (16.7 mg/kg) than recorded from the DMPA (15.4 mg/kg). Conversely, aluminium, iron and manganese were elevated within the DMPA than compared to reference sites, with means across DMPA locations of 4,292.5 mg/kg, 14,375 mg/kg and 179.3 mg/kg compared to reference means of 3,172.5 mg/kg, 11,625 mg/kg and 167.5 mg/kg, respectively. This resulted in median values across for aluminium and iron being naturally above the 80th percentile of the reference sites. The results are likely attributable to differences in organic carbon and PSD, in particular the higher composition of sand and fines at reference locations, indicating direct comparison of these metal concentrations between the DMPA and reference locations requiring normalisation of a reference element for which aluminium may be suitable.

PAHs were not sampled from the DMPA, although PAHs and TBT sampled at reference locations were not detected above the PQL used for tests and were below screening levels.

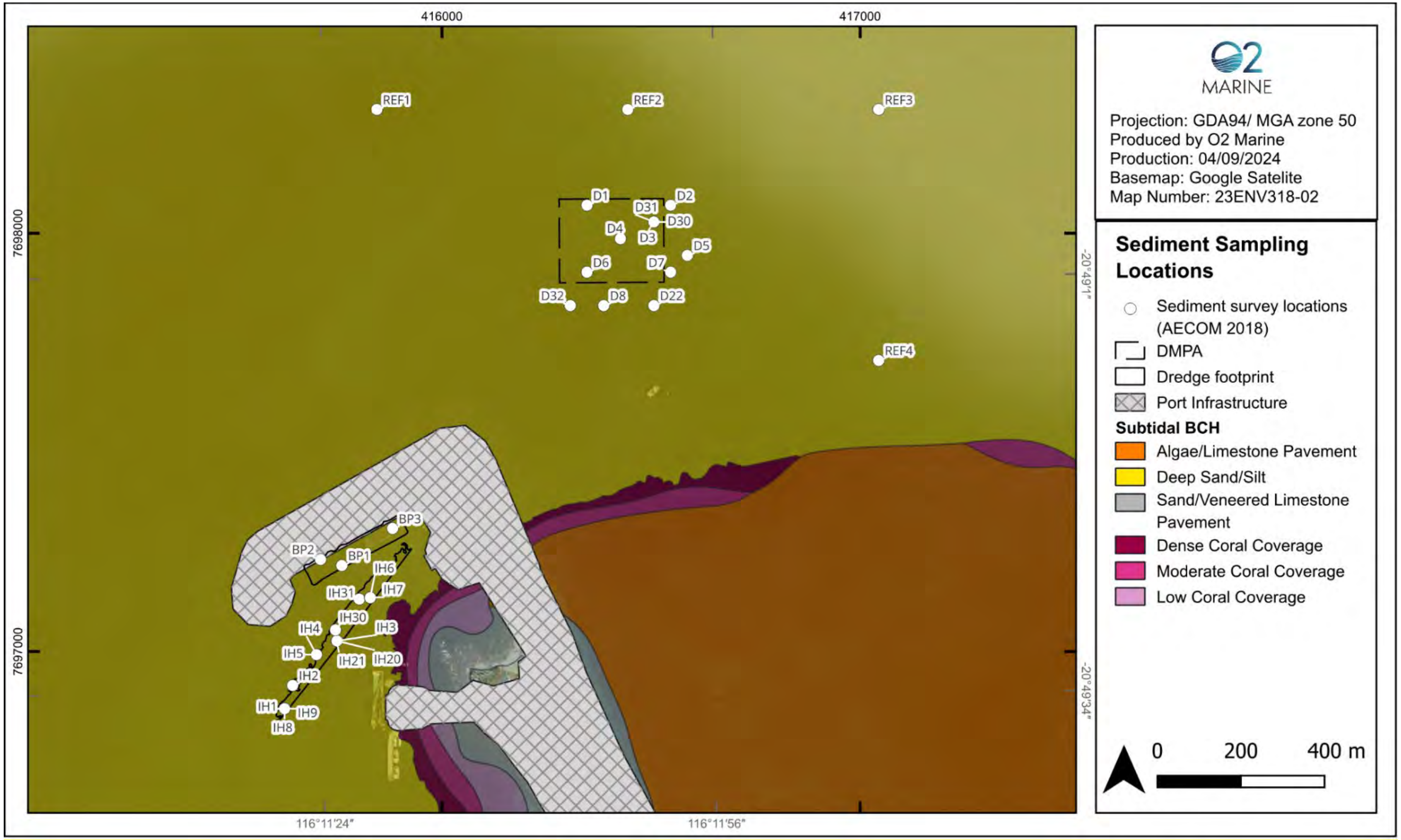

Figure 4: Sediment Sampling Sites

5.2 Sediment Plume Modelling

RPS undertook sediment transport modelling to assess the dispersion of suspended sediment concentrations (SSCs) generated from dredging activities (RPS, 2024). Baseline turbidity was derived from the median of average TSS concentrations obtained from remote-sensing imagery (MODIS) between the 4th of July 2002 and the 30th of March 2018 (see Section 4.2.1). A total of 20 sites were used to generate the plume modelling. The median baseline data at each of these sites across June to August was used for the winter scenarios and across January to March for the summer scenario.

The three modelled scenarios are presented in Table 9. Each scenario simulated dredging of the west berth pocket, east berth pocket and inner harbour turning area using the dredge areas, depths and volumes as shown in Figure 5 at different rates of production. The dredging in each section was assumed to be completed with a BHD equipped with an 8 m^3 bucket (Liebherr P-9350 with engine power of ~1,120 kW; Hall Contracting, 2020). The dredged material was simulated as being placed into a waiting 1,500 m^3 SHB and transported (by harbour tug) to one of two proposed offshore disposal sites where it is discharged at a depth of 3.8 m below mean sea level (i.e. depth of the hopper doors). The production rates for Scenarios 1 and 2 assume that only “soft” material (sediment) makes up the volume to be dredged, while Scenario 3 assumes a mixture of “soft” and “moderate” material (sediments and sedimentary rock) will be dredged. Following modelling, disposal site 1 was rejected in preference for disposal site 2 based on favourable environmental model outputs. Therefore, results for Scenario 1 at disposal site 1 was not used for the assessment

Table 9: Modelled dredge plume scenarios

Scenario	Production Rates (M^3/week)	Duration	Disposal Site	Dredged material type
1	17,830	14 days	Site 1	Sediment only
2	17,830	14 days	Site 2	Sediment only
3	4,293 – 8,533	41 days	Site 2	Mixed sediment and calcareous rock

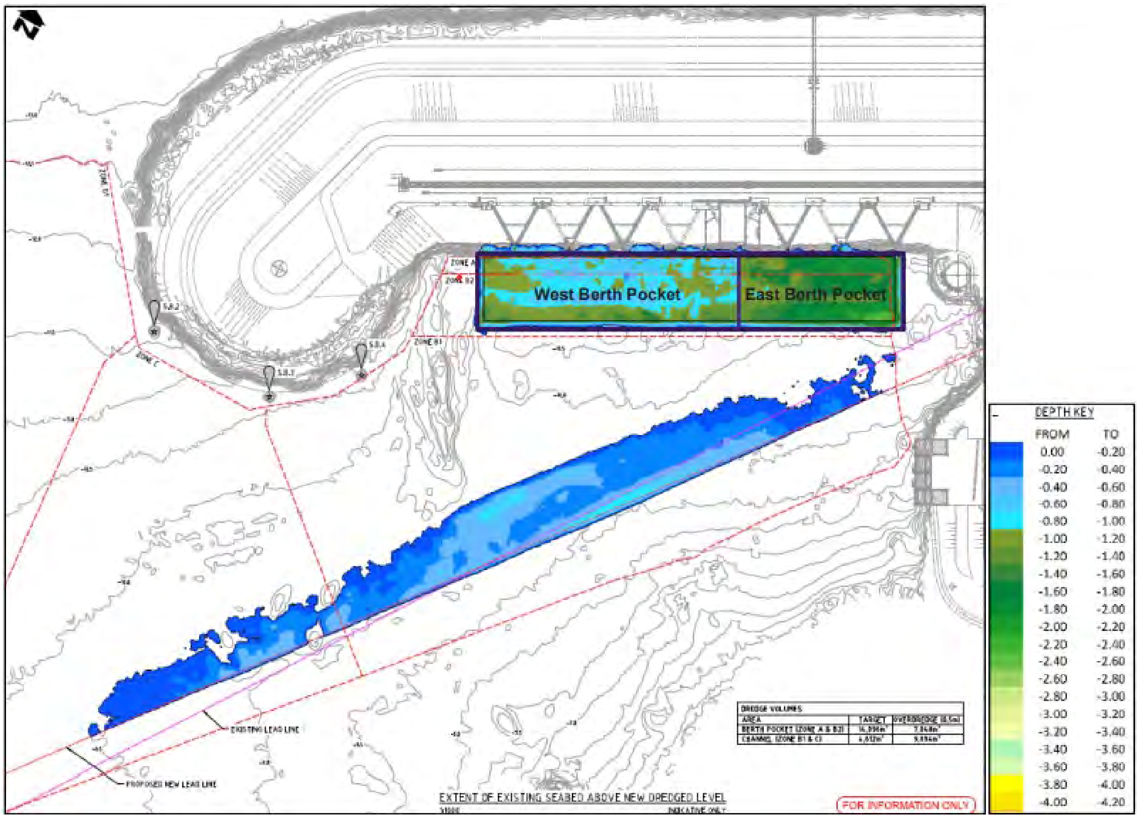

Figure 5: Dredging areas, depths and volumes within the dredge zones

5.2.1 Impact Zonation Scheme

Modelling results determined the spatial extent of the ZoMI and Zone of Influence (ZoI). The ZoHI was determined as a 50 m spatial buffer around both the dredging (berth pocket and inner harbour) and disposal (DMPA) footprints. Coral-based possible- and probable- effects threshold values were derived from Appendix A of the EPAs Technical Guidance for the assessment of marine dredging proposals (2021) and used to determine the spatial extent of the ZoMI, through modelling above background. The ZoI was based on an exceedance of a 1 mg/L threshold above the background in the surface TSS at any time throughout the dredging campaign.

Table 10: Suspended threshold concentrations used to derive spatial boundaries

Zone	Averaging Period	Suspended Sediment Concentration Threshold (mg/L)	
		Possible effect	Probable effect
ZoHI	NA	50 m spatial buffer around both the dredging footprints	
ZoMI	3d	>19.4	>35.7
	7d	>14.7	>24.5
	10d	>13.1	>20.9
	14d	>11.7	>18.0
	28d	>9.3	>13.2
ZoI	NA	>1 above the background in surface SSC	

5.2.2 Modelling Results

The modelling report and detailed results from RPS (2024) are provided in Appendix D. A short summary of key outputs relevant to the DMP is described below. The modelling showed two distinct mobilisation patterns, defined by Summer (wet season) (Figure 6) and Winter (dry season) (Figure 7) current patterns. The predicted plume is expected to move along the coast to the west and east in Summer but only to the west in Winter.

Modelled suspended sediment plumes showed that the ZoMI does not extend beyond the ZoHI. Therefore, there are no predicted indirect impacts to coral communities beyond 50 m surrounding the dredge and disposal footprints. The spatial extent of the ZoI indicates temporary increases in SSC generated from dredging may be discernible in surface waters for several kilometres from the operating dredge and DMPA, but where these changes would not result in a detectible impact on BCH.

Figure 6: Summer sediment plume modelling

Figure 7: Winter sediment plume modelling

5.3 BCH Assessment at DMPA

A BCH assessment of the proposed DMPA and surrounds was conducted by AECOM in December 2023 using video recorded from a remotely operated vehicle (ROV) (AECOM 2024a). Observations from this survey at the DMPA were used to validate the regional BCH map that was produced by URS (2008). The survey sites are shown in Figure 8.

Three survey locations overlap the proposed DMPA (D1, D4, D5) and present habitat comprised of flat, bioturbated unconsolidated sediment at a depth between 11 -14 m LAT (AECOM 2024a). This habitat was also found at 12 locations to the north and west of the DMPA boundary. Nine sampling locations to the east and south of the DMPA in similar depths recorded non-benthic primary producing filter feeder communities comprised >10% cover. The habitat at these locations was mostly described as sand or sediment on veneered pavement, with sloping relief recorded at approximately half the sites. Site C4 was the only exception which identified shallower (<10 m LAT) low profile reef substrate ~1 km south-east of the DMPA supporting a mixed filter feeder and hard coral community.

The filter feeder community included sponges and Gorgonians (sea whips and fans). Sparse and patchy sponges, sea whips and fans are common in highly dynamic and often turbid marine environments of the Pilbara coast (Maunsell 2006). AECOM (2024) detail these communities as non-primary producing filter feeders, although these taxa likely contain varying levels of chlorophyll-a and thus have varying degrees of phototrophic reliance, so 'non-primary producing' may not be a strictly accurate description for the species present (Abdul Wahab et al. 2017). However, both phototrophic and heterotrophic species can survive under moderately low light intensities (Daily Light Integral (DLI) ≤3.1 mol photons m^2d^{-1}) for periods of at least 28 days, indicating they are less susceptible to dredging impacts than coral communities (EPA 2021). Macroalgae was recorded from four sites (C2, C4, D12 and D13). The hard corals observed at site C4 in shallower water included Faviid, *Turbinaria*, and encrusting coral. Motile invertebrates, such as echinoderms and gastropods were also present at one of the sites (D6).

The results indicate that there is a filter feeder community with cover of >10% present on sand and sediment with veneered pavement which occurs at depths between 11-14 m to the south and east of the DMPA that was not mapped in URS (2008). The survey area and results have been mapped and overlaid onto the original map in Figure 3 from Section 4.4: Existing Environment. This habitat may extend further north-east and south-west along the same bathymetry contours where sloping sand and sediment veneered pavement is present. However, the presence of corals in the vicinity of Cape Preston has been known since pre-construction with a long-term annual coral monitoring program in place to monitor the health of corals.

Figure 8: Benthic remotely operated vehicle sampling locations in the vicinity of the DMPA

6 Predicted Impacts

6.1 Disposal Site Geochemistry

The dredge area is comprised of sandy sediments with no significant contaminants of concern. The sediment geochemistry of the dredging area showed that sediments are of 'clean' condition and suitable for unconfined disposal. Similar PSD results in both the dredge footprint and the DMPA indicate that the sediment type would not differ significantly from what is currently there.

6.2 Dredging and Disposal Plume

It is predicted that the small scale of this dredging program (~36,000 m^3) and the mixture of sediments and sedimentary rock requiring relatively slow production rates will produce a patchy plume governed by short time scales. Elevated SSCs above the possible and probable thresholds for hard coral (Table 10) are predicted to be limited to within 50 m surrounding the dredging and disposal footprints defined as the ZoHI and disperse quickly (within hours). Therefore, there is no ZoMI, while the ZoHI transitions directly into the ZoI. The ZoI was based on an exceedance of ≥1 mg/L threshold above the background in the surface TSS at any time throughout the dredging campaign and represents an area within which changes in environmental quality associated with dredge plumes may be visible during the dredging operations, but where these changes would not result in a detectible impact on benthic biota (e.g. a reduction in biomass).

6.3 Benthic Communities and Habitat

Dredging of the inner harbour and barge berth pocket will result in direct irreversible loss of 9.4 ha of subtidal sand/silt which is the dominant habitat type in the marine management unit (1,773.18 ha). In addition, there will be a direct irreversible loss of 0.03 ha (0.17%) of dense coral community within the Marine Management Unit. The dense coral community that is predicted to be lost occurs entirely within the inner harbour and is within 50 m of the dredge footprint. Permanent loss of the coral community within the inner harbour was predicted as part of the port development and approvals (GHD 2014). Coral monitoring at site 6 within the inner harbour indicates cover has declined from 12.5% in 2009 to ~8% in 2024, although the results indicate construction and operational activities have not led to an unacceptable decline within the marine management unit and implies the community may be more resilient than initially predicted. Modelling predicts the coral community occurring immediately outside of the ZoHI will not be impacted. This area is identified as the ZoI where changes in environmental quality associated with dredge plumes are predicted and anticipated during the dredging operations, but these changes would not result in a detectible impact on benthic biota (e.g. a reduction in biomass).

A further 7.7 ha of subtidal unconsolidated flat sand/silt will be directly impacted because of the disposal of dredged material in the DMPA. This will impact any burrowing organisms present as indicated by the medium level of bioturbation observed throughout the DMPA (AECOM 2024a). However, this is unlikely to represent significant components of the regional food web as similar habitats are widespread around the PoCP and the DMPA. An additional two mapped areas, each of 1.3 ha within the DMPA ZoHI, overlaps the filter feeding habitat which will also result in direct irreversible loss. The filter feeder habitat which recorded >10% coverage is limited to the periphery of the ZoHI and is mostly in the 50 m buffer surrounding the DMPA, not within the DMPA itself. Furthermore, any impacts to filter feeders within the ZoHI are not expected to impede the long-term survival of the communities (i.e. beyond 5 years), as only a thin layer of sediment has been modelled to remain at the DMPA post-dredging (50 mm of unconfined material), which is less than the 150 mm threshold recommended for BCH survival in NAGD (CoA 2009). Most of the mapped area comprising filter feeders with >10% cover occurs outside the boundary of the ZoHI on unconsolidated sand (southwest of DMPA) and another area of filter feeders on veneered pavement (southeast). Modelling indicates filter-feeder communities observed southwest and southeast of the ZoHI will not be impacted based on thresholds derived for hard coral, which are more susceptible to the effects of SSC.

Coral spawning and settlement events may potentially be influenced by dredging and material placement activities. The major synchronous coral spawning event typically occurs in the last week of March and the first week of April each year, with settlement continuing for up to one week after fertilization. Dredging will not occur at any time over a period extending from 3 days before until 7 days after the predicted night of a coral mass spawning.

6.4 Underwater noise

The inner harbour dredge operations are within an operating port subject to bulk materials loading, barge and transhipper vessel movements, tug operations, small vessel operations and desalination. No blasting or drilling will be needed to remove the proposed dredge material as an assessment deemed the sediment to be exclusively ‘Easy’ and only required a BHD for removal. Therefore, dredge-related underwater noise is not considered substantively above current operating activity.

6.5 Vessel movements

Impacts on marine fauna through vessel movements are considered low as the dredge will be operating within an operating port at slow speeds. The SBH will transport the dredged material to the DMPA, which is a <2 km transit route between the dredging area and the spoil ground. Part of this route incorporates the transhipment route which is frequently used by transhippers, barges, tugs and crew support vessels.

6.6 Light spill

Beaches in the vicinity of Cape Preston are utilised for a limited amount of turtle breeding activities and near-shore sub-tidal areas are likely to provide habitat for turtle feeding activities. Beaches surrounding Cape Preston may support low-density nesting (CPM 2011). Vessel lighting is required for safe vessel navigation and night operations for transhippers. The dredge light spill is unlikely to be discernible from existing port operations.

6.7 Introduced marine pests

The transient nature of vessels being used for dredging activities poses a risk of introduced marine pest species. These pests can damage benthic habitats and impact existing marine fauna. The introduction of these species may occur via biofouling on vessel hulls or dredge equipment. The risk is considered minimal if managed in accordance with the existing Ballast Water and Biofouling Management Plan (GHD 2009).

Didemnum perlucidum is present at Cape Preston; this species is considered cryptogenic and widespread within Western Australian waters. This species is monitored by the Department of Primary Industries and Regional Development (DPIRD).

6.8 Hydrocarbons

Hydrocarbons used during dredging or construction may come from diesel and smaller amounts of lubricating oil and grease for dredging equipment. Direct contact with hydrocarbons can affect marine birds by ingestion during preening and hypothermia from matted feathers. Invertebrates and fish may also be exposed and subsequently affected by such incidents. Land-based activities including construction and management of the onshore disposal area may also result in a minor hydrocarbon spillage from plant and equipment. The impacts from hydrocarbon spills may be large, however, the risk of this occurring is low if managed under the existing Bunkering, Bilge, and Sludge Transfer Procedure (CPPC 2024) and spill response is handled in accordance with the Port of Cape Preston Oil Spill Contingency Plan (CPPC 2023).

6.9 Waste

Solid and liquid wastes generated during dredging and construction activities have the potential to negatively impact the surrounding environment if appropriate waste management measures are not implemented. Disposal of waste into the marine environment can pollute and impact MEQ values. Direct contact or ingestion of waste can impact marine fauna. The impacts from waste spills will be minimised with management actions described in Section 6.5 'Waste Management' in the Operational Environmental Management Plan (CPM 2018).

7 Environmental Outcomes and Management Targets

The key environmental factors and objectives to be managed under this DMP have been derived from the Statement of Environmental Principles, Factors and Objectives (EPA 2023), which outlines objectives aimed at protecting all environments (Themes) including Sea, Land, Water, Air and People.

The Key Environmental Factors and EPA Objectives to be managed under this DMP were identified and are listed below:

- Marine Environmental Quality
- Benthic Communities and Habitats
- Marine Fauna.

The Proposal specific Environmental Protection Outcomes (EPOs) and Management Targets (MTs) for each of the key marine environmental factors (BCH, MEQ and marine fauna) are outlined in Table 11.

Table 11: Environmental protection outcomes (EPO) and management targets (MT)

Environmental Factor & EPA Objective	Potential Environmental Impact Pathway	Environmental Protection Outcome (EPO)	Management Target (MT)	Management Strategy
Marine Environmental Quality (MEQ) To maintain the quality of water, sediment and biota so that environmental values are protected.	Disturbance and transportation of contaminants in sediments during dredging and disposal have the potential to deteriorate water quality and contaminate marine organisms	Meet MEQ Objectives for Ecosystem Health	Contaminant concentrations in marine water and sediments will not exceed NAGD (CoA 2009) screening levels/ANZG (2018) DGVs, or above background relevant to the Moderate or High Level of Ecological Protection (see Figure 9)	Refer to Table 13
	Changes to the physicochemical properties of the water column because of dredging (including suspended sediments/turbidity, photosynthetically active radiation (PAR)/DLI)	No irreversible loss, or serious damage to BCH outside of the Zone of High Impact (ZoHI) due to exceedances of turbidity and light management triggers during and post-dredging activities	No exceedances to the combined turbidity and light trigger values No exceedances to the light-only trigger values Turbidity/light parameters return to pre-dredging conditions within four weeks post-dredging	
	Hydrocarbon release into the marine environment from a vessel spill and or bunkering operations	No negative impacts to the marine environment from hydrocarbon spills	No hydrocarbon spills	
	Disposal of waste into the marine environment can pollute and impact MEQ values	No waste is discarded into the marine environment	Implement management actions described in Section 6.5 'Waste Management' in the Operational Environmental Management Plan (2018)	
Benthic Communities and Habitats To protect BCH so that biological diversity and ecological integrity are maintained.	Direct impacts to BCH in the dredging footprint	No irreversible loss, or serious damage to BCH outside of the Zone of High Impact (ZoHI) (Figure 6 & Figure 7)	Dredging operations do not occur outside the defined dredging footprint	Refer to Table 14
	Direct impacts to BCH in the DMPA due to smothering		Disposal operations do not occur outside the DMPA Dredging operations are conducted using equipment outlined in section 2.3.4.	
	Impacts to coral spawning from elevated suspended sediments	Dredging will not occur at any time over a period extending from 3 days before until 7 days after the predicted night of a coral mass spawning		

Environmental Factor & EPA Objective	Potential Environmental Impact Pathway	Environmental Protection Outcome (EPO)	Management Target (MT)	Management Strategy
	Indirect impacts to BCH due to a reduction in available light caused by an increase in suspended sediments released into the water column during dredging and disposal activities	No loss to BCH outside of the Zone of High Impact (ZoHI) (Figure 6 & Figure 7)	No detectable impacts to the condition and spatial extent of BCH outside of the ZoHI attributable to dredging or disposal activities	
Marine Fauna To protect marine fauna so that biological diversity and ecological integrity are maintained.	Injury or death of marine fauna because of dredge operational noise	No reported negative impacts on marine fauna attributable to dredging works No reported negative impacts on marine fauna attributable to disposal activities	No incidence of marine fauna injury or death because of dredge operational noise	Refer to Table 15
	Injury or death of marine fauna due to vessel movement (strike).		No incidences of marine fauna injury or death because of vessel strike	
	Disturbance to turtle nesting due to light emissions from dredging and disposal activities		No disturbance to turtle nesting because of dredging	
	Introduced Marine Pests translocation from construction vessels		Implement the BW&BFMP (GHD 2009)	Refer to the BW&BFMP (GHD 2009)
	Hydrocarbon or waste release causes smothering or other impacts on marine fauna		Implement Port of Cape Preston Oil Spill Contingency Plan (CPM2023) to protect marine fauna in the event of a hydrocarbon spill Implement procedures in section 6.5 *'Waste Management'* in the Operational Environmental Management Plan (2018)	Refer to Port of Cape Preston Oil Spill Contingency Plan (CPM 2023) and section 6.5 *'Waste Management'* in the Operational Environmental Management Plan (2018)

Figure 9: Existing designated Levels of Ecological Protection

7.1 Management Triggers

Trigger values have been developed for a two-tiered management response for MEQ and Marine Fauna. MEQ trigger values are based on the 'possible-effects' and 'probable-effects' guideline values for coral communities based on biological thresholds developed by the Dredging Science Node of the Western Australian Marine Science Institution (WAMSI DSN) detailed in EPA (2021). Marine Fauna trigger values are based on the recommended distance of 300 m for an exclusion zone required under standard sea dumping permit conditions (DAWE 2022).

7.1.1 MEQ Triggers

The trigger values for MEQ are based on possible-effects and probable-effects thresholds for considering the effect of light and turbidity on corals. Exceeding possible-effects thresholds (trigger 1) will initiate Level 1 management actions and exceeding probable-effects thresholds (trigger 2) will initiate Level 2 management actions (Table 13). Management actions are described in Section 8. Management triggers are exceeded at contingency sites when either of the following is met:

- Both the time-averaged values for light and turbidity have exceeded concurrently
- Light levels are continuously below threshold values for the specified duration

Table 12: Combined and light-only trigger values for possible-effect and probable-effect

		Trigger 1: Possible-effect levels*		Trigger 2: Probable-effect levels*	
Combined light and turbidity thresholds					
Site	Averaging Period (days)	NTU (mg/L)	DLI (mol photons $m^{-2} d^{-1}$)	NTU (mg/L)	DLI (mol photons $m^{-2} d^{-1}$)
Contingency sites (ZoI)	3	>17.3	<1.1	>32.6	<0.3
	7	>12.9	<1.8	>22.1	<0.6
	10	>11.4	<2.2	>18.7	<0.9
	14	>10.1	<2.5	>16.0	<1.1
	28	>7.9	<3.1	>11.5	<1.8
Light-only threshold values					
Site	Duration (days)	DLI (mol photons $m^{-2} d^{-1}$)		DLI (mol photons $m^{-2} d^{-1}$)	
Contingency sites (ZoI)	>5	<0.1		-	
	>10	-		<0.1	
	>20	<2.3		<1.6	
	>30	<2.8		<1.9	
* Possible-effect and Probable-effect levels have been created according to the EIA technical guidance for marine dredging proposals possible-effects and probable-effects guideline values for the ZoMI for corals (EPA 2021)					

7.1.2 Marine Fauna Triggers

Management actions are triggered by distances between vessel/s and fauna, which are informed by the minimum distance of 300 m recommended for sea dumping permits based on underwater noise. Distances are categorised as either observation or exclusion zones which are determined based on the distances that are derived to prevent temporary threshold shifts (TTS) and permanent threshold shifts (PTS), respectively. These zones are presented in Table 22, Figure 13.

Table 13: Dredging and disposal marine fauna management zones (DAWE 2022)

Marine Fauna Group	Observation Zone (m)	Exclusion Zone (m)
Whales	500	300
Dolphins	500	300
Dugongs	500	300
Turtles	500	300

Dredging or disposal activities will be stopped when marine fauna are within 300 m of the vessel. See Section 8 for further details on the management zones and mitigation actions for marine fauna.

8 Monitoring and Management

Identified environmental factors most susceptible to dredging and disposal activities associated with the proposal include:

- MEQ
- BCH
- Marine fauna.

Monitoring and management actions will be implemented in association with dredging and disposal activities to mitigate any adverse impacts on the surrounding environment in reference to the MTs for each Environmental Factor. The following monitoring is proposed:

- Telemetered water quality monitoring pre-, during and post-dredging program
- Satellite water quality monitoring (MODIS)
- Monitoring of coral health
- Marine fauna observations.

Environmental monitoring will aim to identify any change in water quality as an indicator towards the health of corals at several key locations for the duration of dredging and disposal. Introduced marine pests will be monitored and managed through the existing Ballast Water and Biofouling Management Plan (GHD 2009).

The potential environmental impacts identified in Section 6 have been assigned monitoring and management actions to measure compliance against the EPOs and MTs. Management measures for each environmental factor are detailed below. Management actions are designed to specifically address the three identified environmental factors: MEQ, BCH and Marine Fauna.

8.1 Marine Environmental Quality

The mitigation actions proposed to minimise potential impacts on the environmental factor 'Marine Environmental Quality' are described in Table 14.

Table 14: Management actions to minimise impacts on Marine Environmental Quality

Marine environmental quality					
Activity	Dredging and disposal operations				
Potential Impacts	• Disturbance of contaminants in sediments during dredging has the potential to deteriorate water quality and contaminate marine organisms • Changes to the physicochemical properties of the water column because of dredging and/ or disposal • Hydrocarbon release into the marine environment from a vessel spill and or bunkering operations				
Management Targets	**Management Actions**	**Environmental Performance**			
	Actions	**Responsibility**	**Reporting/Evidence**	**Timing**	**Contingency**
Contaminant concentrations in marine water and sediments will not exceed NAGD (CoA 2009) screening levels/ANZG (2018) DGVs, or above background relevant to the Moderate or High Level of Ecological Protection (see Figure 9)	Sediment geochemical assessment undertaken (Section 5.1).	CPM	• Sediment geochemical assessment report (AECOM 2024b)	• Sediment geochemical assessment completed (Section 5.1).	Post-dredging sediment sampling of spoil ground
No exceedances to the combined turbidity and light attenuation trigger values No exceedances to the light-only trigger values Turbidity/light attenuation parameters return to pre-dredging conditions within four weeks post-dredging	Implement the Marine Water Quality Monitoring Program (MWQMP) as defined in Appendix B.1 Implement a two-tiered management approach as outlined in Section 8.1.1.	CPM	• MWQMP final report	• Commence MWQMP four weeks prior to dredging • MWQMP during dredging • MWQMP continue for four weeks post-dredging and disposal activities, or until water quality returns to pre-dredging baseline conditions	• Refer to Section 8.1.1.
No hydrocarbon spills	• Implement Bunkering, Bilge, and Sludge Transfer Procedure (CPPC 2024) • Inspect all dredge equipment to check for leaks or damage	Contractor	• Vessel/equipment maintenance schedule/ documentation • Pre-mobilisation equipment checklist	Throughout dredging	• Implement the Port of Cape Preston Oil Spill Contingency Plan (CPPC 2023)

Marine environmental quality					
Activity	Dredging and disposal operations				
Potential Impacts	• Disturbance of contaminants in sediments during dredging has the potential to deteriorate water quality and contaminate marine organisms • Changes to the physicochemical properties of the water column because of dredging and/ or disposal • Hydrocarbon release into the marine environment from a vessel spill and or bunkering operations				
Management Targets	**Management Actions**	**Environmental Performance**			
	Actions	**Responsibility**	**Reporting/Evidence**	**Timing**	**Contingency**
	• Training and awareness on hydrocarbon/chemical risks to be included in site induction (including all staff, contractors, and subcontractors		• Induction package • Incident report as per Appendix C • Contractor performance assessment		• Cease works if significant spillage or damage observed • Activate spill response actions (control drainage, clean up) as required; and • Investigate and implement corrective measures within 24 hours • All marine pollution events will be reported to the Department of Transport (DoT) electronically via "Pollution Report" (POLREP)

Implement management actions described in Section 6.5 'Waste Management' in the Operational Environmental Management Plan (2018)	• As per Operational Environmental Management Plan (2018)
	• Waste transport:
	  ◦ Use licensed contractors to collect controlled wastes
	  ◦ Appropriately secure all loads
		Contractor	• Waste disposal transfer record
			• Contractor performance assessment
				Throughout dredging	• Investigate why non-conformance is occurring.
					• Implement corrective measures before the next inspection

Marine environmental quality					
Activity	Dredging and disposal operations				
Potential Impacts	• Disturbance of contaminants in sediments during dredging has the potential to deteriorate water quality and contaminate marine organisms • Changes to the physicochemical properties of the water column because of dredging and/ or disposal • Hydrocarbon release into the marine environment from a vessel spill and or bunkering operations				
Management Targets	**Management Actions**	**Environmental Performance**			
	Actions	**Responsibility**	**Reporting/Evidence**	**Timing**	**Contingency**
	• Dispose of hazardous materials appropriately • Waste handling on all project vessels: • Provide waste management site-specific induction, incl. waste separation and securing loads • Provide appropriate reciprocals for waste segregation (general, recycle, hydrocarbons) • Check waste reciprocals (and lids) adequately secure from wind, fauna and spillage				

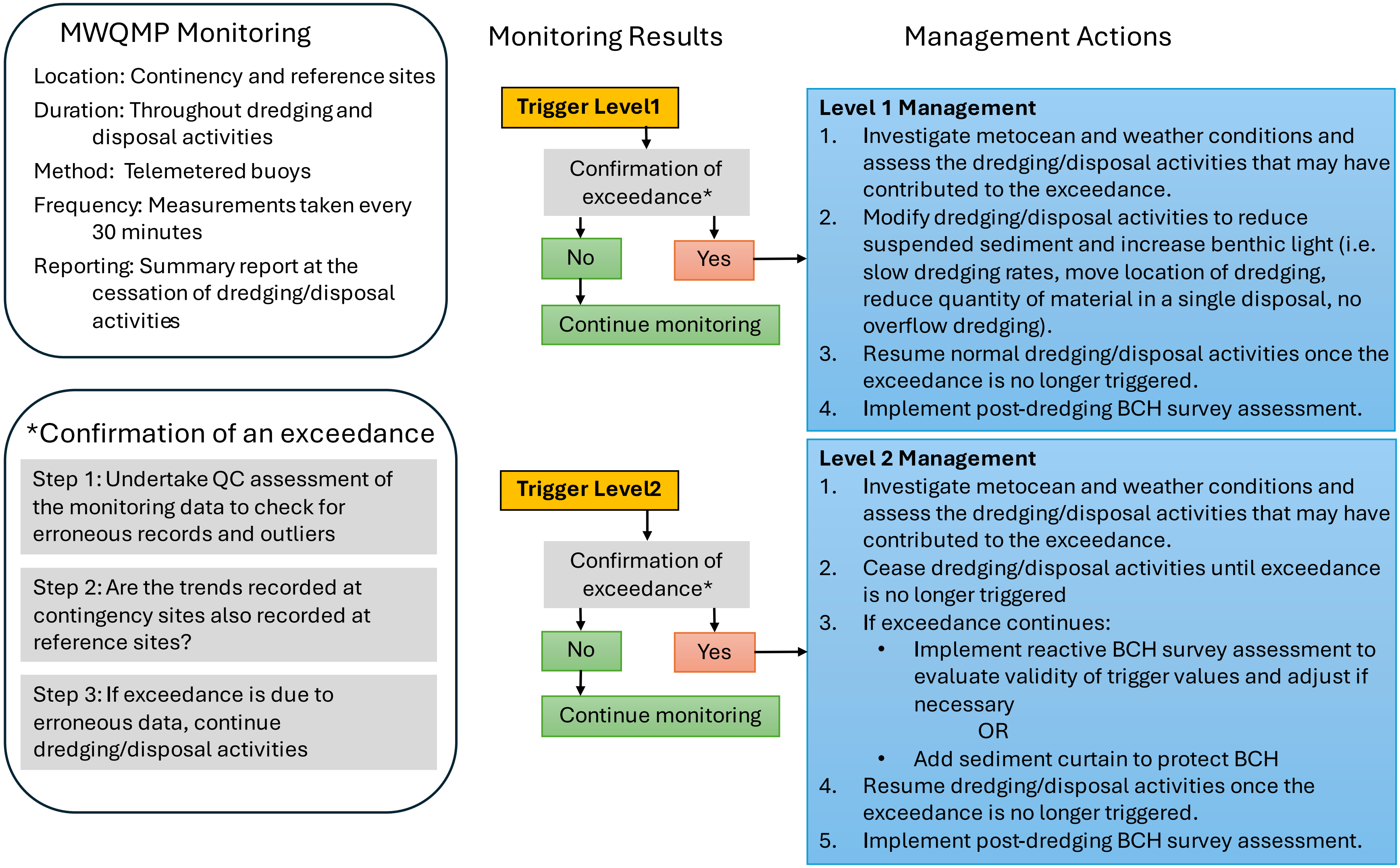

Figure 10: Two-tiered management response for the MWQMP

8.1.1 Response Actions for Management Trigger Exceedance

Management actions are based on a two-tiered management response for dredging and disposal activities:

- Confirm that the management trigger has been exceeded. Including undertaking a quality control (QC) assessment of monitoring data to check for erroneous records and outliers and comparing the trends recorded at contingency sites to reference sites.

- An investigation of metocean and weather conditions and review of recent dredging and disposal operations will be conducted to assess whether the dredging/disposal activities may have contributed to the exceeded to help determine appropriate management response.

- A confirmed exceedance of a management trigger will initiate requirement to undertake a post-dredging BCH survey assessment.

- If a trigger 1 management exceedance has been confirmed, level 1 management actions will be implemented. These include modifying dredging/ disposal activities to reduce suspended sediment and increase benthic light. For example, modified activities may include slowing the rate of dredging, moving the dredge to a different area away from the monitoring sites that have exceeded, conducting no overflow dredging, and reducing the quantity of material in the SHB for disposal. Resumption of normal (unmodified) dredging/disposal activities can only recommence once the exceedance is no longer triggered (Figure 10).

- If a trigger 2 management exceedance has been confirmed, level 2 management actions will be implemented. This involves ceasing dredging/disposal activities until exceedances are no longer triggered. The resumption of dredging/disposal activities can only recommence once the exceedance is no longer triggered (Figure 10). If exceedances continue, CPM will implement a reactive BCH survey assessment to evaluate the validity of trigger values and adjust if necessary. If a reactive survey is implemented, and the BCH has not been affected, consideration will be given to modify the trigger values for the remaining duration of dredging and disposal activities. Alternatively, CPM may utilise a sediment curtain as a preventative measure to protect BCH and enable dredging activities to continue.

8.2 Benthic Communities and Habitat

The management actions to minimise potential impacts on the environmental factor ‘Benthic Communities and Habitat’ are described in Table 15.

Table 15: Management actions to minimise impacts on Benthic Communities and Habitats

Benthic Communities and Habitats					
Activity	Dredging and disposal operations				
Potential Impacts	• Direct loss of benthic communities and habitats due to dredging activities • Indirect impacts on benthic communities and habitats due to reduction in available light caused by an increase in suspended sediments released into the water column during dredging and/or disposal				
Management Targets	**Management Actions**	**Environmental Performance**			
	Actions	**Responsibility**	**Reporting/Evidence**	**Timing**	**Contingency**
Dredging & disposal operations do not occur outside the defined footprint Dredging operations are conducted using equipment outlined in section 2.3.4.	• Employ a high-resolution positioning system to control dredge operations • No spillover of dredging material from the hopper	Contractor	• Validate positioning and vessel monitoring system • Dredge report submitted post-dredging period	Throughout dredging	• Cessation of dredging and relocation of dredge or SHB • Service/replacement of positioning system • Investigate and report non-conformance to regulators
Dredging will not occur at any time over a period extending from 3 days before until 7 days after the predicted night of a coral mass spawning. This is predicted to be: 18-30 Mar 2025 17-29 Apr 2025 (otherwise see Table B1 from EPA 2021)	Plan dredging activities outside sensitive windows for coral spawning	CPM	Dredge timing records	Planning	N/A
No detectable impacts to the condition and spatial extent of BCH outside of the ZoHI attributable to dredging or disposal activities	• Implement MWQMP as defined in Appendix B.1 • Implement BCHMP as defined in Appendix B.2	CPM	• MWQMP Report • BCHMP Report (if required)	Pre- during and post-dredging monitoring	Continue to implement annual Coral monitoring program as required in accordance with PEMP to identify evidence of BCH recovery as per Appendix B.2

8.3 Marine Fauna

The management actions proposed to minimise potential impacts on the environmental factor 'Marine Fauna' (including MNES) are described in Table 16.

8.3.1 Additional Mitigation Measures During Ecological Windows

Further mitigations will be implemented during key fauna Ecological Windows (i.e. the southern migration of the humpback whale or marine turtle nesting/hatchling seasons). These additional measures are required as humpback whale cows and calves are known to migrate closer to the coast and in shallower waters and there is a higher likelihood of turtle hatchlings being present in the coastal waters.

Dedicated marine fauna observers (MFOs) will be used if dredging/disposal operations occur during the southern migration of the humpback whale which occurs from August to October each year. Dedicated MFOs have a higher level of training/experience in marine fauna observations, having:

- demonstrated knowledge and experience conducting marine fauna observations, distance estimation and reporting
- will be situated in a location where they can observe both the dredging area and spoil grounds
- will not have any other duties while engaging in visual observations and are exclusively engaged in undertaking marine fauna observations during operations
- able to adhere to the requirements of the Wildlife Conservation (Closed Season Marine Mammals) Notice 1998
- must demonstrate a knowledge of marine wildlife species in the North-west region, including Threatened and Migratory Species listed under the EPBC Act and BC Act and priority listings
- be familiar with the morphological and behavioural characteristics of target marine fauna.

Table 16: Management actions to minimise impacts on Marine Fauna

Environmental Factor	**Marine fauna**				
Activity	Dredging, disposal and general vessel operations				
Potential Impacts	• Injury or death of marine fauna because of dredge operations (loading and dumping) • Injury or death of marine fauna due to vessel movement (strike) • Direct impacts from underwater noise from dredging operations • Direct impacts from light pollution • Habitat disturbance through the increase in turbidity				
Management Targets	**Management Actions**	**Environmental Performance**			
	Actions	**Responsibility**	**Reporting/Evidence**	**Timing**	**Contingency**
No incidence of marine fauna injury or death because of dredge operational noise	Implement marine fauna monitoring and management as outlined in Appendix B.3	CPM	• Marine Fauna Observer (MFO) daily records • Final Summary report • Refer to Appendix B.3	Throughout dredging Refer to Appendix B.3	When marine fauna is observed within an exclusion zone then dredging will cease immediately Injury or death observations of marine fauna reported to DBCA
	Internal training of Trained Marine Fauna Observer(s) (MFO) (refer to Appendix B.3)				
	Dredging activities will implement additional management actions if conducted during ecological windows for whales or marine turtles (Refer to Section 8.3.1)				
	Implement pre-start and soft-start procedures as outlined in Appendix B.3				
	Ensure all vessel equipment and machinery is in good condition and subject to regular maintenance				
	Provide notifications of activities through Department of Transport Notice to Mariners.				
No reported incidences of marine fauna injury or death because of vessel strike	Implement marine fauna monitoring and management as outlined in Appendix B.3	CPM	Refer to Appendix B.3	Throughout dredging Refer to Appendix B.3	When marine fauna is observed within an exclusion zone then dredging will cease immediately
	Minimise the duration of run-time for vessel engines, thrusters and dredging plant by avoiding standby or running mode to the degree practical and consistent with safe operations				

Environmental Factor	**Marine fauna**				
Activity	Dredging, disposal and general vessel operations				
Potential Impacts	• Injury or death of marine fauna because of dredge operations (loading and dumping) • Injury or death of marine fauna due to vessel movement (strike) • Direct impacts from underwater noise from dredging operations • Direct impacts from light pollution • Habitat disturbance through the increase in turbidity				
Management Targets	**Management Actions**	**Environmental Performance**			
	Actions	**Responsibility**	**Reporting/Evidence**	**Timing**	**Contingency**
	Maintain vessel speeds under 8 knots within the inner harbour and all vessels are to adhere to the standard set in the National Whale Watching Guidelines (CoA 2017)	Contractor			Injury or death observations of marine fauna reported to DBCA
	When in transit, all dredging-related vessels will be operated in accordance with EPBC Regulations 2000 - Part 8 Division 8.1				
No disturbance to turtle nesting because of dredging	Lights will be kept to a minimum safe operational condition	Contractor	NA	Throughout dredging	NA
Implement the BW&BFMP (CPM 2009) for Invasive Marine Pests	Comply with the BW&BFMP (CPM 2009)	Contractor	NA	Throughout dredging	Detections of IMP reported to DPIRD
Implement Port of Cape Preston Oil Spill Contingency Plan (CPM 2023) to protect marine fauna in the event of a hydrocarbon spill Implement procedures in section 6.5 'Waste Management' in the Operational Environmental Management Plan (2018)	All spills (regardless of volume) will be contained and cleaned up immediately. Resultant wastes (soils, rags and absorbent material) are appropriately stored and disposed of by an appropriately licenced waste contractor as controlled waste	Contractor	See MEQ (Table 13)	Throughout dredging	See MEQ (Table 13)

9 Role and Responsibilities

The roles and responsibilities for the implementation of this DMP are summarised in Table 17.

Table 17: Roles and responsibilities of key personnel

Position	Responsibility
CPM Project Manager	• Overall responsibility for implementation of this DMP • Overall responsibility for complying with relevant legislation, standards and guidelines • Overall responsibility for reporting environmental incidents to the regulators, including the Department of Transport (DoT) within 24 hours in accordance with DoT incident reporting procedures (when relevant) • Ensures dredging activities are conducted in an environment safe for both site personnel and the public
CPM Environment Manager	• Complies with the requirements of this DMP • Provides advice on dredging and dredging material environmental issues • Oversee implementation of environmental controls, monitoring programs, inspections, audits and management actions in this DMP • Completes compliance reporting requirements • Responsible for the implementation of the environmental monitoring program and inspections • Prepares environmental monitoring reports • Provides advice with respect to environmental issues as required • Reports on environmental performance for the project to key stakeholders • Responsible for environmental compliance reporting • Responsible for reporting all environmental non-compliance incidents
Dredging contractor	• Complies with the requirements of this DMP • Undertakes dredging and excavation works • Implements an environmental management plan following the requirements of this DMP • Implements the management actions of this DMP • Ensures adequate training of all staff within their area of responsibility • Ensures all equipment is adequately maintained and correctly operated • Responsible for reporting all environmental incidents to CPM. Ensures dredging activities are conducted in an environment safe for both site personnel and the public
All persons involved in the project	• Comply with the requirements of this DMP • Comply with all legal requirements under the approvals documents and relevant Acts • Always exercise a Duty of Care to the environment • Report all environmental incidents

10 Reporting

Incidents are defined as breaches or non-adherences to objectives and procedures applied to the project and prescribed in this DMP. Incidents are to be reported to the CPM by the person responsible for the incident or the first person at the site of an incident. CPM will assess the type and severity of the incident in accordance with internal procedures. Relevant personnel shall be notified and consulted whether the incident requires notification to regulatory agencies. The reporting requirements for this DMP are summarised in Table 18.

Table 18: Compliance reporting requirements

Report	Content	Timeframe	Responsibility	Recipient
Environmental Incidents or Environmental Risks Report	Report any environmental incident or environmental risk Detail the incident or risk, the measures taken, the success of those measures in addressing the incident or risk and any additional proposed to be taken Document any incidents involving the dumping activities that result in injury or death to any marine species. The date, time and nature of each incident and the species involved, if known, must be recorded.	Within 12 hours	Dredging Contractor report to CPM Within 12 hours CPM report to relevant stakeholders in line with this DMP, project approvals and or legislated requirements.	CPPC / DoT – Reportable Oil Spill/POLREP DBCA – Reportable wildlife incident
Non-compliance Summary Report	Identify which EPO has not been achieved Detail the monitoring results that identified the EPO was not being achieved Describe the investigation being undertaken into the cause of the EPO not being achieved Identify any corrective or contingency management actions proposed to be implemented or being implemented	Within 7 days of determining that an EPO has not been achieved	CPM	DWER
Non-compliance Investigation Report	Identify which EPO has not been achieved Detail the findings of the investigations undertaken into the cause of the EPO not being achieved	Within 30 days of determining that any EPO has not been achieved	CPM	DWER
Close-out Report	Report which evaluates the performance of monitoring and management in achieving the EPOs.	Within 12 months following the completion of dredging	CPM	DWER

10.1 Additional Reporting

A summary of the additional reports that are expected to inform compliance reporting commitments is listed in Table 19.

Table 19: Additional reporting requirements that are required to demonstrate compliance

Topic	Content	Timeframe	Responsibility	Recipient
Marine Water Quality Monitoring Program Reporting	• Marine Water Quality Monitoring Program Summary Report	Monitoring summary report to be issued with close-out report	CPM	DWER
BCH Reporting	• Post-dredging BCH survey assessment report • Reactive BCH survey assessment report, if required	When required. Post-dredge report issued within 4 weeks following the removal of loggers	CPM	DWER
Bunkering	Bunkering, Bilge, and Sludge Transfer Checklist and fuel supplier bunker safety notice completed and signed	When required	Contractor	CPM
Site and vessel inspection checklists/ logs	• Dredge operation log – (e.g., operations times, types of operations, Global Positioning System (GPS) location, dredge volumes). • Marine fauna observation Logs – (e.g., dredge operation time, name of the observer, fauna species, distance/direction from the vessel, management response)	Daily during dredging	Contractor	CPM
Pollution Incidents	Reactive pollution incident report as required. Approval Holder to coordinate state reporting requirement to DoT Maritime Environmental Emergency Response (MEER) duty officer and online Pollution Report Form (POLREP)	Within 24 hours of the incident	Contractor CPM	Approval holder DoT / MWPA
Complaints	Approval Holder to be notified of any complaints received concerning the dredging activities. Notification should detail the nature of the complaint and how it was resolved.	Within 72 hours of any complaint received	Dredging Contractor	Approval Holder

11 Stakeholder Consultation

The Project has been assessed by the Environmental Protection Authority at Public Environmental Review (PER) level. The PER Iron Ore Mine and Downstream Processing, Cape Preston, Western Australia) was submitted in December 2000 and a Supplementary Environmental Review ((SER) Iron Ore Mine and Downstream Processing, Cape Preston, Western Australia) was submitted in February 2002 to address changes to the original proposal. The Minister for the Environment approved the Project under Statement 635 in October 2003. A total of 154 Public Submissions were received and responded to during this process and published in EPA Bulletin 1056.

The PER included dredging activities that incorporated a shipping channel and dredge within the port breakwater structure for a small craft (small craft harbour). Bulletin 1056 details the EPA assessment of the PER. The subsequent MS635 conditionally approves the Project including port construction with up to 4.5 Mm^3 of dredging for small craft harbour and import berth with spoil disposed offshore.

Mardudhunera people (Traditional Owners) Consultation Process

There is an Indigenous land use agreement (ILUA) between CITIC parties and the Yaburara & Mardudhunera People (YM) parties (now recognised as the Mardudhunera people) in relation to the Project (Cape Preston Project Deed (YM Mardie Indigenous Land Use Agreement) (ILUA)). That ILUA was registered on 6 November 2015. Pursuant to this current YM ILUA, the Mardudhunera Native Title determinants recognise, acknowledge and agree that the existing and any future mining tenements and titles granted for the purposes of the Project and future proposals are valid, effective and enforceable under the Native Title Act, the *Iron Ore Processing Agreement Act 2002* and otherwise at law. The proposed Project activities also include the construction of the Cape Preston Port, including capital dredging.

Repeat attempts to engage with the Mardudhunera people and their representatives have not yielded a response to the Stakeholder Consultation Information provided.

11.1 Stakeholder Consultation Register

CPM prepared a stakeholder engagement package to seek comment from stakeholders as listed as in the Stakeholder Consultation Register (Table 20) regarding the dredging activities at the Port in conjunction with the consultation for the DCCEWW Sea Dumping Permit. Further information regarding stakeholder consultation records are provided in Appendix E.

CPM considers that all concerns raised through the consultation process have been satisfactorily addressed.

DPIRD expressed concern in the preliminary engagement and CPM is working through these concerns with their representatives. CPM considers that while many of the concerns raised by DPIRD are valid issues for larger dredging programs, they will not be adversely affected by this dredging project. CPM has provided a comprehensive response to the matters raised by DPIRD which DPIRD has acknowledged has been received. Correspondence with DPIRD is provided in Appendix E.

Table 20: Stakeholder consultation register

Stakeholder	Initial Date	Contact	Type of Consultation	Summary	Outcome
Aquaculture council	11/10/2024	Justin Bellanger – CEO	Email, phone call	Email submission with Stakeholder Consultation Information Memorandum and Stakeholder Feedback Form.	-
	15/10/2024	Steven Gill	Phone call	Concerns were raised on impacts of dredge plume (contaminants) to Pearl farm northeast of Dampier.	Further information on sediment contaminants and plume extension provided on the 18/10 via email. Model has shown that ZoI would not extend to the Pearl farm area. No further information requested.
City of Karratha (CoK)	02/10/2024	Clair Morrison	Email, phone call	Email submission with Stakeholder Consultation Information Memorandum and Stakeholder Feedback Form.	Return email from CoK on 16/10, no comments on proposed dredging.
DBCA	02/10/2024	Harley Taylor	Email, phone call	Email submission with Stakeholder Consultation Information Memorandum and Stakeholder Feedback Form	Return email 14/10. DBCA advised that it will provide direct advise to the EPA directly as the Dredge Management Plan is regulated under the EP Act.
DoT	02/10/2024	Steven Wenban	Email	Email submission with Stakeholder Consultation Information Memorandum and Stakeholder Feedback Form.	Return email from DoT on 04/11, no comments on proposed dredging.
DPIRD – Fisheries	02/10/2024	Linda Wiberg	Email	Email submission with Stakeholder Consultation Information Memorandum and Stakeholder Feedback Form.	Return email on 11/10 requesting extension. Response back to CPM on 01/11. Fisheries outlining concerns of potential impacts from dredging on demersal fish species and habitat.

Stakeholder	Initial Date	Contact	Type of Consultation	Summary	Outcome
	27/11/2024	Linda Wiberg	Email, phone call	Further information provided on potential impacts if dredging and spoil disposal on benthic habitats such as macroalgae and teleosts.	Return email, on 27/11, outlining that the limited spatial and temporal scale of the dredging will have no effect on macroalgae or juvenile fish. DPIRD has acknowledged receipt of CPM response on 28/11.
Pilbara Ports	02/10/2024	Dan Pedersen	Email, phone call	Email submission with Stakeholder Consultation Information Memorandum and Stakeholder Feedback Form.	Return email from Pilbara Ports on 11/10, no comments on proposed dredging.
Mardie Station	16/09/2024	Pastoral Management Pty Ltd – Mardie Station Pastoral Lease	Internal Briefing	Internal discussion of proposed dredge work	No concerns raised
Mardudhunera People – Traditional Owners	29/05/2024	Mardudhunera People – Traditional Owners	Email, phone call	Contact made via CPM Manager Heritage Gary Blinco	No response provided to CPM
	22/08/2024	Mardudhunera People – Traditional Owners	Email, phone call	Contact made via CPM Manager Heritage Gary Blinco	No response back provided to CPM. TO unable to organise attendance for meeting.
	02/10/2024	Mardudhunera People – Traditional Owners	Email, phone call	Contact made via CPM Manager Heritage Gary Blinco	Feedback that meeting deferred for the week after. No response provided back to CPM.
	07/10/2024	Steve Graham – Operations Manager	Email, phone call	Email submission with Stakeholder Consultation Information Memorandum and Stakeholder Feedback Form.	On request by Steve Graham information was provided to Heritage Consultant via email on 14/10

Stakeholder	Initial Date	Contact	Type of Consultation	Summary	Outcome
	14/10/2024	Simon Davis – WAC Heritage Consultant	Email, phone call	Email submission with Stakeholder Consultation Information Memorandum and Stakeholder Feedback Form.	Requested extension on 23/10 until 01/11 for feedback - no further response to date
	27/11/2024	WAC at office in Karratha	In person	CPM Heritage Manager attended WAC office in Karratha	WAC refused to meet – busy with other matters.
Recfish West	02/10/2024	Danielle Hartshorn	Email	Email submission with Stakeholder Consultation Information Memorandum and Stakeholder Feedback Form.	Recommended CPM contact local groups whose interests will not be affected by the proposal. No action taken by CPM in response to feedback due to the small area of influence predicted by modelling and plumes not extending to the areas noted.
WAFIC	02/10/2024	Olivia Mickle	Email	Email submission with Stakeholder Consultation Information Memorandum and Stakeholder Feedback Form.	Requested confirmation of dredge placement area being offshore. Requested other information which was included in the original submission document. Provided response on 11/10 via email.
	11/10/2024	Olivia Mickle	Email	Further questions raised regarding the response CPM provided via email, mainly impacts on fisheries.	Queries addressed on 11/10 via email. Return email from WAFIC on 17/10, no further comments on proposed dredging, however requested updates on the dredging program and marine notices to mariners.

Ongoing Stakeholder Consultations

WAFIC and DPIRD have requested ongoing updates regarding the proposed dredging (Table 20). CPM will provide relevant information to these stakeholders as needed. No further other consultation will be required due to the limited spatial and temporal scale of the project. Upon completion, CPM will notify interested stakeholders, providing final updates to confirm the conclusion of the work. CPM endeavours to undertake quarterly relationship meetings with the Mardudhunera People to discuss upcoming projects, dredging will also be added to the agenda.

11.2 Complaints Register

In the event of a complaint received regarding dredging activities, complaints will be reported to CPM, entered and tracked in CPM's incident management systems. Details to be recorded include:

- date, time and method of complaint
- description of the complaint
- complainant details
- cause, action and proposed action, including allocation of a person to action the complaint and an action date
- follow-up and close-out.

Corrective action in response to valid complaints is to occur as soon as practicable following receipt of the complaint. Records will be made available to CPM and authorities upon request, considering any privacy issues of the complainant as appropriate

12 Availability of the DMP

Following confirmation this DMP meets the requirements of the Minister for the Environment, it will be made publicly available as required by MS635 Condition 7-3, in accordance with *Post Assessment Guideline for Making Information Publicly Available* Post Assessment Guideline No. 4, Office of the Environmental Protection Authority, August 2012.

This DMP will be made publicly available on the CPM website:

https://citicpacificmining.com/our-responsibilities/environment

13 Audit and Review

This DMP is a living document and will be reviewed per the timings listed in Table 20. Any significant changes must be documented in Appendix A. Plan Amendments

Table 21: DMP review schedule

Timing	Rationale
Upon receipt of approval conditions	Regulator (DWER) approval conditions obtained will necessitate a comprehensive review of this DMP to ensure all relevant commitments are covered within this Plan to ensure compliance.
Prior to the commencement of action	Ensure that the contractor and approval holder implement all commitments accordingly and that operational details are compliant. To confirm the most suitable monitoring locations, trigger levels and monitoring methods are appropriate.
Any time operational activities significantly alter	Operational changes to the project may result in an altered risk profile. Therefore, the DMP will require a review to ensure that it remains fit for purpose for altered operational conditions. Any significant change in environmental risk will require the DMP to be resubmitted to DWER for endorsement.
Following any significant incidents or non-compliance events	To ensure that the management actions and controls in place are adequate to ensure no re-occurrence of incidents or non-compliance.

During review of the DMP, consideration will be given, but not limited to:

- Overall effectiveness of the DMP
- Changes in schedule
- Changes to monitoring trigger values, where determined to be ineffective or inappropriate
- Any changes in methodology
- Any changes to equipment resulting in the use of equipment that is not covered by Section 3.

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15 Appendix A. Plan Amendments

Document Change Register

Organisation	Date	Comment	Response
O2 Marine	12/09/2024	Final for submission	
O2 Marine	28/11/2024	Final incorporating DWER RFI	
CPM	9/12/2024	Resupply Appendix E consultation records	

16 Appendix B. Monitoring Programs

16.1 Appendix B.1. Marine Water Quality Monitoring Program

B.1.1. Objectives

The MWQMP will aim to provide an evaluation of the following MTs for MEQ which are:

1. No exceedances of the combined turbidity and light management trigger
2. No exceedances of the light-only management trigger
3. Turbidity/light parameters return to pre-dredging conditions within four weeks post-dredging

The MWQMP will also provide an evaluation of the following EPO:

1. No irreversible loss, or serious damage to BCH outside of the Zone of High Impact (ZoHI) due to exceedances of turbidity and light management triggers during and post-dredging activities.

B.1.2. Rationale

Telemetered loggers will be deployed at each contingency and reference site to provide real-time monitoring allowing for a reactive two-tiered management response. Instruments will be deployed at contingency sites located at coral communities closest to dredging and disposal activities, and at reference sites, to measure continuous turbidity and light prior to, during and post dredging. Turbidity will be recorded as nephelometric turbidity units (NTU), while light will be measured as photosynthetically active radiation (PAR), which is the portion of the light spectrum utilised by plants for photosynthesis (i.e. wavelengths 400-700 nm). Satellite imagery will be collected twice daily to assess the spatial extent of the visible plume.

B.1.3. Monitoring Locations

Six marine water quality monitoring stations (MWQMS) will be installed to monitor water quality, which includes three contingency sites and three reference sites located at existing coral monitoring sites that are used in CPM's annual coral monitoring program. The sites have been selected based on the proximity to dredging and disposal activities and predicted sediment plume dispersion. The monitoring locations are presented in Table 21 and Figure 10.

Table 22: Proposed coordinates of water quality monitoring locations

Site ID	Easting	Northing	Description	Site Type
S1	422580	7696785	*Porites*	Reference
S3	416767	7697437	Acroporidae & Merulinidae	Contingency
S6	415948	7697073	Acroporidae & Merulinidae	Contingency
S7	415982	7696769	Merulinidae & *Porites*	Contingency
S9	415734	7695483	*Turbinaria*	Reference
S15	415540	7695004	*Turbinaria*	Reference

Figure 11: Monitoring locations using combined total extent of winter and summer plume predictions

B.1.4. Frequency

MWQMSs will be installed at least four weeks prior to the commencement of dredging and will be removed at a minimum of four weeks post-dredging. Continuous turbidity and PAR measurements will be collected by *telemetered* loggers for the duration of monitoring. The loggers will also record temperature and depth. Loggers will be programmed to take data readings every 30 minutes throughout the monitoring program. Loggers will be recovered for servicing at a maximum recommended frequency of ~6 weeks, nominally immediately prior to the start of dredging, immediately post-dredging and on removal at the end of four weeks post-dredging (unless delays require servicing at more frequent intervals). The data will be monitored digitally and checked at least daily.

If management triggers are exceeded, management response actions are required, and reactive BCH health monitoring will be implemented (management triggers and response actions are presented in Section 7.1.1 and Section 8.1, respectively).

Moderate Resolution Imaging Spectroradiometer (MODIS) satellite images will be monitored throughout dredging operations to observe the movement and extent of the sediment plume and compare it to the predicted plume modelling that is presented in Section 5.2. MODIS instruments onboard the Terra and Aqua satellites will each pass once per day, Terra in the morning and Aqua in the afternoon. Satellite images from both MODIS instruments will be monitored daily.

Water quality will continue to be collected and analysed until water quality returns to pre-dredging levels, or at least four weeks following the cessation of dredging (whichever is longer).

B.1.5. Environmental protection outcomes and management targets

As coral communities have been identified in the vicinity of Cape Preston, this monitoring program will use the derived possible-effects and probable-effects guideline values from the ZoMI for corals to:

- determine whether thresholds for turbidity and light have been exceeded throughout the dredging program,
- confirm that conditions return to pre-dredging levels within four weeks following the completion of dredging and disposal activities.

The trigger values used for the monitoring program are provided in Table 12.

To take a conservative approach to define the management zones, the ZoHI represents the dredge footprint plus a 50 m buffer. Dredging positioning data will be used to evaluate compliance with the spatial extent of the ZoHI. The ZoMI possible and probable effects trigger values are based on measurements of turbidity and PAR parameters. Turbidity NTU thresholds were derived using the SSC values used for modelling from EPA (2021) and applying the NTU/SSC regression relationship from Fearns et al. (2019) for waters near Onslow (NTU=(SSC/1.07)-0.8). Thresholds for PAR are presented as DLI, which is the sum of PAR values delivered to a specific area over 24 hours.

MODIS imagery can be used to validate and compare the spatial extent of the plume with that predicted for the ZoI from predictive modelling. This activity is not necessarily for compliance, although reactive BCH monitoring may be considered necessary where the plume dispersion and concentrations are significantly different to that predicted.

B.1.6. Parameters and Procedures

Light Intensity

Light quantity (as measured as PAR) and quality will be recorded every 30 minutes approximately 0.5 m above the seabed at each monitoring location. The PAR data will be calculated into DLI and means will be derived over the relevant averaging periods for comparison to ZoMI thresholds (Table 12). Light quality uses nine wavelength multispectral irradiance to evaluate the quantity of each wavelength, where some bands are more critical than others. This information is not required for assessment against EPOs and MTs, although light quality measured during dredging provides valuable information to help understand the potential impacts to coral because of decreased light quality during dredging. Prior to calculating DLI, raw PAR data should be checked for quality to ensure potentially erroneous data is not included for comparison to thresholds as described in Section B1.7.

Turbidity

Turbidity (NTU) will be recorded every 30 minutes approximately 0.5 m above the seabed at each monitoring location. Means will be derived The NTU logger data over the relevant averaging periods for comparison to ZoMI thresholds (Table 12). Prior to calculating means, raw NTU data should be checked for quality to ensure potentially erroneous data is not included for comparison to thresholds as described in Section B1.7.

MODIS imagery is acquired in 36 spectral bands for which the reflectance enables measurements of near-surface TSS concentrations. An algorithm has been derived from baseline data to correlate site-specific reflectance readings with TSS concentrations. Two MODIS satellite images will be available per day, although the quality of the outputs can be weather dependant (i.e. relevant images may not be available of the area due to cloud coverage). For all good quality images captured during dredging, raw imagery will be processed using the algorithm for visual spatial context of near-surface TSS concentrations.

B.1.7. Data Analysis

Data will first undergo a QA/QC process to remove erroneous data before being complied for assessment against the coral threshold's averaging periods of 3 days, 7 days, 10 days, 14 days, and 28 days (Table 12). If any results from contingency sites exceed the thresholds, data will be validated and compared to the reference sites to determine if exceedance is confirmed and whether dredging was attributable. Investigations may include consideration of the following factors:

- Correct instrument calibration, function, operation and maintenance
- Potential influence of shipping movements through the channel
- Locations and status of dredging activities in relation to the site(s) at the time of the exceedance
- Metocean conditions at the time of the exceedance
- Assessment against background conditions (reference site)
- Spatial extent of water quality decline at the time of exceedance based on a review of plume extent (i.e. multispectral imagery).

Quality Assurance and Quality Control

Data collected in the field will be managed in accordance with the National Oceanic Atmospheric Administration NOAA Field Procedure Manual 2020. Specifically, data will be backed up via direct download from the instruments and electronic copies of all field data will be saved on two external hard disks. The time and location of each site activity, as well as any noteworthy observations on marine fauna, water clarity, meteorological and/or sea state conditions, will be recorded in a physical field journal and typed up for electronic archiving. Upon return from the field, these data are to be immediately saved along with a scanned copy of the field journal notes from that sampling occasion.

QA/QC is designed to ensure that all instruments are always operating normally and that the data is admissible as evidence in the circumstance it is required. Standard QC criteria are used for the removal of bad data for all parameters related to the current project: water depth, water temperature, turbidity, and PAR. All raw data and QC data (data that passed the QC criteria in Table 22) are logged in real-time, and data checked for erroneous spikes (based on the preceding and following data) are logged in near real-time with a 30-minute delay.

Table 23: Data QC criteria (completed by the loggers prior to telemetry)

Parameter	Description	Raw Variable (Units)	Automated QC (Bad Data)	QC Variables applied to
Water Depth	Water depth at sensor height, derived from gauge pressure readings. It may be zeroed in air during instrument calibration or derived by subtracting the nominal atmospheric pressure from barometric readings.	depth_raw (m)	• depth_value < 0.5 m	• depth_QC • temperature_QC • turbidity_QC (for NTU measured depth) • conductivity_QC (for CTD measured depth) • PAR_QC (for MS9 measured depth) • Salinity_QC (for CTD measured depth)
Water Temperature	Water temperature	temperature_raw (°C)	• temperature_value < 15°C *[This criterion **does not apply** to 'ambient' above water measurements]* • temperature_value > 35°C *[This criterion **does not apply** to 'ambient' above water measurements]* • temperature_value > [2 x preceding temperature_value] • temperature_value < [0.5 x following temperature_value]	• temperature_QC • salinity_QC (for CTD derived temperature)
Turbidity	Nephelometric turbidity	turbidity_raw (NTU)	• turbidity_value < -0.5 NTU • turbidity_value > 400 NTU • turbidity_value > 150 NTU, and preceding and following turbidity_value < [0.5x turbidity_value], or preceding and following turbidity_value > [2.0x turbidity _value]	• turbidity_QC
Conductivity	Conductivity	conductivity_raw (µS/cm)	• conductivity_value < 30,000 mS/cm • conductivity_value > 70,000 mS/cm • conductivity _value > [1.1x preceding conductivity _value] • conductivity _value < [(1/1.1)x following conductivity _value]	• Conductivity_QC • Salinity_QC
Salinity	Salinity derived from temperature, conductivity and pressure using the UNESCO equation of state (derived within data logger)	salinity_raw (PSU)	• salinity_value > 42 PSU	• Salinity_QC
Light (PAR)	Photosynthetically Active Radiation	PAR_raw (µmol/m2/s)	• PAR_value recorded between 20:31 and 03:31 hours. • PAR_value ≤ 0 µmol/m2/s • PAR_value > 2000 µmol/m2/s *[This criterium **does not apply** to 'ambient' above water measurements]*	• PAR_QC

B.1.8. Corrective Actions

Management actions will be implemented according to the level of exceedance as described in Section 8.1.1. regardless of whether the investigation has determined that dredging and/or disposal activities contributed to the exceedance. A reactive post-dredging BCH survey assessment will be conducted if any trigger is exceeded.

B.1.9. Reporting

A Marine Water Quality Monitoring report will be prepared which will include water quality results from pre-, during and post-dredging program. This report will be submitted to CPM within two months following the recovery of the loggers.

16.2 Appendix B.2. Benthic Communities and Habitat Monitoring Program

B.2.1. Objectives

The Benthic Communities & Habitat Monitoring Program (BCHMP) will aim to provide an evaluation of the EPOs for BCH which are:

1. No irreversible loss, or serious damage to BCH outside of the ZoHI (Figure 6 & Figure 7)
2. No recoverable loss to BCH outside of the ZoHI (Figure 6 & Figure 7)

B.2.2. Rationale

Coral communities within proximity to dredging and disposal locations are susceptible to the effects of increased suspended sediment and the associated decline in benthic light availability. Therefore, coral health will be the lead indicator for monitoring BCH.

CPM has been undertaking coral monitoring in the vicinity of CoCP since 2009 and have developed a long-term dataset for reef in the area, with surveys typically implemented in May/June annually. The most recent survey will be used as a pre-dredge condition for coral communities. The BCH monitoring program (BCHMP) is designed to identify and measure changes in coral cover, as well as health measures of the condition of individual colonies, which are compared to changes occurring naturally at control sites.

The necessity to undertake a BCH survey will be reactive, dependent on whether exceedances of the water quality thresholds for coral (Table 12) are recorded during or post the dredging program. If required, a BCH survey will be conducted to determine whether the water quality exceedance has resulted in detectable impacts on coral communities.

B.2.3. Locations

Coral monitoring locations for the Sino Iron Project Coral Monitoring Assessment are provided in Figure 11. There are 15 sites in total, including eight impact sites and seven reference locations., Six sites have been selected as the monitoring locations in the MWQMP. Three impact sites have been selected which will form contingency sites (i.e. not predicted to be impacted) for the dredging and disposal activities, as well as three reference sites. If an exceedance of the management trigger has likely been recorded at one of these sites, it is most likely that these locations will be used for the reactive survey. However, additional sites from the coral program may be selected based on the data collected during the MWQMP, including MODIS imagery showing the typical trajectory of the plume.

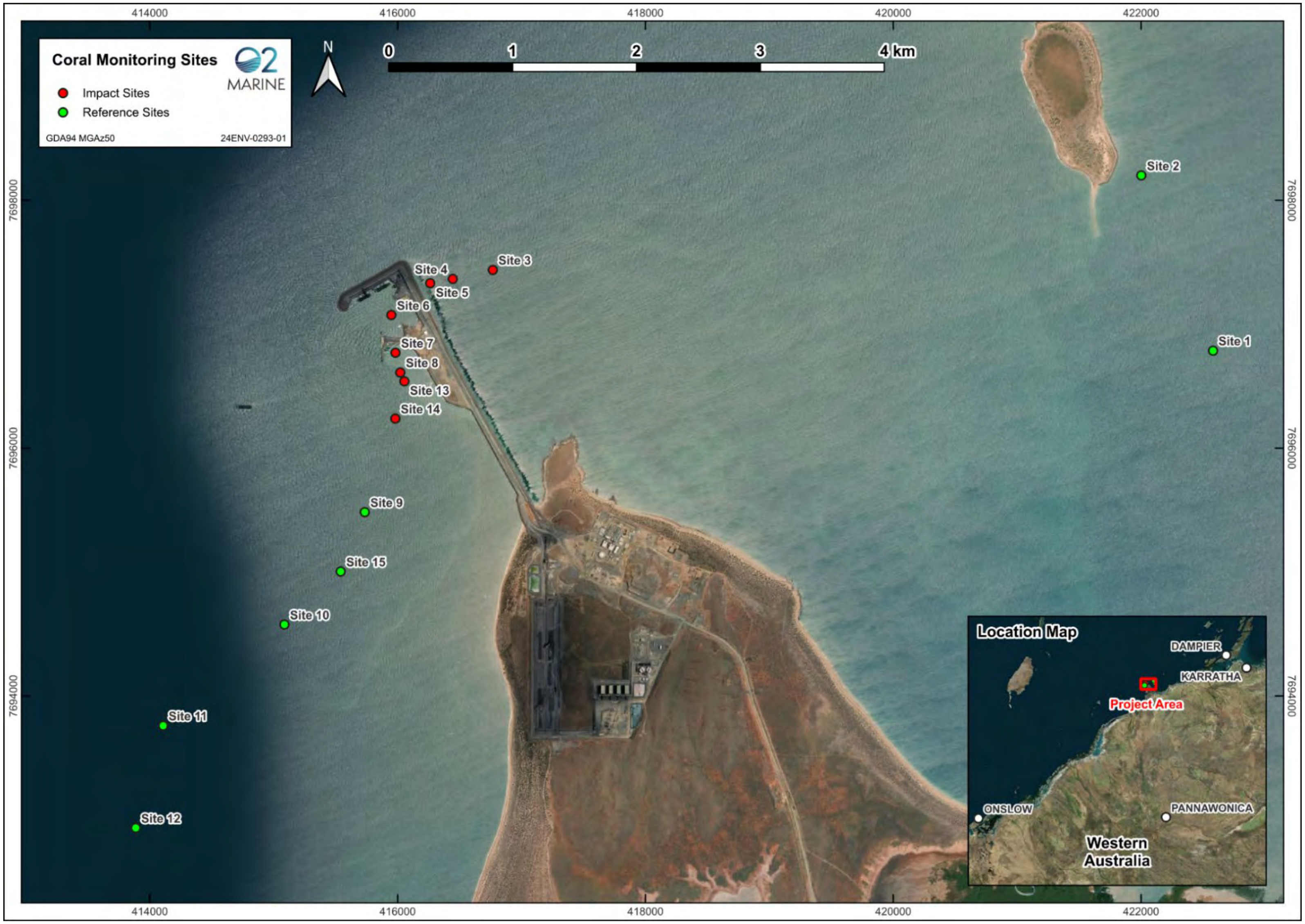

Figure 12: Coral monitoring locations for the annual Sino Iron Project Coral Monitoring Assessment

B.2.4. Frequency

Pre-Dredge Survey

CPM currently conducts annual coral monitoring in the vicinity of CoCP. The reported condition recorded in the most recent annual BCH monitoring report will be used as a pre-dredge condition for assessment.

Reactive Post-Dredging Survey

If an exceedance of trigger values is recorded through the MWQMP at any of the sites, this will elicit a reactive post-dredging coral survey. The survey will most likely be undertaken post-dredging. However, reactive surveys may be required in the event of unforeseen circumstances (see level 2 management actions in Figure 10) which result in delays to the schedule or if MODIS imagery identifies significant variation in turbidity plumes generated from that which was predicted from the modelling.

B.2.5. Survey Methods

Survey Sites

At each monitoring location, five transects of 10 m length have been established at similar depths across selected representative coral communities. At each site, a central star picket was inserted at a conspicuous location. Sites were established by inserting permanent stakes (12 mm steel reinforcement bars, 3 per transect) at the start, middle (5 m mark) and end of each transect. During each field survey, a transect line (tape measure) was temporarily attached to the three stakes, to mark the transect centreline. The five transects at each site were labelled using the appropriate number of cable-ties, attached to the marker closest to the central star picket. The general format of each site is given below in Figure 12.

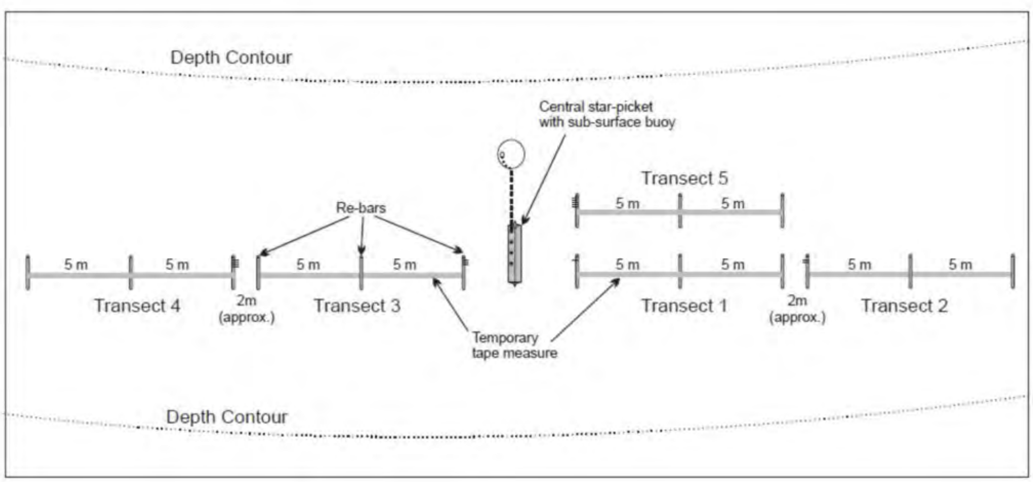

Figure 13: General arrangement of coral transects at each monitoring site

Line Transect

At each monitoring site, the percent cover of major benthic organisms will be assessed by measuring the intercept length of all benthic organisms and substrate directly beneath the measuring tape at each of the five transects. Intercept lengths for all colonies of a species or benthic group along each transect will be totalled and converted to percent cover. Organisms or groups of organisms will be recorded using the following classification:

- All hard corals identified at least to genus level (or to growth form where appropriate)
- All soft corals, identified at least to genus level
- All other key benthic groups (such as ascidians, macroalgae, sponges, zoanthids)

The use of permanently marked monitoring transects is designed to reduce errors and ensure that the same sections of the benthic community are measured during each survey. The sites were selected to represent areas with the highest coral cover and hence are regarded as fixed rather than randomly selected. However, in practice it is impossible to continuously measure the same line along the 10 m long sections of transect between the marker stakes. Even when stretched tightly between the stakes, the survey tape can be moved by wave surge, or it may bend around protruding coral colonies. The tape is often above the bottom over depressions in the substratum and in those cases parallax errors make it unlikely that the same section of substratum is measured accurately during repeated surveys. The loss of marker stakes also leads to errors within each transect. While permanent transects reduce errors compared to using random transects, sampling error (variability) is still a standard component of the line intersect method.

A digital camera will be used to collect a video of each transect from approximately 1 m above the seabed to provide a visual of the area surveyed and redundancy in case somehow data may be lost.

B.2.6. Data Analysis

Benthic Cover

Mean percent cover (± standard deviation (SD) and error (SE)) for all benthic groups including combined hard corals, coral family groups (Acroporidae, Merulinidae, Dendrophylliidae, Lobophylliidae, and Poritidae), ascidians, macroalgae, zoanthids, and sponges will be calculated for each site individually and pooled in terms of their status (i.e. Reference or Impact zone). These will be plotted by time (June 2009 – reactive survey date). The Impact and Reference zones have been strategically chosen in relation to the extent of the predicted plume from the dredge plume modelling.

To assess differences in the patterns of benthic cover between the Impact and Reference zones and time, generalised linear mixed effects models (GLMM) will be developed in R using RStudio (R Core Team, 2024) for each benthic group, impact zone (Impact/Reference) and timepoints as fixed effects (including interactions), and individual sites as random effects. A significant difference (95% confidence, $\alpha = 0.05$) between independent groups (site and survey) would indicate that a particular benthic group had increased or decreased significantly in cover.

Model formula:

$$y_i \sim N(\mu_i, \sigma^2)$$
$$\mu_i = \beta \mathbf{X}_i + \gamma \mathbf{Z}_i$$

where β and γ are vectors of the fixed and random effects parameters respectively and X is the model matrix representing the overall intercept and effects of sampling time and location. Z represents a cell means model matrix for the random intercepts associated with sites.

Coral Health Assessment

Coral health for each of the tagged coral colonies photographed during the field survey will be assessed based on the following health parameters:

- Proportion of partial mortality
- Proportion of coral bleaching
- Proportion of active disease infection
- Proportion of colony affected by predation
- Proportion of colony producing mucus
- Proportion of sediment cover
- Depth of sediment (mm) on the surface of each colony

The depth of sediment deposition will be measured *in situ*, while the percent of each coral colony affected by the remaining health parameters will be visually estimated through examination of the tagged coral photographs.

Each parameter will be recorded in 5% increments, except for sediment depth which will be recorded to the nearest millimetre. Basic statistical terms (e.g. mean, standard deviation, and standard error) will be used to facilitate comparisons in coral health metrics between monitoring zones (i.e. Impact and Reference).

An estimate of net coral colony mortality will be calculated with the methods proposed by URS (2008). This involves summing the changes in the percent mortality of each colony between the baseline and each subsequent survey and dividing by the number of colonies. This change could be either positive (if more of a colony died) or negative (if the colony regrew into dead patches or if previous presumed ‘mortality’ was not real). In the latter case a coral may have been recorded as partially dead under smothering algae or sediment, but subsequent natural removal of the algae or sediment may have revealed that the ‘smothered’ coral patch was still alive.

Net coral colony mortality will then be calculated by subtracting the presumed natural change in mortality for the combined Reference sites, from the mortality change at the Contingency sites that was assumed due to a combination of natural processes and impacts through dredging/disposal activities. Net mortality will be considered positive if coral mortality change was higher in the Contingency sites than in the Reference sites (as would be expected if the dredging/disposal activities were responsible for the observed coral mortality). A negative value for net mortality will indicate that natural mortality changes in the Reference sites were higher than changes in the Contingency sites.

As with most biological measurements, there are sources of error in coral health measurements. Many coral colonies are not discrete with easily recognisable edges, so defining the ‘colony’ and the parts that have suffered mortality can be difficult, especially as dead parts of the colony can appear similar to the surrounding reef pavement after several months.

Another source of error is that colony photographs are two dimensional and sections of the colony may not be visible beneath overgrowing algae or sediment. For example, a colony may be erroneously recorded as dead/damaged although it is still alive underneath the algae or sediment. Locating the same colonies accurately provides a source of error, although the level of replication with 60 colonies per site is likely to provide some useful information for coral health measures to represent health among the community, regardless of whether the colonies are fixed or random.

Management Triggers

Evaluation has been adapted from the Sino Iron Project Coral Monitoring Assessment management triggers used in CPM’s annual coral monitoring. They have been based on the difference between Contingency and Reference sites that would be surveyed if a reactive post-dredging survey is to take place. Coral mortality was also calculated for “net change”, which describes the cumulative difference between the means calculated in the reactive post-dredging survey and immediately preceding annual coral survey between Contingency and Reference sites. Trigger values have been derived for the parameters shown in Table 21, together with the indicative management response in the event trigger values are exceeded.

Table 24: Classification details of indicators to be recorded for each colony during each survey

Parameter	Triggers	Management Response
Live hard coral cover (%)	> - 20%	Continue annual coral monitoring for a minimum of five years to identify evidence of BCH recovery. Where BCH has not shown evidence of recovery after three years, options for translocation, artificial reef, seagrass transplantation and/or restoration will be considered or continue annual monitoring of recovery until EPA are satisfied monitoring can discontinue.
Net colony mortality (%/year of colony area)	> 0%	
Corals with sediment (%)	> 30%	Trigger of coral health parameter provides an alert to CPM that if trend continues coral cover may be affected. 1. Cross-check accuracy of survey data and analysis 2. Review port operations and environmental management to identify any areas for improvement. 3. Assess likelihood of an impending coral cover loss 4. Evaluate options for improvement and prepare for management intervention to be considered.
Sediment depth (mm)	> 0.7mm	
Coral colony area mortality (%)	> 20%	
Corals dead or missing (%)	> 10%	
Coral colony area bleaching (%)	> 10%	

B.2.7. Reporting

Reactive Post-Dredging Survey Report

A report will be prepared following the completion of reactive monitoring. This report will include:

1. Review of results from the MWQMP management trigger exceedances during the survey
2. Details of dredging operations to inform activities
3. A summary of data collected during the survey
4. Comparison of coral community condition with pre-dredge and against reference locations
5. Evaluation of whether coral EPOs have been achieved or not
6. Evaluation of the effectiveness of the BCHMP and MWQMP
7. Recommendations for additional investigations/management/monitoring if required

16.3 Appendix B.3. Marine Fauna Management Procedures

B.3.1. Underwater Noise Protocols and Procedures

A crew member will undergo training to become a Trained Marine Fauna Observer (see below for details). Dredging and disposal operations will adopt a precautionary approach by utilising management zones in combination with conducting pre-start marine fauna observations, marine fauna observations throughout operations, soft-start procedures, shut-down and stand-by measures to minimise impacts to marine fauna as far as practicable.

Trained Marine Fauna Observers

Trained MFOs are crew members who have been trained in marine fauna species observations and are familiar with the mitigation measures consistent with CPM's the Dredging Management Plan. At least one trained MFO will be on duty during the dredging and disposal operations. A trained MFO may have other vessel duties concurrent to acting as the MFO.

Trained MFOs must attend at least one marine fauna training session and be deemed competent through a Verification of Competency (VOC) session. Training must include:

- Mitigation and management procedures, including management zones and vessel speed restrictions
- Target marine species
- Pre-start, Soft-start, Shut-down and Low-visibility Condition Procedures
- Recording and reporting procedures
- Impacts and risks associated with dredging and disposal
- All commitments that CPM have agreed to as part of this DMP

Figure 14: Marine Fauna Management Zones

At least one trained MFO onboard each vessel will continue monitoring the Observation and Exclusion Zones during operations. In the event dredging activities cease during SHB transfer and return to the DMPA for spoil disposal activities, one trained MFO onboard the SHB for observations may be sufficient for dredging and loading within the inner harbour area. The trained MFO will notify the dredging/disposal operator(s) if marine fauna is observed within the Observation Zone.

The following mitigation actions must take place that are based off the EPBC Act Policy Statement 2.1 (DEWHA 2008):

- Continue observations if target marine fauna enters the Observation Zone (but not the Exclusion Zone), dredging and disposal operations may continue
- Shut-down procedure will be implemented within two minutes (or as soon as safely possible) of a target marine fauna being sighted within the Exclusion Zone
- Dredged material will not be disposed of within the Caution Zone (see Table 25)

Pre-start Procedures

Before dredging or disposal activities commence, MFOs will conduct continuous visual observations within the observation zone for 30 minutes to observe any marine fauna that is present in the vicinity. The commencement of operations includes on the first day of dredging operations and whenever there has been a break in dredging operations. The MFO must be positioned in a location where they have sight lines to the full Observation Zone.

Operations may commence Soft-start Procedures if target marine fauna is not observed within either the Observation or Exclusion Zones for the full 30 minutes.

Soft-start Procedures

The soft-start procedure involves slowly increasing the noise of the operational equipment to alert marine fauna to the presence of the operational equipment and allow them to move away to distances where direct interaction is less likely. A soft-start may include activating the bucket in a controlled manner over a period of 30-minutes, before commencing dredging, to passively disturb and deter resident fauna. The MFO will continually monitor the Observation and Exclusion Zones during the soft-start procedures.

Full operations may commence if target marine fauna is not observed within either the Observation or Exclusion Zones throughout the soft-start procedures.

- If marine fauna is observed in the Observation Zone, soft-start procedures will continue until the marine fauna has left the Observation Zone.
- If target marine fauna is sighted in the Exclusion Zone, soft-start procedures will cease until the observed target marine fauna leaves the Exclusion Zone or has not been observed for 30 minutes. After the target marine fauna has left the Exclusion Zone (or no sightings have been made for 30 minutes) the soft-start procedures will recommence.

Shut-down Procedures

All dredging operations must cease within two minutes (or as soon as safely possible) of a target marine fauna being seen entering or within the Exclusion Zone. Operations may not recommence until the target marine fauna has exited the Exclusion Zone on its own accord or has not been seen by the MFO within the Exclusion Zone for 30 minutes. When operations resume, operations begin with soft-start procedures.

Low-visibility Conditions

During periods of low visibility (i.e. poor weather such as fog, rain or thick smoke, night-time, or where the full Observation Zone cannot be viewed), then operations may commence with soft-start procedures, provided that during the preceding 24-hour period:

- There have not been three or more circumstances where marine fauna has been observed in, or about to enter, the Exclusion Zone which resulted in the implementation of a Shut-down Procedure
- Two hours of good visibility were maintained before the onset of low visibility conditions and no marine fauna were sighted
- If marine fauna is observed, the Shut-down Procedures will apply.

B.3.2. Vessel Movement Protocols and Procedures

The risk of interaction or collision with vessels to marine fauna from dredging and disposal activities resulting in injury or fatality will be managed through vessel speed limits and the use of Caution and No-Approach Zones during the vessel transiting to and from the disposal spoil ground. The route between the dredging area and the DMPA is ~1.5 km (one way). It is estimated that that a trip out to the DMPA and back again will take ~1 hour.

A trained MFO will observe for target marine fauna during vessel movements to and from the spoil ground. If marine fauna is sighted by the MFO within the Caution Zone, the vessel speed must be limited to a maximum of 6 knots. The No-Approach and Caution Zones are presented in Table 23.

Table 25: Caution and No-Approach Zones for Vessel Movements (Commonwealth of Australia 2017).

Marine Fauna Group	No-Approach Zone	Caution Zone (m)
Whales	100 m (300 m in front and behind)	300 m
Whale with calf	300 m all around	-
Dolphins	50 m (150 m in front and behind)	150 m*
Dolphin with calf	150 m all around	-
Dugongs	100 m	300 m
Turtles	50 m	100 m

* Exception for bow/wake riding

B.3.2. Frequency

Marine fauna observations shall be undertaken for the duration of dredging and disposal activities.

B.3.3. Location

Appropriate monitoring locations shall be selected by the MFO before the commencement of dredging activities. This may entail an MFO onboard each vessel or one MFO with an unobstructed view across the exclusion zones described above.

B.3.4. Records and Reporting

Field log

Trained MFOs will use pre-designed datasheets to record observer effort, fauna observations and mitigation measures. They will be based on those developed by the Australian Government to record marine fauna sightings made during seismic surveys. Datasheets will include:

- Location, date and start time of survey
- Name, qualifications and experience of MFOs involved in the survey
- Location, times and reasons when observations were hampered by poor lighting conditions
- Location and time of start-up delays or stop work procedures because of marine fauna sightings
- Location, time and distance of any fauna sightings including species where possible.

Reportable incidents

All contractor employees shall immediately report all environmental incidents as non-conformance (I.e., performance indicators are not met, or management actions are not followed (See Section 8.3; Table 15) to the site supervisor who will investigate the incident with both CPM's Project Manager and Contractor Project Manager.

Reportable incidences are injury to wildlife because of the Proposal activities or general observations of injured wildlife not related to Proposal activities to be reported to the Subcon PM. The PM is to notify CPM, who will notify the Department of Biodiversity Conservation and Attractions (DBCA) within 48 hours (Wildcare Ph: 08 9474 9055).

It is a requirement that all incidents follow CPM's Incident Management Procedure. The employee is to report the incident immediately to the site supervisor. In every case the site supervisor is to document the incident using CPM's Incident Management System (Appendix C).

Completion report

On completion of the program, a full report will be submitted which will allow compliance auditing.

A log detailing marine fauna sightings and activities will be maintained on the dredge and all dredge-related vessels.

17 Appendix C. Incident Management Procedure

CITIC PACIFIC MINING

EMS - Environmental Incident Management Procedure

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V #	**Date**	**Author**	**Amendment Summary**
00	18.09.2011	Tom Wang	Initial draft for review.
1.0	28.09.2011	Tom Wang	Amendments based on comments.
2.0	14.10.2011	Tom Wang	Minor amendments.
3.0	07.12.2011	Tom Wang	Amendments based on comments.
4.0	13.12.2013	Daniel Jones	General annual review
5.0	23.12.2014	Tom Wang	General annual review
6.0	39.08.2015	Tom Wang	Major changes to accommodate new incident management flow chart and EMS requirements.
7.0	08.11.2016	Tom Wang	EMS update review, include requirement to perform ENV risk assessment.
8.0	28.06.2017	Nick Burkett	Included incident flowcharts.
9.0	12.08.2019	Bart King	Included CEMS incident flow chart as appendix J
10.0	06.05.2020	Harley Barron	Remove quickspills, include new environmental consequence table, update dust reporting appendix, other minor updates.
11.0	26.05.2021	Peter Yoba	Review and include Fire Incident flowchart
14.0	10.06.2021	Peter Yoba	Major review, update government reporting requirements & publish
15.0	3.02.2023	Tom Wang	Review DR029118 and update in CDMS
16.0	27.03.2023	Nick Burkett	
17.0	10.10.2023	Nick Burkett	Updated to include Desal outfall incident

REFERENCE	CDMS / DOC ID
Policy / Procedure / Standard / Plan / Manual / Framework	
Insert reference (Arial 10 black)	Insert Doc ID hyperlink

Contents

1 Introduction

1.1 Purpose

The purpose of this procedure is to define and provide guidance for reporting and investigating environmental incidents, with a view to reducing the likelihood of those incidents from reoccurring.

This procedure also ensures that incidents are managed in accordance with CITIC Pacific Mining's various legislative requirements such as Licenses to Operate, Tenement Conditions, Mining Proposals and other applicable legislation.

1.2 Scope

This procedure applies to all environmental incidents, including quick spill report incidents. This procedure is applicable to all personnel employed on the Sino Iron project, including contractors.

2 Definitions

TERM	DESCRIPTION
DoT	Department of Transport
Environmental Incident	An unwanted event that resulted in, or could have resulted in pollution, environmental harm, noncompliance with environmental compliance requirements or objectives.
Environmental Aspect	Element of an organization's activities, products or services that can interact with the environment.
Environmental Impact	Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's environmental aspects.
CPM	CITIC Pacific Mining Management Pty Ltd
Shall	Mandatory
Should	Recommended but non-mandatory.
CORE	Compliance Obligation Register for Environment
OEMP	Operational Environmental Management Plan
Environmental Harm	Means direct or indirect — (a) harm to the environment involving removal or destruction of, or damage to — (i) native vegetation; or (ii) the habitat of native vegetation or indigenous aquatic or terrestrial animals; or (b) alteration of the environment to its detriment or degradation or potential detriment or degradation; or (c) alteration of the environment to the detriment or potential detriment of an environmental value; or (d) alteration of the environment of a prescribed kind

3 Environmental Management System

This procedure supports the CPM Environmental Management System (EMS), in particular the Compliance Obligation Register for Environment (CORE) and the Aspects and Impacts registers.

4 Environmental Incident Management Procedure

4.1 Identifying an Incident

Environmental incidents are varied and can range in impact depending on the circumstances and environment in which they occur. Part of the Environment department's role is to provide guidance and advice on what constitutes an incident. At a high level, incidents are normally related to being a non-compliance with:

- Licence to Operate conditions;
- Tenement conditions;
- Mining proposal conditions;
- Clearing Permits;
- Legislation;
- Ministerial conditions; and
- Other licenses or approvals to conduct activities.

At a low level, they can be associated with failure to meet targets, comply with internal procedures and various impacts on the environment outside of CPM's approved impacts. Examples of these are:

- Air quality impact and dust generation outside of any authorised licence limits;
- Erosion and sedimentation;
- Land contamination due to a spill of a liquid or solid;
- Impacts to flora and fauna outside of allowable limits;
- Release of waste material into the natural environment;
- Unauthorised use of topsoil and land clearing;
- Non-compliance to ground disturbance permit (GDP) conditions;
- Waterway damage and contamination; and
- Non-compliance to emissions monitoring equipment management.

4.2 Incident Notification

Incidents shall be notified to the CPM Environment department as soon as practicable. The reporting timeframe is identified in Appendix A. Where incidents have multiple causes the Environment impact shall be identified too.

All events involving a spill of hydrocarbons, chemicals or other material shall be reported to the Environment department as soon as is practicable. The

Environment department will determine whether the material spilled, the volume spilled or the location of the spill will constitute a hazard report or an incident report.

Where any doubt exists over whether an incident should be raised or not, contact the Environment department for clarification. Non-compliances with Licence to Operate conditions shall be reported immediately to the Environment department and an incident notification shall be raised as soon as practicable.

After confirmation with the Environment department, the Supervisor is required to complete an Incident Notification by entering it directly into Cintellate. Refer to DR001914 CPM Incident Management Procedure for detailed instructions.

4.3 Cintellate Environment Form

Once the environmental incident is entered into Cintellate, the incident reporter is required to identify the aspect (primary and secondary environment classification), contaminants (spill or release incidents only) and the monetary cost of the incident by adding and completing the Environmental form in Cintellate (refer to Appendix C). The Environmental form has been developed to further categorise environmental and heritage incidents into the specific aspects and impacts of the incident. Please note, at least one environmental aspect shall be selected.

4.4 Incident Investigation

All environmental incidents shall be investigated following the procedure outlined in DR031605 CPM Incident Investigation, Analysis and Reporting Procedure section 6.3.

- Responsible supervisor/s should lead and conduct the incident investigation as soon as practicable. CPM Environment department may assist with the investigation depending on the severity or on an as requested basis;
- Once the investigation is complete, CPM Environment department shall review the investigation in Cintellate and complete the HSE review section. The reviewer can either accept for close out or reject with comments.
- The identified area/department manager shall conduct final review and sign off once CPM Environment accepted the investigation for close out.

5 Government Reportable Incidents

All environmental incidents on the Sino Iron project must be reported. Notification to CPM Environment department immediately after the event has occurred ensures the appropriate action can be taken to maintain compliance with reporting requirements. The CPM Environment department will assess and determine the appropriate reporting requirements.

The decision to report an incident externally will take into account the applicable legislative requirements including, but not limited to:

- *Environmental Protection Act 1986 Section 72*.
- Tenement conditions
- Licenses to Operate

- Controlled waste transport carrier, vehicle and receival point registration
- Mining Proposals

External incident reporting to government authorities shall be performed by the **CPM Environment department only**.

Here, government reportable incidents need to be reviewed on site by the Superintendent or his/her delegate. It has to be justified on why it is government reportable then send it to the GM Sustainability & Environment or his/her delegate for review.

6 Environmental Incident Assessment

CPM Environment department shall assess each environmental incident to determine actual environmental harm and external reporting requirements. There are a number of regulators which govern environmental management, as such a thorough investigation is required to determine whether an incident should be reported to the regulator and when. This can be achieved by following the appropriate flowcharts (Appendixes E-K) for each incident type. The environmental incident assessment flowchart (refer to Appendix B) outlines the process.

The Cintellate Environmental form is a tool for identifying incident aspect(s). The incident reporter is responsible for completing the Environmental form (refer to section 3.3). The CPM Environment department shall thoroughly review each section. If any discrepancies with the completed incident aspects are found, the CPM Environment representative shall contact the incident reporter for clarification.

The incident location shall be clearly identified to assist with the document review process and risk assessment. Once the incident aspect(s) and location are determined, relevant documentation shall be reviewed:

- Tenement conditions;
- GDP conditions;
- Licence conditions;
- Clearing permits;
- CPM procedures and management plans;
- Legislation;
- OEMP;
- CORE; and
- Mining proposals.

Any breaches to conditions should be documented and risk assessed. The Cintellate "Environment Department Only" form (refer to Appendix D) shall be filled out as part of the incident assessment.

6.1 Risk Ranking

A risk ranking shall be assigned for all environmental incidents. There are two sections for risk ranking in each incident, one is a generic assessment to be performed by the person investigating the incident; the other is in the Environment department only tab. The Environment department only risk assessment enables the Environment department to use subject matter knowledge to determine the risk associated with environmental impacts.

All risk assessments shall follow the corporate risk management guidance, for a more detailed breakdown of risk consequences, refer to Appendix M – Environmental Consequence Description which details consequence severity for environmental assessment. Note that the incident likelihood is the main driver for elevating risk and should be considered appropriately.

If government reporting requirements are identified, the completed Cintellate environment incident review form shall be presented to CPM Environment Superintendent and Senior Advisor/s for final review. The following government reporting information should be clearly identified:

- The government department to report to;
- Specify reporting deadlines as per requirement;
- Any specific reporting format (e.g. forms, email, phone etc.); and
- Specify CPM personnel responsible for the reporting.

6.2 Management Review

CPM Environment shall complete the Cintellate Environment Department Only form and complete the Cintellate incident's HSE review-external and government reporting section. The Environmental Spill Incident Flowchart (refer to Appendix E) shall be followed for all spill related external reporting.

7 Roles and Responsibilities

Person involved with the incident

- Report the incident immediately to supervisor;
- Secure the area where incident occurred;
- Assist with incident investigation; and
- Receive feedback on the control of hazards and methods to reduce risk of future similar environmental incidents.

Supervisors

- Notify CPM Environment department immediately after the incident;
- Arrange clean-up for spill related incidents;
- Submit incident notification and complete Environmental form on Cintellate;
- Select investigation team and conduct incident investigation;
- Complete incident Investigation and sign for close out;

- Provide information to any subsequent investigation as required;
- Provide feedback to staff and contractors regarding the resolution of the incident; and
- Ensure corrective actions are completed within the required timeframe.

The Registered Mine Manager, Operations Managers or Area Construction Managers

- Ensure that an early and comprehensive investigation occurs and that the appropriate recommended actions have been agreed and distributed for implementation.

CPM Environmental Advisor

- Conduct environmental incident assessment and complete Cintellate Environment Department Only form.
- Determine if the incident requires reporting to Government;
- Assist in the incident investigation as required;
- Review Cintellate Environmental form, incident investigation and corrective actions;
- Provide supplemental information to Cintellate; and
- Complete Cintellate HSE Review section.

CPM Senior Advisor & Superintendent

- Provide guidance and support with environmental incident management;
- Review environmental incident assessment & complete the Cintellate incident's HSE review-external and government reporting section; and
- Review and sign off incident investigation and corrective actions.

Cintellate Support

- Data entry into Cintellate;
- Proof read incident notification and completed incident investigation to ensure correct details are provided prior to saving into Cintellate; and
- Match the completed investigation to the incident and data then close out in Cintellate and file hard copy.

8 References

CPM Incident Management Procedure (DR001914)

CPM Incident Investigation, Analysis and Reporting Procedure (DR031605)

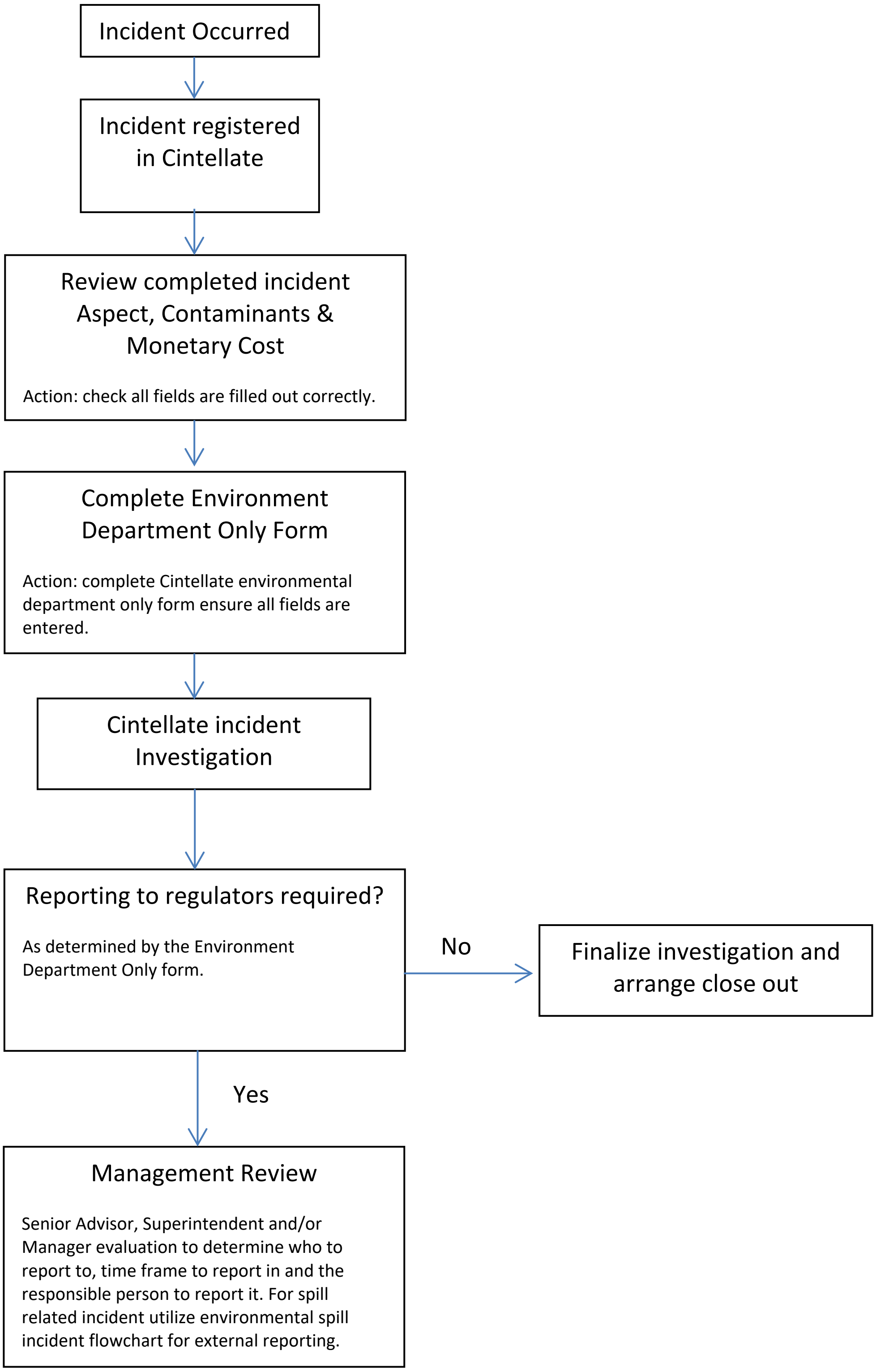
CPM Hazardous Materials Spill Response Procedure (DR017219)

CPM Risk Assessment Procedure (DR001941)

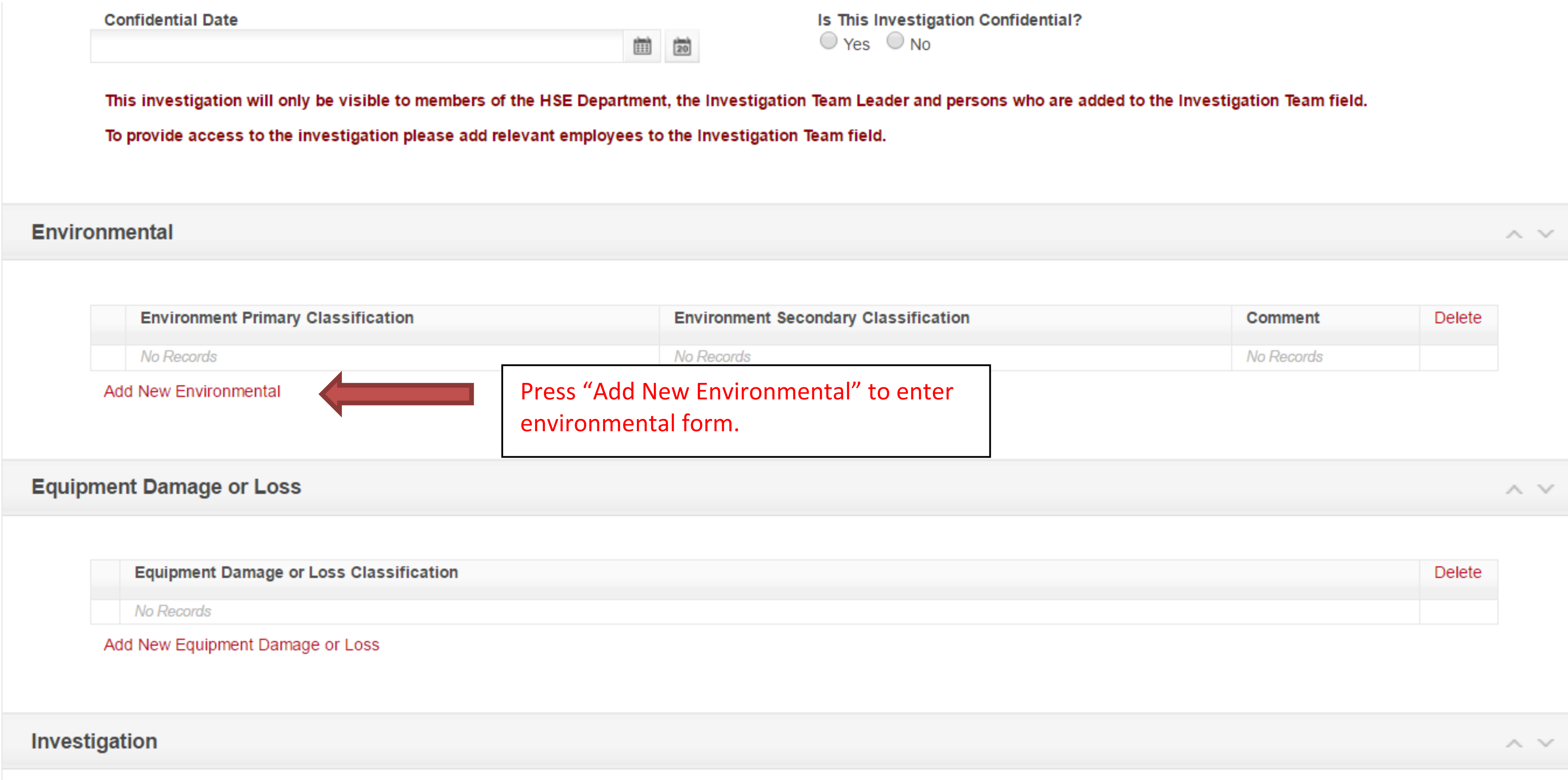
Appendix A - Incident Reporting Timeframe

Severity of Incident	Low (1)	Minor (2)	Moderate (3)	Major (4)	Critical (5)
Employee reports to Supervisor	Immediately	Immediately	Immediately	Immediately	Immediately
Supervisor / Superintendent report to Depart HS&E Advisor and Area Manager	As part of daily reporting	Within 12 hours of incident	Within 12 hours of incident	Immediately	Immediately
Area Managers report to Registered Manager / General Managers	As part of daily reporting	As part of daily reporting	Within 12 hours of incident	Immediately	Immediately
General Managers report to the Chief Executive Officer	As part of daily reporting	As part of daily reporting	Within 12 hours of incident	Immediately	Immediately
Chief Executive Officer report to Chairman	N/A	N/A	Within 24 hours of incident	Immediately	Immediately

Appendix B - Environmental Incident Assessment Flowchart



Appendix C - Cintellate Environmental Form



Confidential Date

Is This Investigation Confidential?
Yes No

This investigation will only be visible to members of the HSE Department, the Investigation Team Leader and persons who are added to the Investigation Team field.

To provide access to the investigation please add relevant employees to the Investigation Team field.

Environmental

	Environment Primary Classification	Environment Secondary Classification	Comment	Delete
	No Records	No Records	No Records	

Add New Environmental

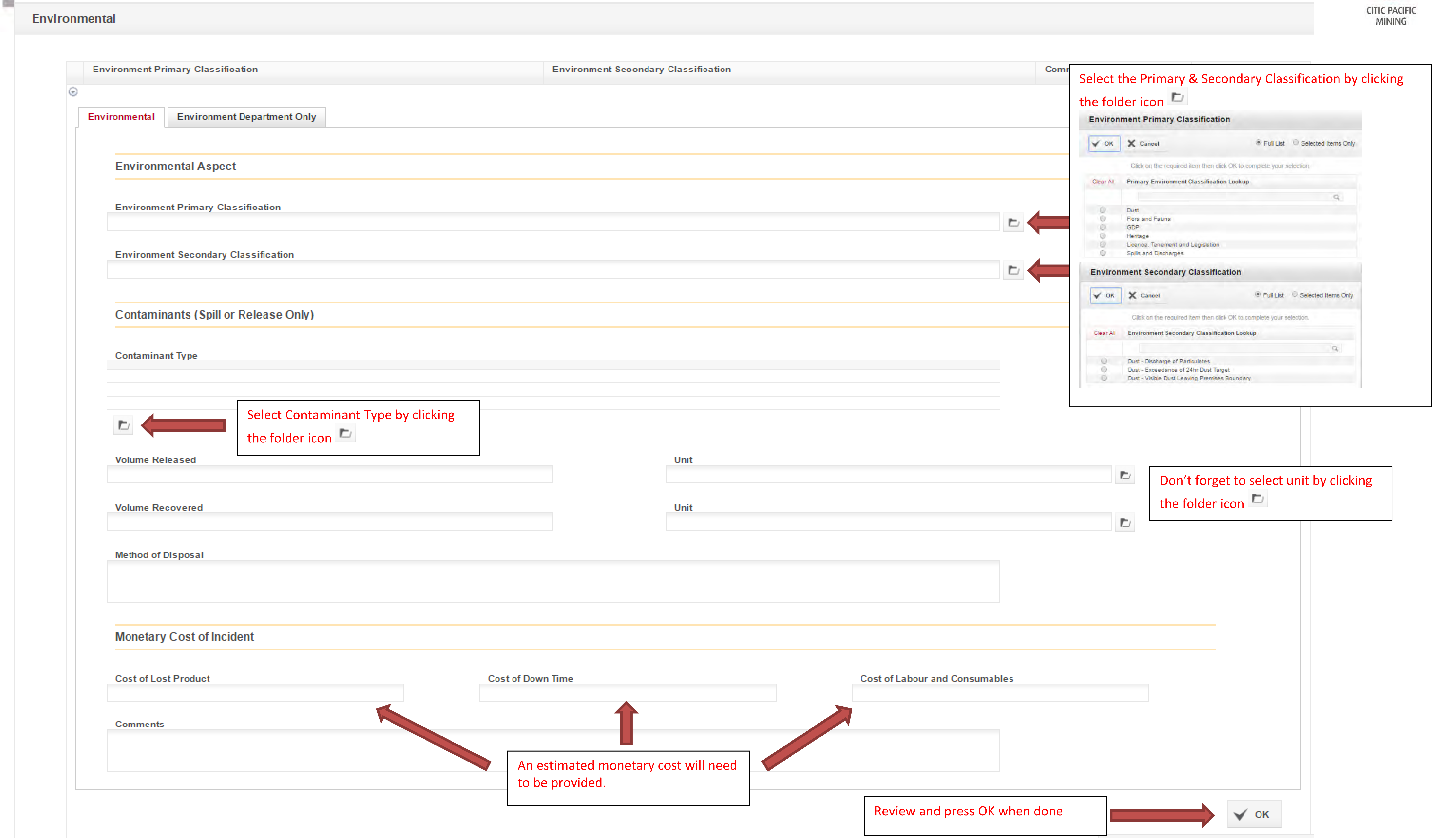
Press "Add New Environmental" to enter environmental form.

Equipment Damage or Loss

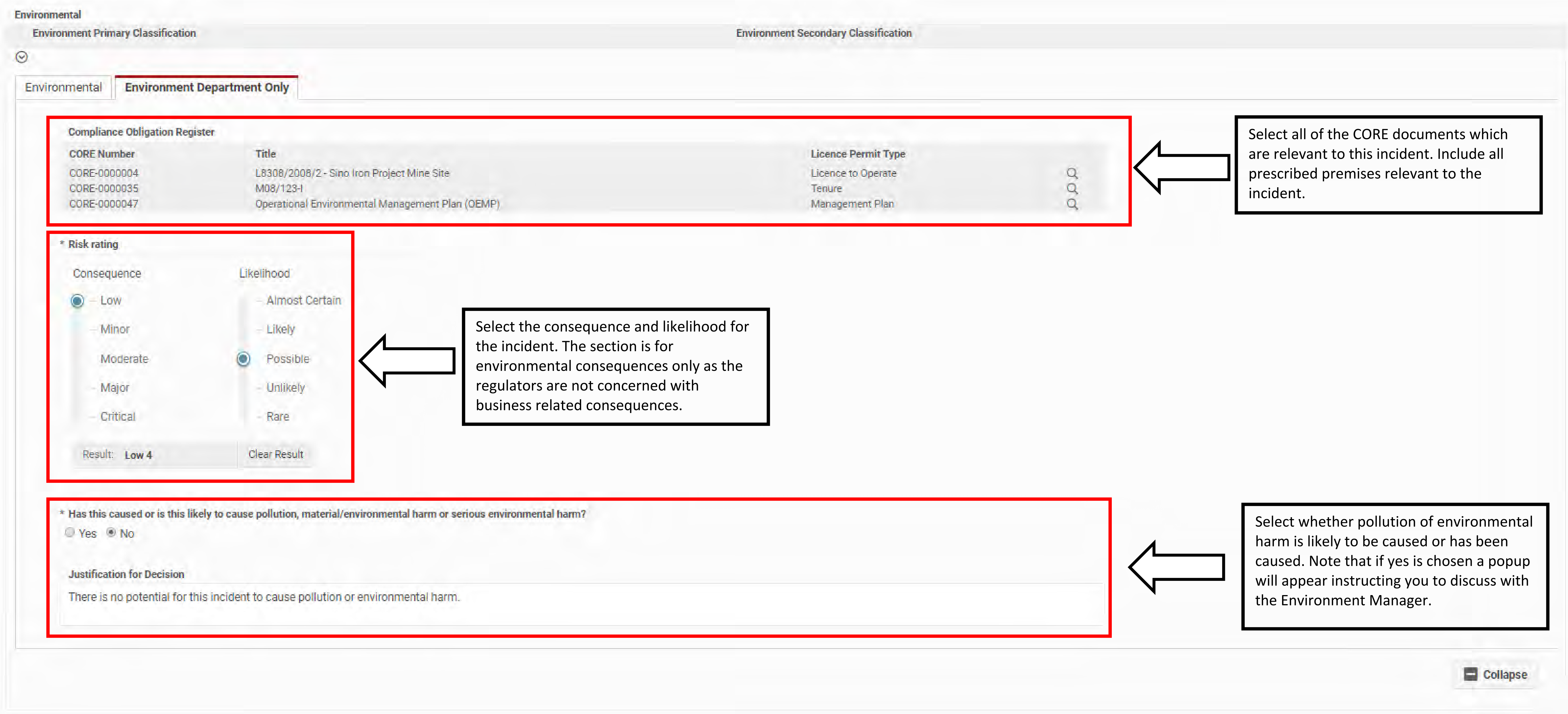
	Equipment Damage or Loss Classification	Delete
	No Records	

Add New Equipment Damage or Loss

Investigation


Environmental
Environment Primary Classification
Environment Secondary Classification
Comm
Environmental
Environment Department Only
Environmental Aspect
Environment Primary Classification
Environment Secondary Classification
Contaminants (Spill or Release Only)
Contaminant Type
Select Contaminant Type by clicking the folder icon
Volume Released
Unit
Volume Recovered
Unit
Method of Disposal
Monetary Cost of Incident
Cost of Lost Product
Cost of Down Time
Cost of Labour and Consumables
Comments
An estimated monetary cost will need to be provided.
Select the Primary & Secondary Classification by clicking the folder icon
Environment Primary Classification
OK
Cancel
Full List
Selected Items Only
Click on the required item then click OK to complete your selection.
Clear All
Primary Environment Classification Lookup
Dust
Flora and Fauna
GDP
Heritage
Licence, Tenement and Legislation
Spills and Discharges
Environment Secondary Classification
OK
Cancel
Full List
Selected Items Only
Click on the required item then click OK to complete your selection.
Clear All
Environment Secondary Classification Lookup
Dust - Discharge of Particulates
Dust - Exceedance of 24hr Dust Target
Dust - Visible Dust Leaving Premises Boundary
Don't forget to select unit by clicking the folder icon
Review and press OK when done
OK

Appendix D - Cintellate Environment Department Only Form


Environmental

Environment Primary Classification | Environment Secondary Classification

Environmental | **Environment Department Only**

Compliance Obligation Register

CORE Number	Title	Licence Permit Type
CORE-0000004	L8308/2008/2 - Sino Iron Project Mine Site	Licence to Operate
CORE-0000035	M08/123-I	Tenure
CORE-0000047	Operational Environmental Management Plan (OEMP)	Management Plan

* Risk rating

Consequence	Likelihood
(●) Low	Almost Certain
Minor	Likely
Moderate	(●) Possible
Major	Unlikely
Critical	Rare

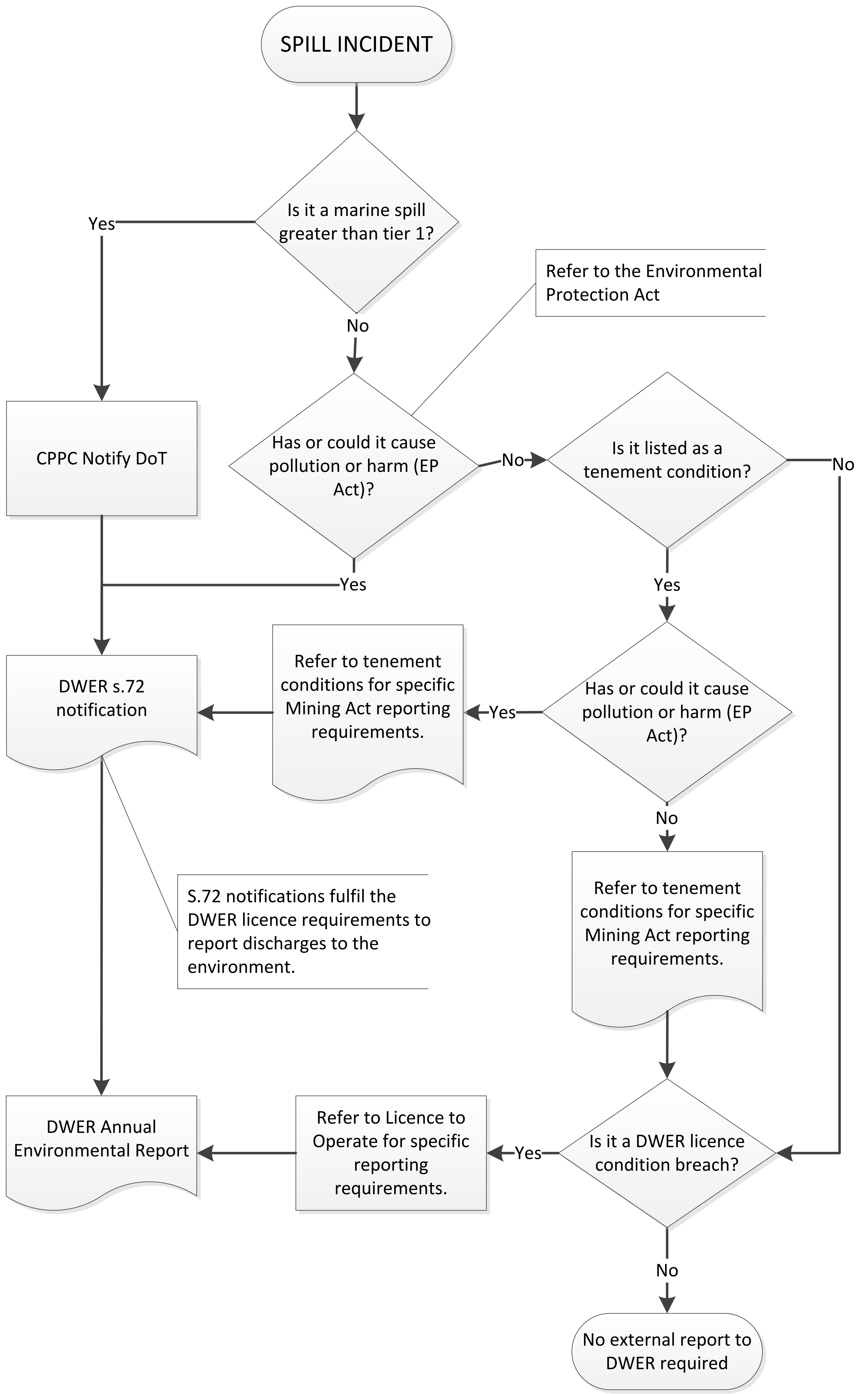
Result: Low 4 | Clear Result

* Has this caused or is this likely to cause pollution, material/environmental harm or serious environmental harm?

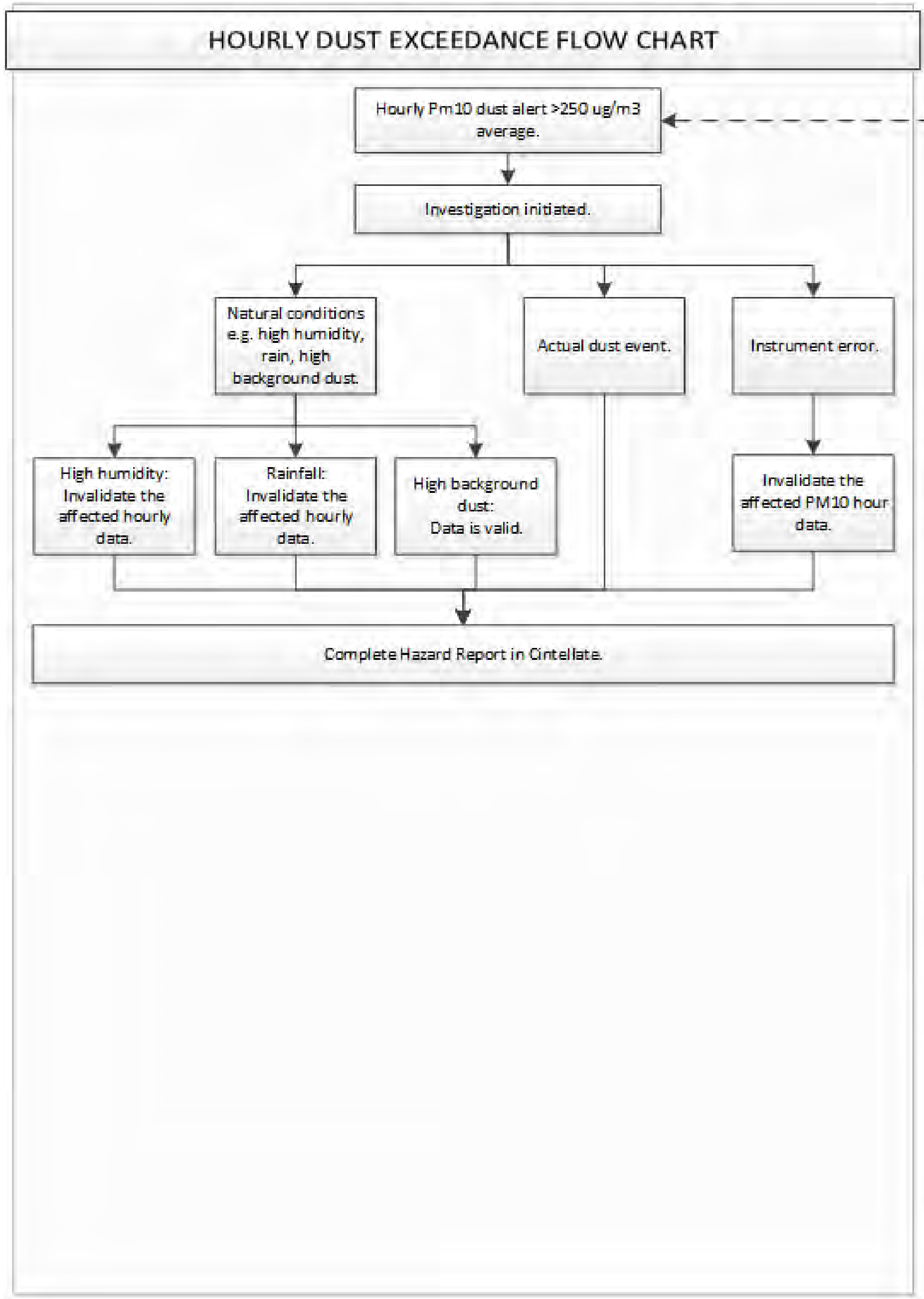
( ) Yes (●) No

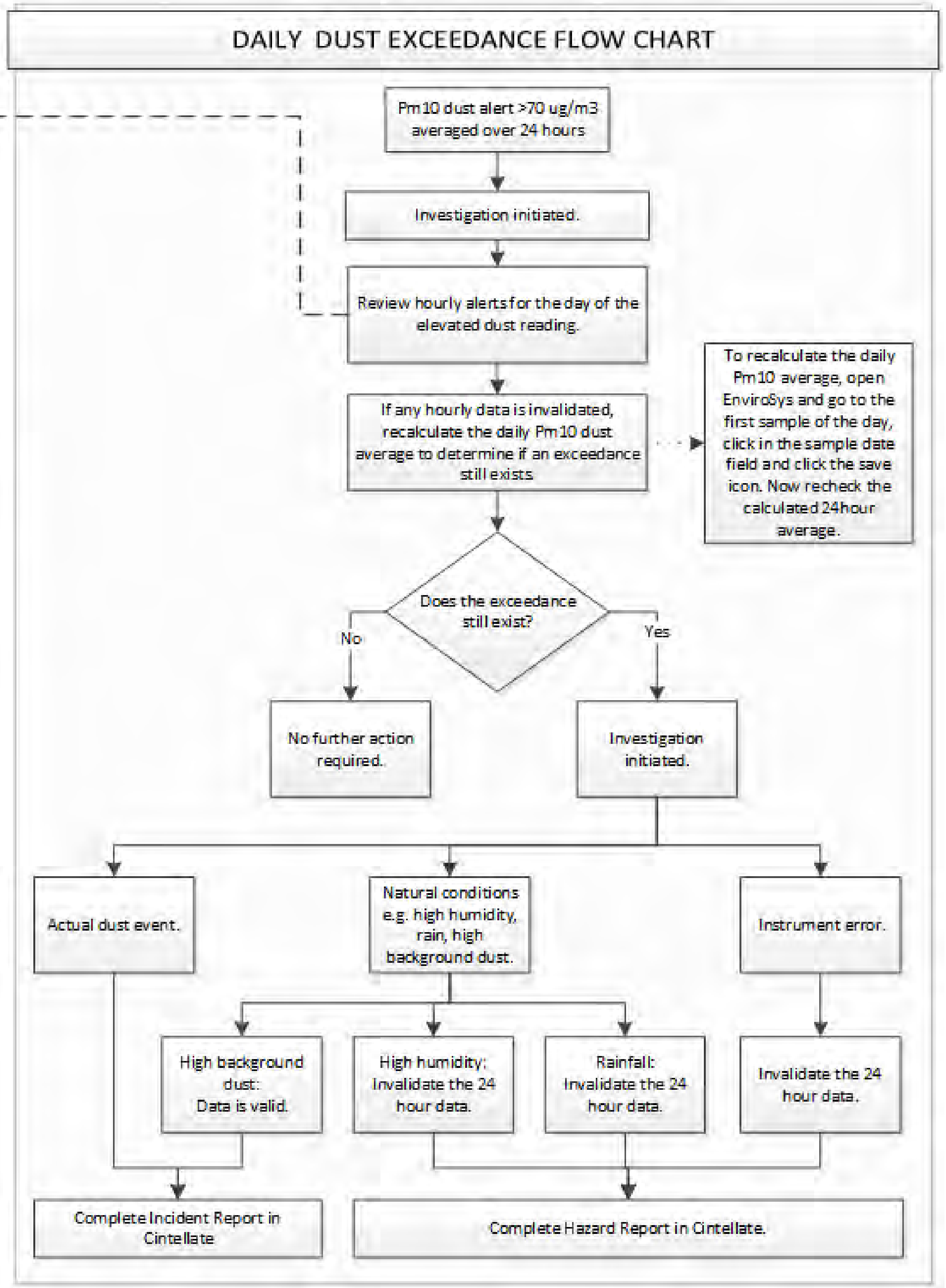
Justification for Decision

There is no potential for this incident to cause pollution or environmental harm.

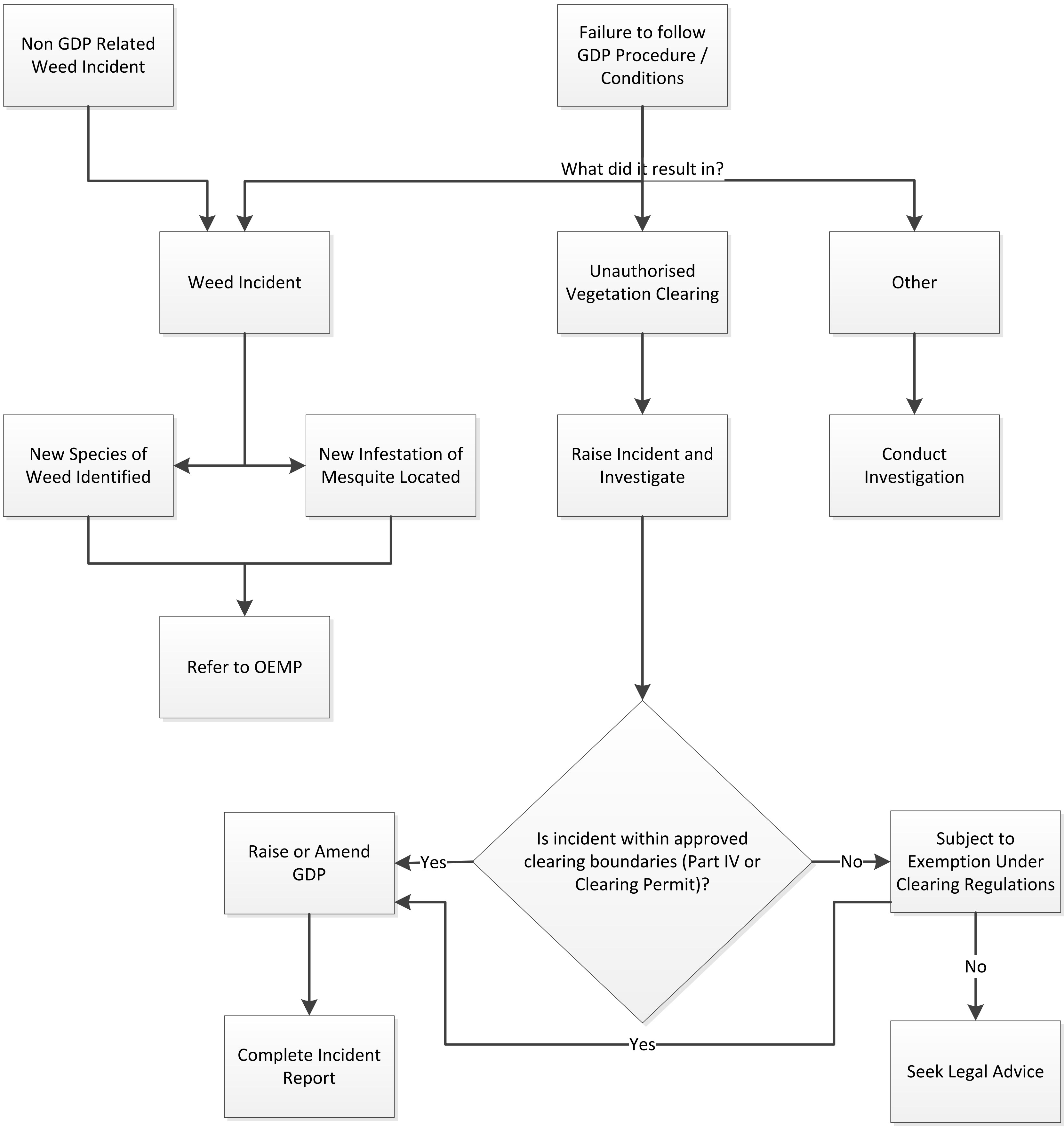

SPILL INCIDENT
Is it a marine spill greater than tier 1?
Yes
No
CPPC Notify DoT
Refer to the Environmental Protection Act
Has or could it cause pollution or harm (EP Act)?
No
Is it listed as a tenement condition?
No
Yes
Yes
DWER s.72 notification
Refer to tenement conditions for specific Mining Act reporting requirements.
Yes
Has or could it cause pollution or harm (EP Act)?
No
S.72 notifications fulfil the DWER licence requirements to report discharges to the environment.
Refer to tenement conditions for specific Mining Act reporting requirements.
DWER Annual Environmental Report
Refer to Licence to Operate for specific reporting requirements.
Yes
Is it a DWER licence condition breach?
No
No external report to DWER required

Appendix F - Dust Incident Flowchart

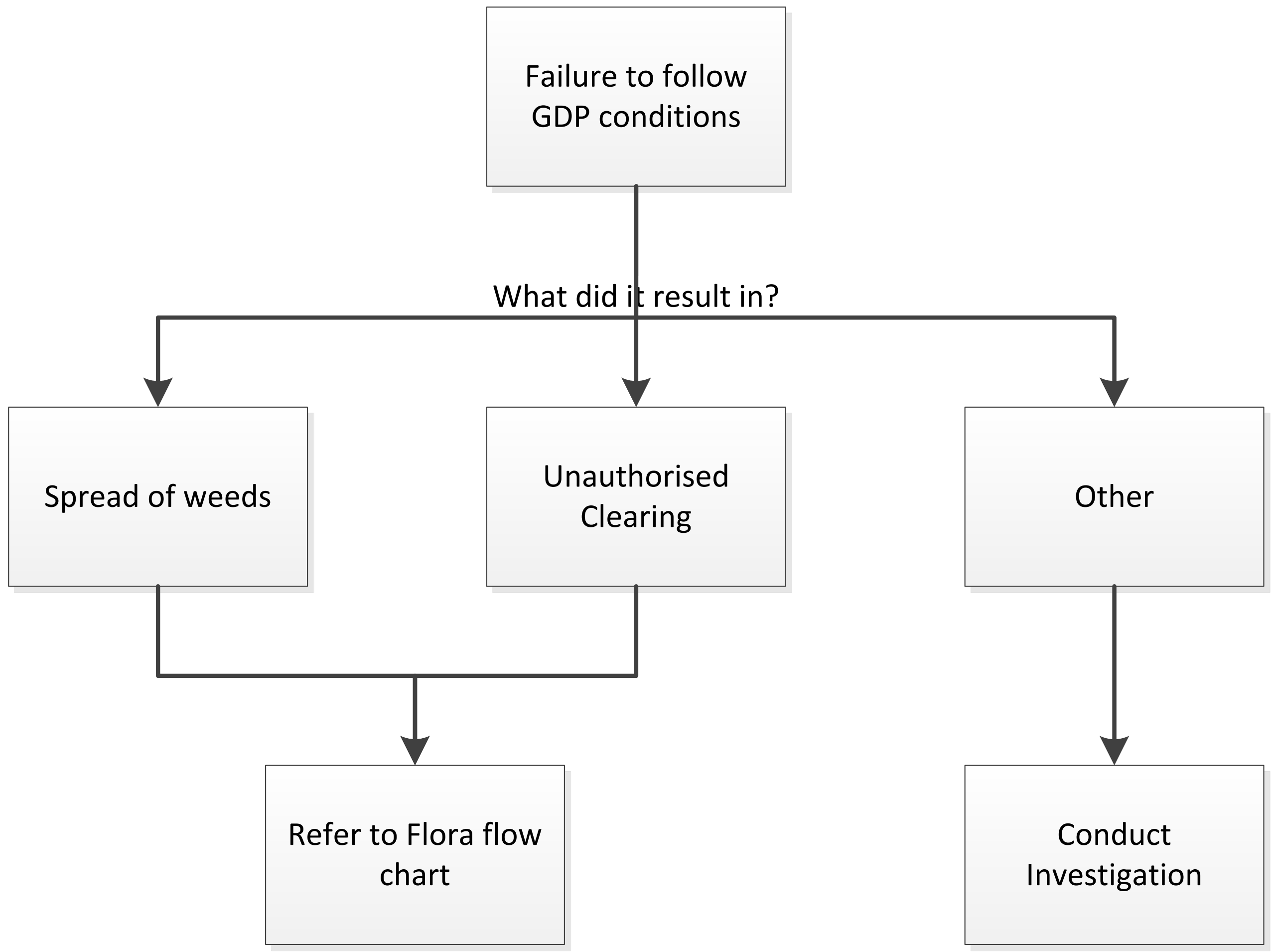




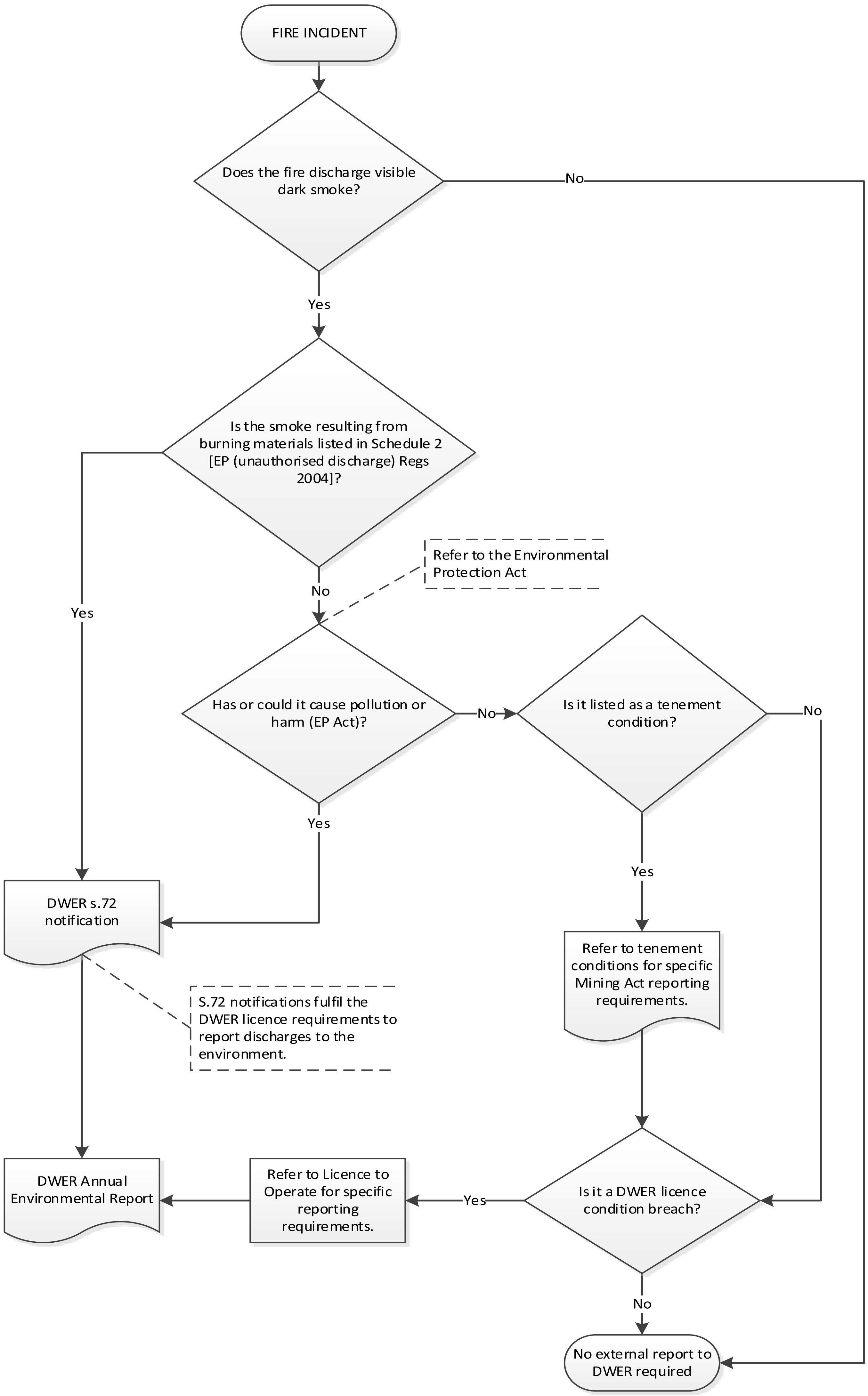
Appendix G - Fauna Incident Flowchart


Non GDP Related Weed Incident
Failure to follow GDP Procedure / Conditions
What did it result in?
Weed Incident
Unauthorised Vegetation Clearing
Other
New Species of Weed Identified
New Infestation of Mesquite Located
Raise Incident and Investigate
Conduct Investigation
Refer to OEMP
Is incident within approved clearing boundaries (Part IV or Clearing Permit)?
Yes
No
Raise or Amend GDP
Subject to Exemption Under Clearing Regulations
No
Yes
Complete Incident Report
Seek Legal Advice

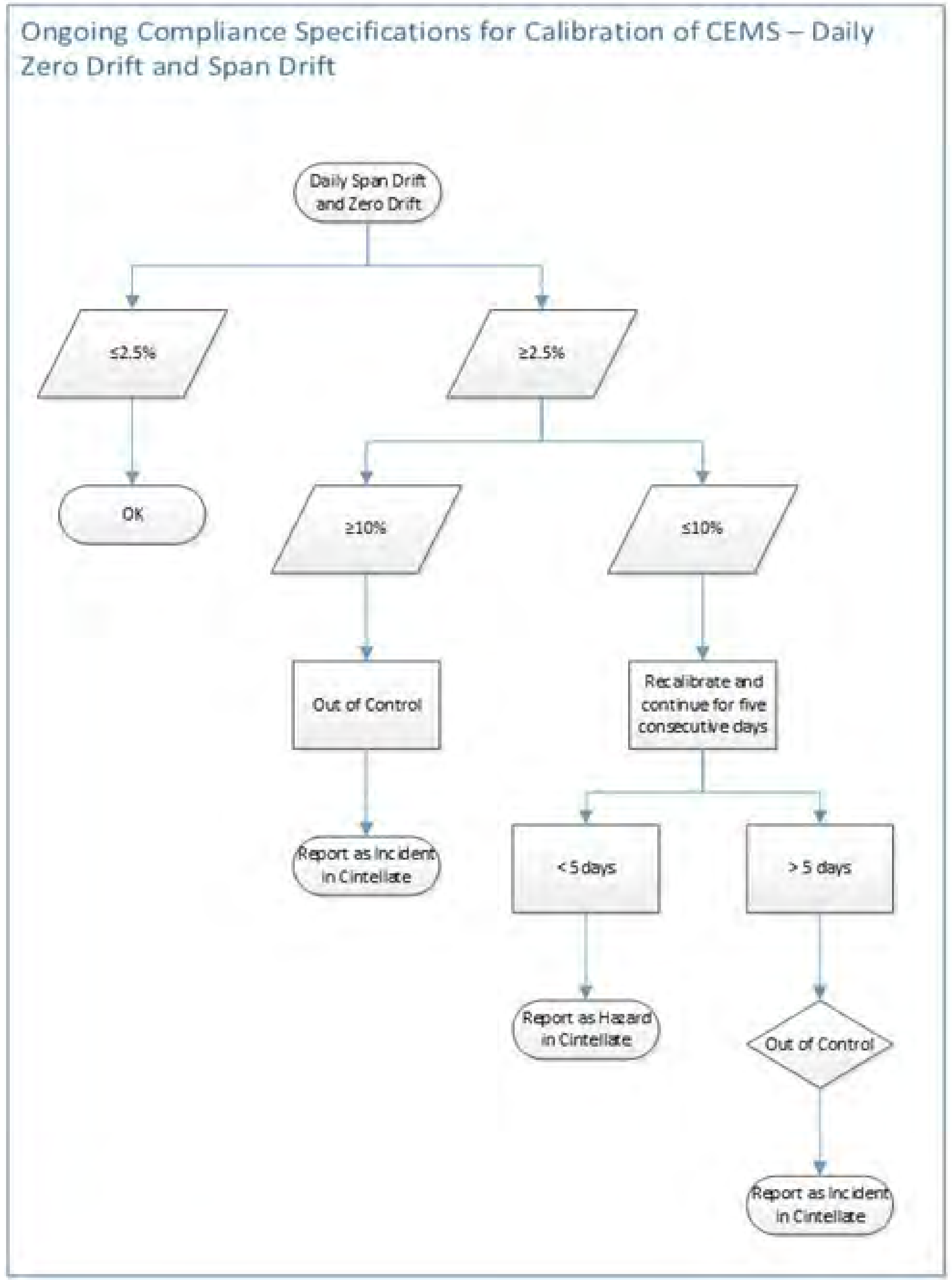
Appendix I - GDP Incident Flowchart

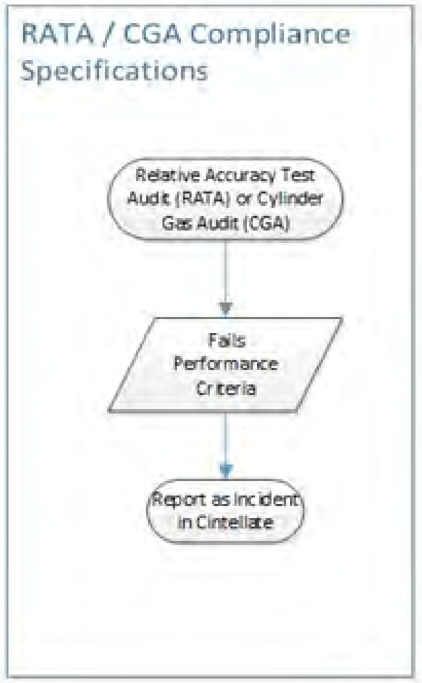


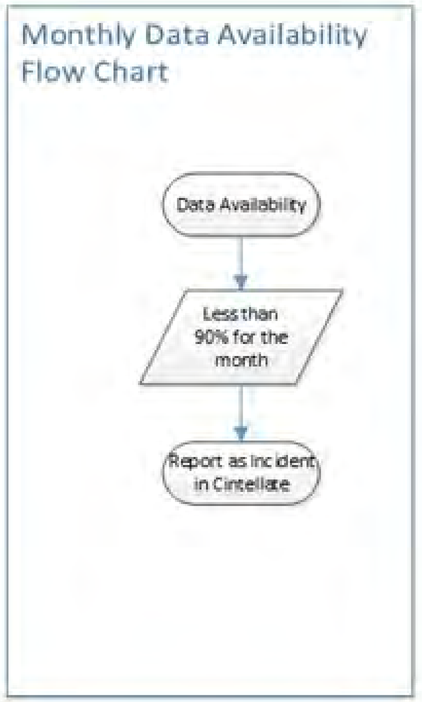
Appendix J - Fire Incident Flowchart



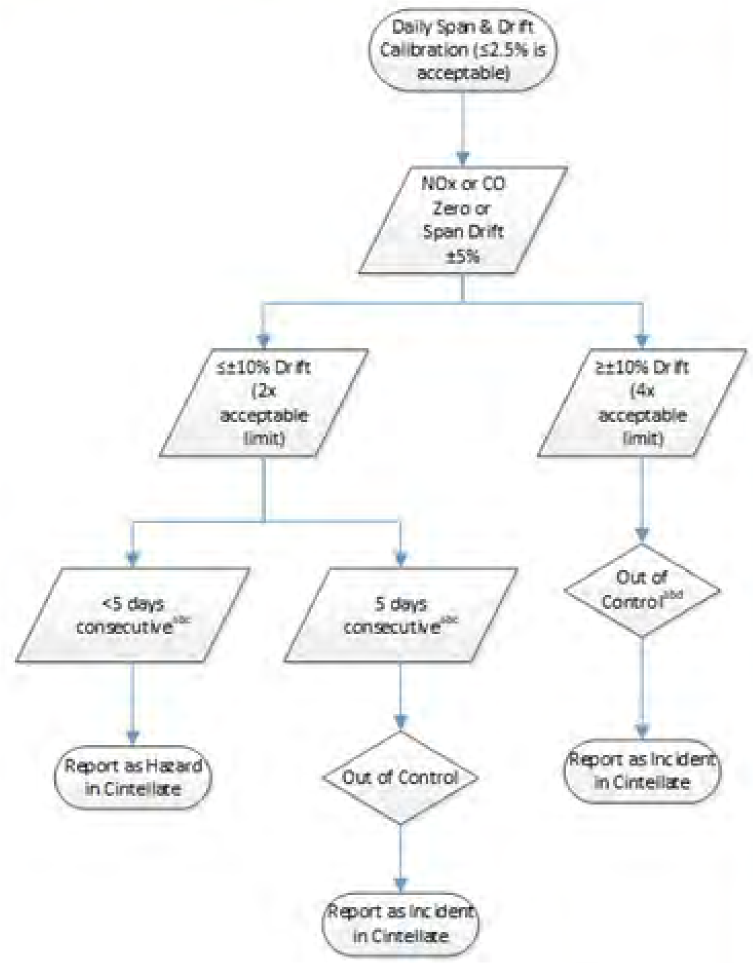
Continuous Emissions Monitoring Systems (CEMS) Ongoing Compliance Requirements







Criteria for Out-of-Control Periods



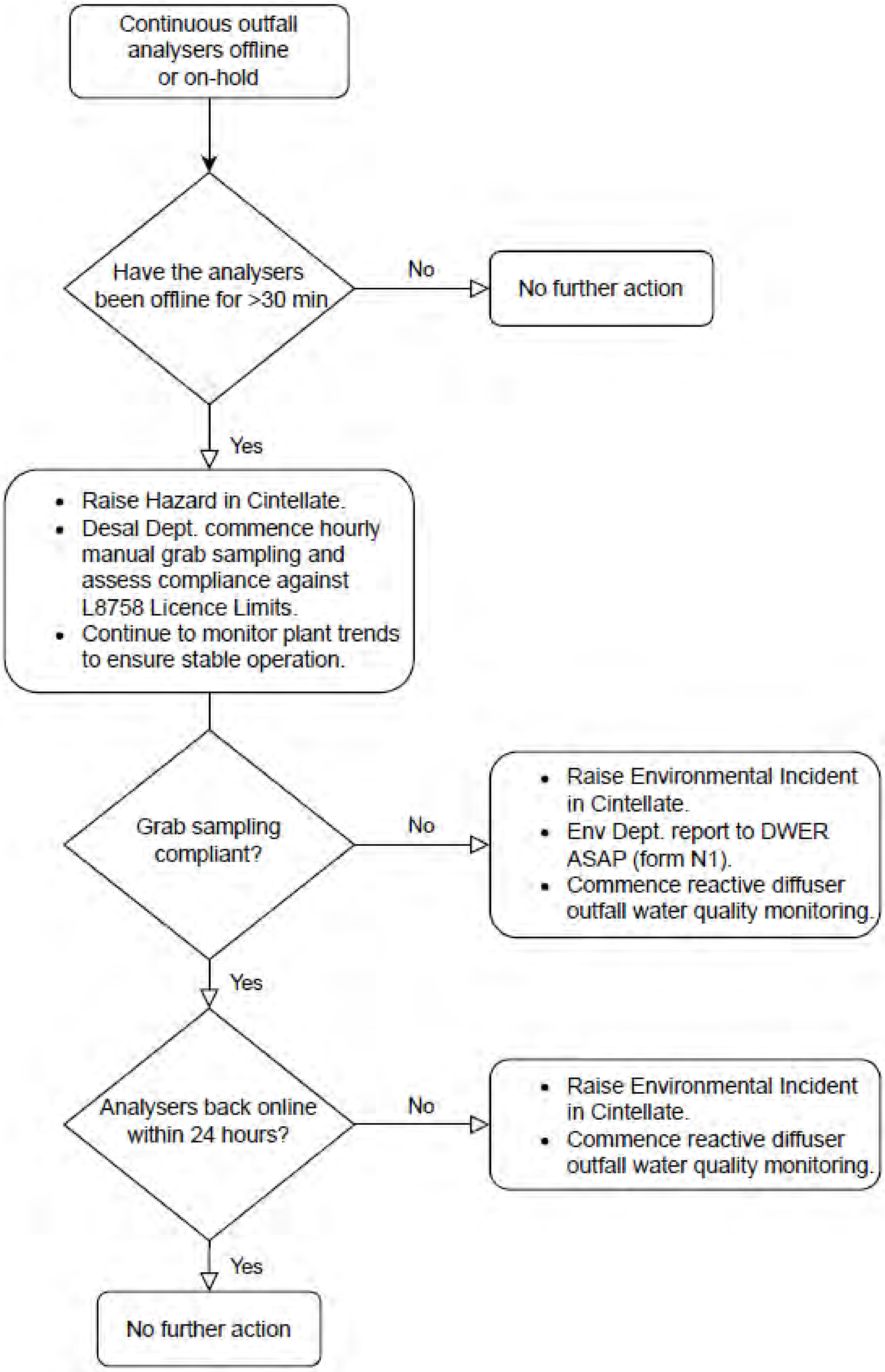
[a] If the CEMS is out-of-control, assess and identify the cause of the excessive drift and correct accordingly. Once the appropriate corrective action has been implemented, repeat the calibration drift test in order to demonstrate the CEMS is back within acceptable limits.

[b] Corrective action must be taken, at a minimum, whenever the daily zero calibration drift or daily span calibration drift exceeds two times the acceptable limits.

[c] If either the zero or span calibration drift result exceeds twice the above stated acceptable calibration drift (but less than four times the acceptable calibration drift) for five consecutive daily periods, the CEMS is out-of-control beginning on the fifth day of error.

[d] If either the zero or span calibration drift result exceeds four times the applicable calibration drift, the CEMS is immediately considered out-of-control, and is deemed out-of-control back to the previous calibration drift found to be within tolerance unless a decisive point error occurrence can be defined.

Appendix L – Desalination Plant Outfall Monitoring Incident Flowchart



Appendix M – Environmental Consequence Description Table

Severity Category	Licence to Operate	EP Act	Biological / Physical / Ecosystem Impact	Hydrocarbon & Chemical Spills - land	Hydrocarbon & Chemical Spills - Marine	Prosecution
Critical *(Level 5)*	• Breach of environmental regulatory conditions results in stop order with > 1 month lost productivity and requires notification to regulator within a prescribed time frame.	• Serious Environmental Harm that is irreversible, of high impact or on wide scale, is significant or in an area of high conservation value or special significance (e.g. beaches / mangroves), results in actual or potential loss, property damage or damage. • Section 72 Notification for discharge of waste which is likely to cause pollution, material environmental harm or serious environmental harm.	• Extinction of a species.	• Widespread contamination that cannot be remediated.	• Tier 3 marine spills are global in need for necessary, available, large-scale resource response. They usually require resources from stockpiles of national or international cooperatives. In most cases, these co-ops will be subject to governmental control. The third tier will respond with industry-controlled, cooperatively-held equipment, stockpiles, and personnel.	• Serious prosecution by Environmental Regulator results in stop order > 1 month or > A$100m fine.
Major *(Level 4)*	• Works approval or prescribed premise altered without approval. • Breach of environmental regulatory conditions results in stop order with < 1 month lost productivity. • Serious breach of licence condition(s) requires notification to regulator within a prescribed time frame.	• Material Environmental Harm that is neither trivial nor negligible (e.g. hypersaline spill resulting in vegetation death) or results in actual or potential loss, property damage or damage. • Section 72 Notification for discharge of waste which is likely to cause pollution, material environmental harm or serious environmental harm.	• Major impact on significant species.	• Widespread contamination that can be remediated in long term.	• Tier 2 Marine Spills accidents which may require national or regional response teams with specialized knowledge to intervene. These events extend outside the operational area of the facility.	• Investigation and fines from Environmental Regulator results in stop order with < 1 month or A$50m to A$100, fine.
Moderate *(Level 3)*	• Breach of environmental regulatory conditions results in stop order with < 1 week lost productivity. • Licence condition requires notification to regulator within a prescribed time frame. • Contravening a licence or works approval condition resulting in potential for Environmental Harm.	• Environmental Harm involving removal or destruction of, or damage to native vegetation, habitat of fauna, or alteration of the environment (e.g. clearing outside of environmental approvals). • Section 72 Notification for discharge of waste which is likely to cause pollution, material environmental harm or serious environmental harm.	• Moderate Impact on Listed Threatened Species or Endangered Communities (EPBC Act).	• Local contamination that cannot be remediated long-term.	• Tier 1 Marine Spill, uses locally held resources and are less severe spills allowing the containment and addressing by a company's internal spill management team.	• Investigation by Environmental Regulator results in stop order or fine $A10m to A$50m.
Minor *(Level 2)*	• Breach of environmental regulatory conditions results in stop order with < 1 day lost productivity. • Single technical breach of licence conditions or legislation. Reported to regulator in annual report.	• No Environmental Harm, as defined by EP Act.	• Minor potential or actual damage to physical environment. • Single impact to environmentally sensitive species e.g. Quoll death.	• Local contamination that can be immediately remediated.	• Marine Spill, does not dissipate or is not easily cleaned up.	• Investigation by Environmental Regulator results in stop order with < 1 day lost productivity or A$1m to A$10m fine.
Low *(Level 1)*	• Breach of environmental regulatory conditions, no lost productivity.	• No Environmental Harm, as defined by EP Act.	• Issue easily rectified with no impact on environment.	• Insignificant effect, easily cleaned up. • ≥ 20L uncontained spill of chemical of hydrocarbon.	• Insignificant Marine Spill, dissipates easily or easily cleaned up.	• Investigation by Environmental Regulator resulting <A$1m fine.

18 Appendix D. Cape Preston Sediment Dispersion Modelling Report (RPS 2024)

CAPE PRESTON PORT - DREDGED SEDIMENT DISPERSION MODELLING

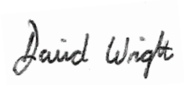
Maintenance Dredging Program

PER361591
Rev 2
20 August 2024

Document status

Version	Purpose of document	Authored by	Reviewed by	Approved by	Review date
Rev A	Internal review	Nuala Page	David Wright	David Wright	03/04/2023
Rev 0	Client review	Nuala Page	David Wright	David Wright	12/04/2023
Rev 1	Response to client comments	Nuala Page	Harley Barron	David Wright	17/05/2023
Rev 2	Resubmitted for client review following incorporation of additional scenarios and analysis	Nuala Page	David Wright	David Wright	20/08/2024

Approval for issue

David Wright		20 August 2024

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Contents

Tables

Figures

1 INTRODUCTION

1.1 Background

RPS was commissioned by Cape Preston Port Company (CPPC) to undertake sediment dispersion modelling of dredging and disposal operations associated with maintenance dredging at Cape Preston Port, in support of the environmental approvals process.

Cape Preston Port is located on the North West Shelf in the Pilbara region of Western Australia. The proposed maintenance dredging will involve dredging at the existing berth, with a small area of dredging required along the approach channel and turning area. It is proposed that dredge material will be disposed of to one of two potential offshore disposal grounds to the northeast of the port breakwaters. The major components of the proposed maintenance dredging program are shown in Figure 1.1.

RPS has conducted sediment dispersion modelling to quantify the potential magnitude, intensity and spatial distribution of total suspended sediment concentrations (TSSC) and sedimentation that would be expected for the dredging and disposal operations associated with the maintenance dredging. The predicted outcomes are to be used to inform the assessment of the potential for influence or impact upon water quality and benthic habitats in the region.

This technical report, provided to O2Marine in its capacity as environmental consultant to CPPC, contains a summary of the sediment fate model inputs, methodologies and assumptions, and the model outcomes following analysis against specified threshold criteria.

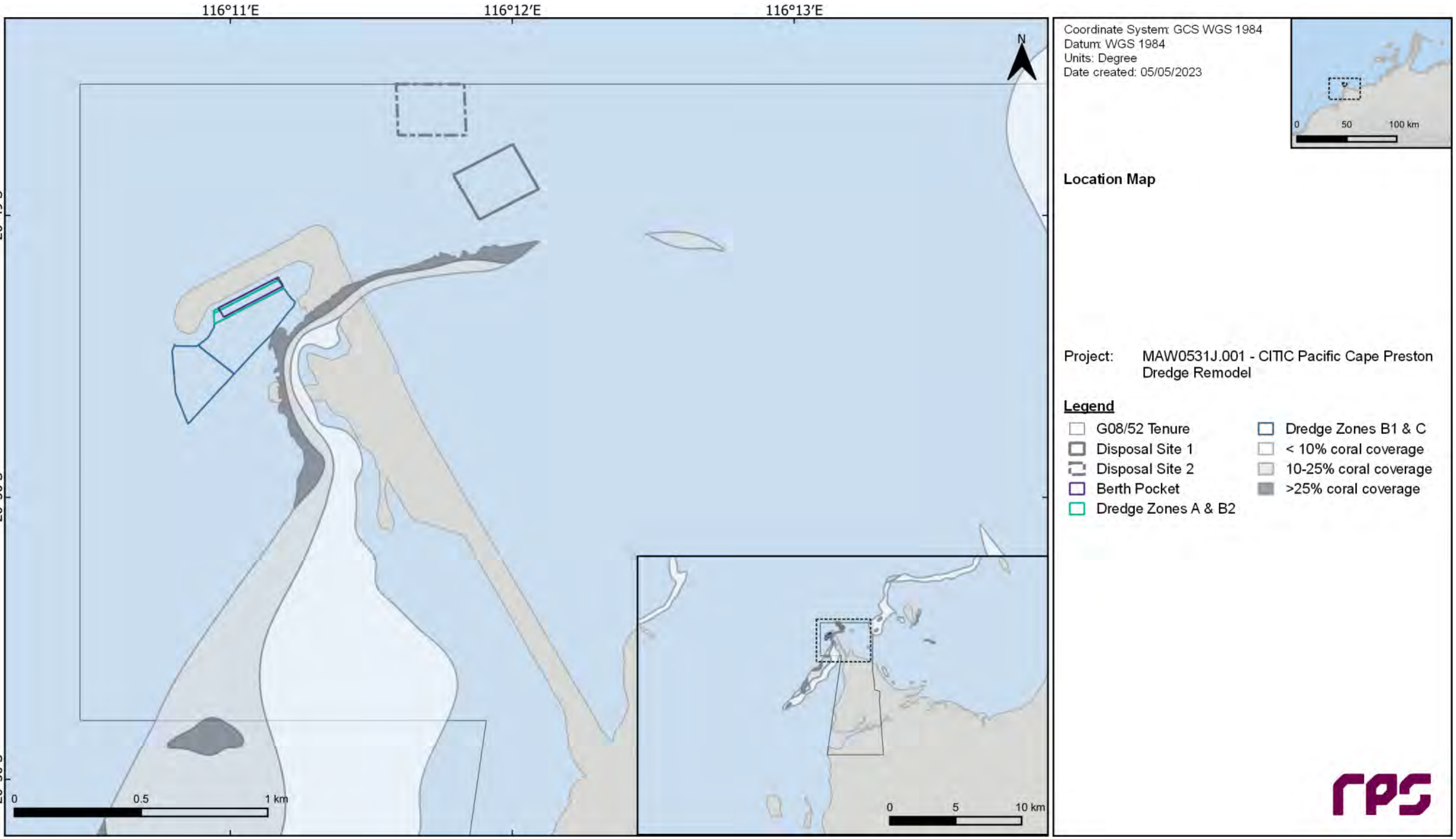

Figure 1.1 **Location of Cape Preston Port, with outlines of the G08/52 tenure (MS1066 development) boundary and the major components of the proposed maintenance dredging program overlain: berth pocket (dredge zones A and B2); approach channel and turning area (dredge zones B1 and C); and two potential offshore disposal grounds.**

1.2 Scope of Work

RPS was commissioned to conduct sediment dispersion modelling for the following activities:

- Dredging of sediment and fragmented rock within the berth pocket and inner sections of the approach channel and turning area using a backhoe dredge (BHD), and disposal of dredged material to one of two potential offshore disposal grounds.

The scope of work required to complete the sediment dispersion modelling included:

1. Hydrodynamic Modelling.
    a. An initial assessment of the existing D-FLOW hydrodynamic model framework in the Cape Preston region determined that refinements were necessary to suit the requirements of this scope of work. Reconfiguration of the model was conducted, followed by re-validation of the model predictions against available measurements of water levels and currents for the same validation period as utilised previously.
    b. Two years (2016-2017) of hydrodynamic simulation data was produced for use as input to the sediment dispersion model.
2. Wave Modelling.
    a. A D-WAVE wave model framework was developed for the nearshore areas around Cape Preston Port to suit the requirements of this scope of work. The model predictions were validated against available predictions from an operational RPS model for the same validation period as the hydrodynamic model.
    b. Two years (2016-2017) of wave simulation data was produced for use as input to the sediment dispersion model.
3. Sediment Dispersion Modelling.
    a. Inputs for the maintenance dredging program were prepared for the DREDGEMAP model, accounting for all potential concurrent sources of sediment characterised by location, intensity, particle size distribution, vertical distribution in the water column, and levels of cohesivity.
    b. Five dredging and disposal scenarios were simulated:
        (i) Dredging commencing in winter (June start) for a 2-week dredging program with disposal to offshore site 1.
        (ii) Dredging commencing in winter (June start) for a 2-week dredging program with disposal to offshore site 2.
        (iii) Dredging commencing in winter (June start) for a 6-week dredging program with disposal to offshore site 2.
        (iv) Dredging commencing in summer (January start) for a 2-week dredging program with disposal to offshore site 1.
        (v) Dredging commencing in summer (January start) for a 6-week dredging program with disposal to offshore site 2.
    c. Simulation outputs from each separate dredging and disposal activity were post-processed, combined and analysed to determine outcomes for each scenario, including percentiles of TSSC, potential zones of influence and impact based on specified threshold criteria, and percentiles and snapshots of sedimentation.
    d. Key model outcomes were provided as spatial datasets in GIS shapefile format.
4. Reporting. A technical report detailing the sediment fate model inputs, methodologies, assumptions and model outcomes following analysis of specified threshold criteria was provided.

1.3 Definitions of Relevant Terms and Abbreviations

BHD:

Backhoe Dredge. A pontoon equipped with a hydraulic excavator. The pontoon is stabilised and secured by three spuds. The excavator uses a large arm fitted with a bucket to excavate material from the seabed and discharge it into (typically) an SHB moored alongside. BHDs are mainly used for dredging or breaking up the sedimentary rock below a layer of sediments, or for dredging in areas inaccessible to larger self-propelled vessels.

Dewatering:

Draining of excess water from an SHB using its drainage system.

Resuspension:

Removal of deposited material from the seabed to the water column as a result of natural or artificial agitation.

Sedimentation rate:

Rate of sediment accumulation on the seabed following deposition of TSSC from the water column.

SHB:

Split Hopper Barge. Vessel with a large open hold used to load and transport dredged material. The unloading is performed by splitting the two halves of the hull to release the material towards the seabed.

TSSC:

Total Suspended Solids Concentration (or Total Suspended Sediment Concentration). The concentration of sediment material in the water column following natural or artificial resuspension from the seabed.

2 HYDRODYNAMIC AND WAVE MODELLING

2.1 Overview

Modelling of the potential sediment dispersion from the dredging and disposal activities associated with the proposed maintenance dredging program required temporal and spatial representation of the hydrodynamic and wave conditions within the project area. A hydrodynamic model framework for the Cape Preston area has previously been constructed, calibrated and validated by RPS for recent studies associated with CPPC's port infrastructure (RPS, 2018, 2019). This model framework has been refined for the sediment dispersion scope of work. The model framework and its refinement are described in the following sections.

The hydrodynamic and wave modelling for the project was conducted using the Delft3D suite of software. The Delft3D suite is a fully integrated computer software package composed of several modules (e.g. flow, waves, sediment, water quality, and ecology) grouped around a common interface. This software suite has been developed to carry out studies with a multi-disciplinary approach and multi-dimensional calculations (e.g. 2-D and 3-D) for a range of systems, such as oceanic, coastal, estuarine and river environments. It can simulate the interaction of flows, waves, sediment transport, morphological developments, water quality and aquatic ecology. Specific modules of the Delft3D suite are referenced in this report, following the convention of the software developers, with the suffix D- (e.g. D-FLOW for the Delft3D Hydrodynamics module and D-WAVE for the Delft3D Spectral Wave module).

The Delft3D suite has been developed by Deltares, an independent institute for applied research on water with over 30 years of experience in modelling aquatic systems (http://www.deltares.nl/en). The Delft3D suite of models adheres to the International Association for Hydro-Environment Engineering and Research guidelines for documenting the validity of computational modelling software, closely replicating an array of analytical, laboratory, schematic and real-world data.

The configuration of the current and wave models is in line with recommendations of best practice for sediment dispersion modelling in Western Australia as outlined by WAMSI Dredging Science Node guidance (Sun *et al.*, 2016). Inclusion of mesoscale ocean currents is recommended, as these currents have a significant influence on the net drift of suspended material over the time scales of dredging operations (days to weeks) and are therefore important to predictions of sediment transport. The use of three-dimensional current modelling with a series of interconnected grids of progressively finer resolution is also recommended, as are coupling of the current and wave models and validation of current predictions against measured data.

2.2 Hydrodynamic Model (D-FLOW)

2.2.1 Model Description

The D-FLOW model is ideally suited to represent the hydrodynamics of complex coastal waters, including regions where the tidal range creates large intertidal zones and where buoyancy processes are important. RPS has applied the model for numerous studies in the region.

D-FLOW is a multi-dimensional (3-D) hydrodynamic (and transport) simulation program which calculates non-steady flow and transport phenomena that result from tidal, meteorological and baroclinic forcing on a rectilinear or a curvilinear, boundary-fitted grid. In three-dimensional simulations, the vertical grid can be defined following the sigma-coordinate approach, where the local water depth is divided into a series of layers with thickness at a set proportion of the depth.

D-FLOW allows for the establishment of a series of interconnected (two-way, dynamically nested) curvilinear grids of varying resolution; a technique referred to as "domain decomposition". This allows for the generation of a series of grids with progressively increasing spatial resolution, down to an appropriate scale for accurate resolution of the hydrodynamics associated with features such as dredged channels. The main advantage of domain decomposition over traditional one-way, or static, nesting systems is that the model domains interact seamlessly, allowing transport and feedback between the regions of different scales. The ability to dynamically couple multiple model domains offers a flexible framework for hydrodynamic model development. This modelling method was applied in this study.

Inputs to the model, as discussed in the following sections, included:

- Bathymetry of the study area, including shipping channels, islands, and adjacent features. The wetting and drying of the intertidal zones were simulated in applicable areas.
- Boundary elevation forcing data.
- Spatially varying surface wind and pressure data.

2.2.2 Bathymetry and Domain Definition

The hydrodynamic model was established over the domain shown in Figure 2.1. Accurate bathymetry is a significant factor in development of a model framework required to resolve highly variable wave and current conditions. The bathymetry was developed using data provided by CPPC and supplemented with data from Geoscience Australia and the C-MAP electronic chart database where relevant and required.

The composite bathymetric data was interpolated onto the D-FLOW Cartesian grid. The resultant bathymetry is shown in Figure 2.1 and Figure 2.2. The extent and shape of the model coastline will change as water levels rise and fall with tidal movements due to the inclusion of wetting and drying within the model system.

The vertical grid of the model comprised five layers of varying thickness, depending on location, throughout the domain. Five layers was found to be enough to resolve the circulation and provide suitable bed level currents, without overly compromising model performance. As the model was set up as a proportional sigma-grid in the vertical dimension, these layers therefore represented a terrain-following arrangement with a layer thickness of 20% of the total local water depth.

To offset the computational effort required for a large, multi-layered model domain, and to achieve adequate horizontal and temporal resolution, a multiple-grid (domain-decomposition) strategy was applied using four sub-domains of varying horizontal grid cell size (Figure 2.1 and Figure 2.2). Horizontal resolutions within each sub-domain were 40 m for the Cape Preston Port area (sub-grid 3), 200 m for the broader Cape Preston area (sub-grid 2), 500 m for the intermediate region (sub-grid 1) and 2 km for the outer domain (sub-grid 0).

Each sub-domain is an individual hydrodynamic model simulated in parallel with the others, with dynamic coupling at the shared boundaries between sub-domains. The outermost sub-domain captured large-scale oceanographic phenomena which progressively fed into the finer-resolution domains representing the area of interest. The resolution of the innermost sub-domain was specified after assessment of the requirement to adequately resolve the variation in current fields, and in turn the sediment dynamics.

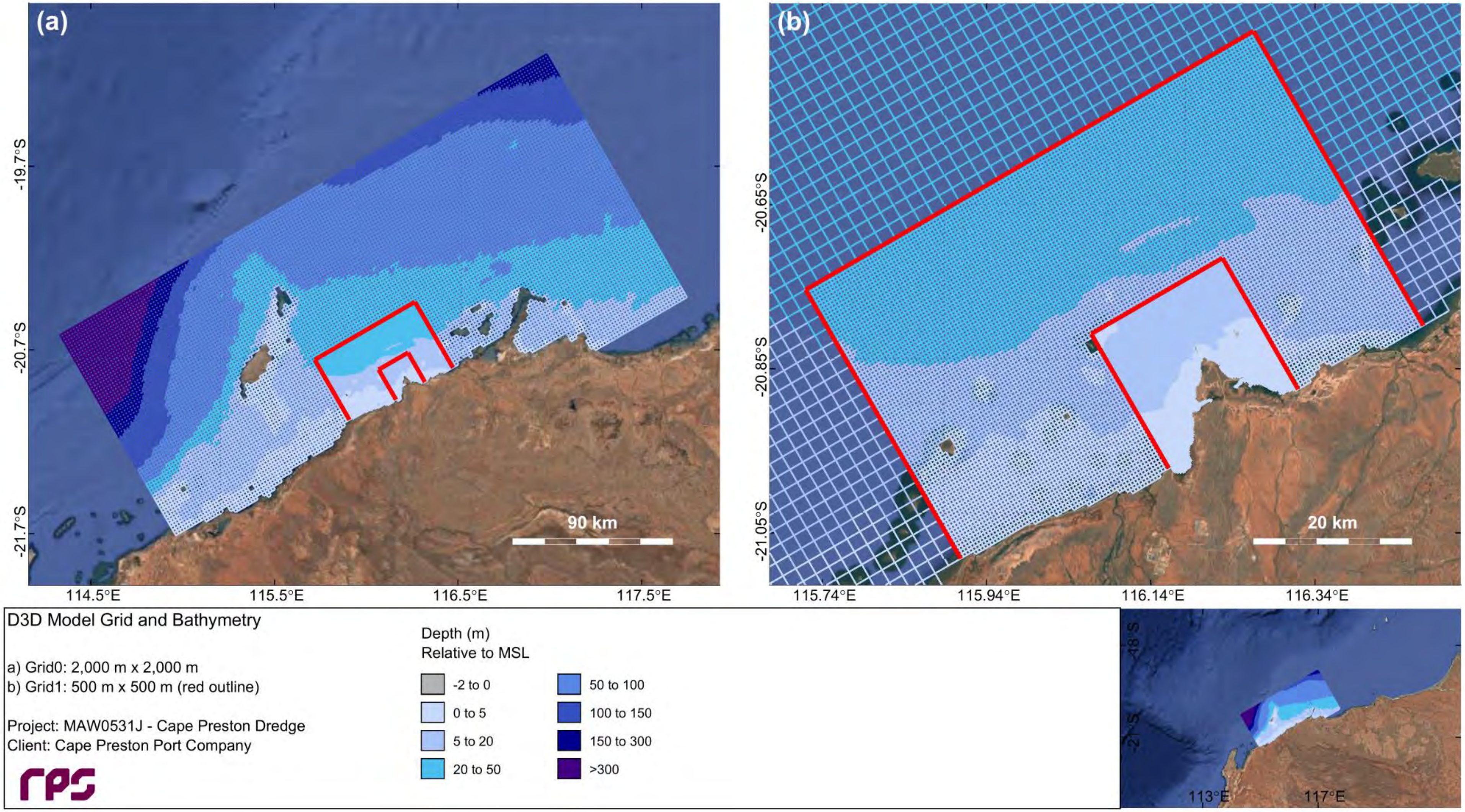

Figure 2.1 **Model grid setup showing the domain-decomposition scheme applied, highlighting the two outermost grids.**

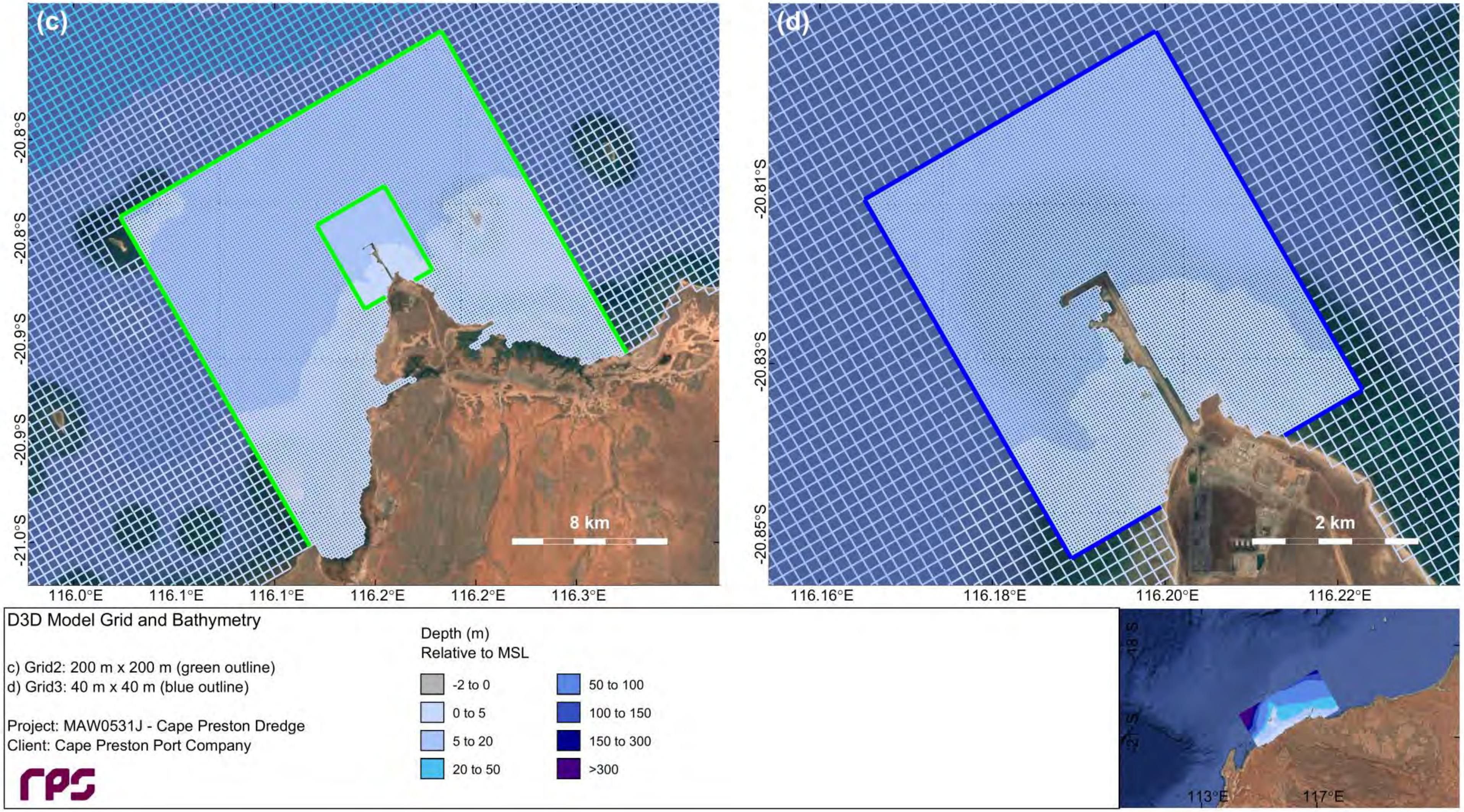

Figure 2.2 **Model grid setup showing the domain-decomposition scheme applied, highlighting the two innermost grids.**

2.2.3 Boundary and Initial Conditions

2.2.3.1 Overview

As the hydrodynamics in the study area are controlled primarily by tidal flows and wind forcing, these processes were explicitly included in the developed model.

The model was forced on the open boundaries of the outer sub-domain with time series of water elevation obtained for the chosen simulation period. Spatially varying wind speed and wind direction data was used to force the model across the entire domain.

2.2.3.2 Water Elevation

Water elevations at hourly intervals were obtained from the TPXO8.0 database, which is a recent iteration of a global model of ocean tides derived from measurements of sea-surface topography by the TOPEX/Poseidon satellite-borne radar altimeters. Tides are provided as complex amplitudes of earth-relative sea-surface elevation for eight primary (M_2, S_2, N_2, K_2, K_1, O_1, P_1, Q_1), two long-period (M_f, M_m) and three non-linear (M_4, MS_4, MN_4) harmonic constituents at a spatial resolution of 0.25°.

The tidal sea level data was augmented with non-tidal sea level elevation data from the global Hybrid Coordinate Ocean Model (HYCOM; Bleck, 2002; Chassignet *et al.*, 2003; Halliwell, 2004), created by the USA's National Ocean Partnership Program (NOPP) as part of the Global Ocean Data Assimilation Experiment (GODAE). The HYCOM model is a three-dimensional model that assimilates observations of sea surface temperature, sea surface salinity and surface height, obtained by satellite instrumentation, along with atmospheric forcing conditions from atmospheric models to predict drift currents generated by such forces as wind shear, density, sea height variations and the rotation of the Earth.

The HYCOM model is configured to combine the three vertical coordinate types currently in use in ocean models: depth (z-levels), density (isopycnal layers), and terrain-following (σ-levels). HYCOM uses isopycnal layers in the open, stratified ocean, but uses the layered continuity equation to make a dynamically smooth transition to a terrain-following coordinate in shallow coastal regions, and to z-level coordinates in the mixed layer and/or unstratified seas. Thus, this hybrid coordinate system allows for the extension of the geographic range of applicability to shallow coastal seas and unstratified parts of the world ocean. It maintains the significant advantages of an isopycnal model in stratified regions while allowing more vertical resolution near the surface and in shallow coastal areas, hence providing a better representation of the upper ocean physics than non-hybrid models. The model has global coverage with a horizontal resolution of $1/12^{th}$ of a degree (~7 km at mid-latitudes) and a temporal resolution of 24 hours.

2.2.3.3 Wind Forcing

Spatially variable wind data was sourced from a Cape Preston regional hindcast wind model, which was developed by RPS for a previous study of the port facilities commissioned by CPPC (RPS, 2017). The hindcast wind model has hourly output at spatial resolution of $1/20^{th}$ of a degree.

2.2.4 Model Validation

The D-FLOW model framework for Cape Preston has been extensively calibrated and validated for recent studies associated with CPPC's port infrastructure (RPS, 2018, 2019). For this study, the inner grids of the model framework were adapted to suit the scope of the sediment dispersion modelling. Measured current speed and direction data from CPPC's AWAC2 station (116.180° E, 20.827° S) for a spring/neap tide period during June 2016 was used to reconfirm the validity of the model framework following the modifications to the inner grids.

The comparison between measured and modelled currents is presented in Figure 2.3, and shows excellent agreement between the data sets. Both the phase and amplitude of the tidally dominated circulation patterns are well reproduced. The comparison confirms the suitability of the adapted model framework.

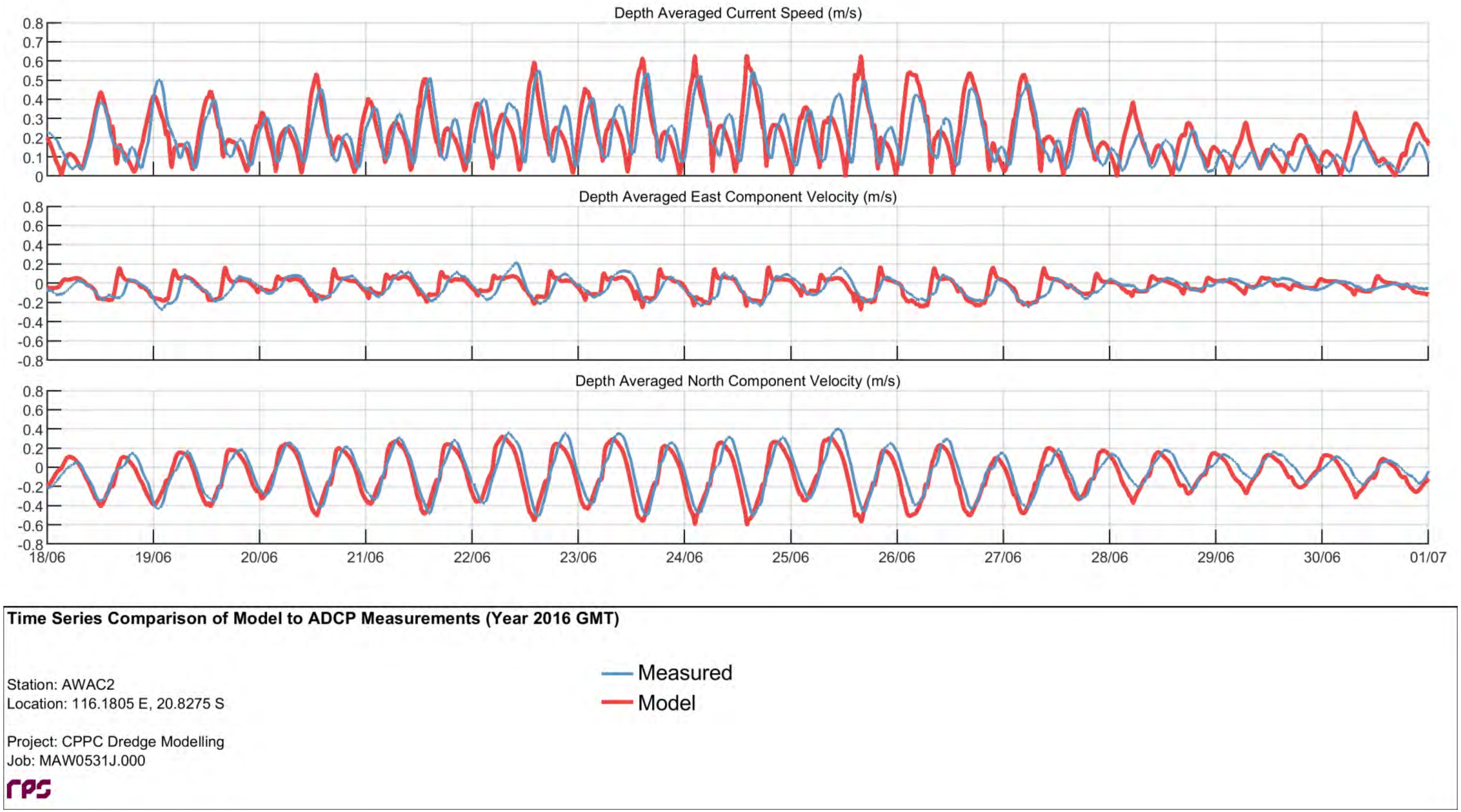

Figure 2.3 Validation of current predictions for the D-FLOW model framework applied in this study.

2.3 Wave Model (D-WAVE)

2.3.1 Model Description

Reliable forecasting for the fate of fine sediments in the study location, which is a wave-exposed coastal region, required the input of wave spectra information to calculate the shear-stress and orbital velocities imposed by waves which will affect the settlement and re-suspension of fine material that is initially suspended by dredging and related operations. D-WAVE is a variant of the well-known SWAN wave model that has been customised for compatibility with the Delft3D software suite.

The D-WAVE model is a spectral phase-averaging wave model originally developed by the Delft University of Technology. D-WAVE, a third-generation model based on the energy balance equation, is a numerical model for simulating realistic estimates of wave parameters in coastal areas for given wind, bottom and current conditions.

D-WAVE includes algorithms for the following wave propagation processes: propagation through geographic space; refraction and shoaling due to bottom and current variations; blocking and reflections by opposing currents; and transmission through or blockage by obstacles. The model also accounts for dissipation effects due to white-capping, bottom friction and wave breaking as well as non-linear wave-wave interactions. D-WAVE is fully spectral (in all directions and frequencies) and computes the evolution of wind waves in coastal regions with shallow water depths and ambient currents.

RPS has successfully applied D-WAVE in many studies in the region, including ambient condition modelling in Mermaid Sound and dredging fate projects in the wider Pilbara region.

2.3.2 Model Implementation

The D-WAVE model was developed to cover the same grid regions defined by the hydrodynamic model (Figure 2.1 and Figure 2.2). The bathymetry and wind data input to the wave model was the same as used for the hydrodynamic model. Time-varying water level information for each grid node in the wave model was provided by the D-FLOW hydrodynamic model.

The boundary data to represent swells imposed from a distance was sourced from a Cape Preston regional hindcast wave model, which was developed by RPS for a previous study of the port facilities commissioned by CPPC (RPS, 2017). The hindcast wave model is a refined implementation of the WAVEWATCH III 0.5° spectral wave model operated by the National Oceanic and Atmospheric Administration (NOAA) (NOAA, 2018). The model has hourly output at a spatial resolution of 1/10th of a degree near the outer boundary of the D-WAVE model framework (Figure 2.1).

Data from the Cape Preston regional hindcast wave model was also available at a finer resolution (1/50th of a degree) around Cape Preston. Although this data would also have been suitable for the purposes of sediment dispersion modelling, the D-WAVE framework was preferred because it allowed for explicit coupling with D-FLOW.

The D-WAVE model was run in a coupled mode with the hydrodynamic model for the years of 2016 and 2017.

2.3.3 Model Validation

The D-WAVE model results were independently validated by comparison to fine scale (1/50th of a degree) output from the Cape Preston regional hindcast wave model at a location near to Cape Preston (116.16° E, 20.78° S) for a spring/neap tide period during June 2016. The purpose of this comparison was to ensure transmission of wave energy from the outer boundary of the D-WAVE framework was consistent with the fine scale output from the Cape Preston regional hindcast wave model, which has been extensively validated.

The comparison is presented in Figure 2.4 and shows excellent agreement between the model predictions. The comparison confirms the suitability of the developed model framework.

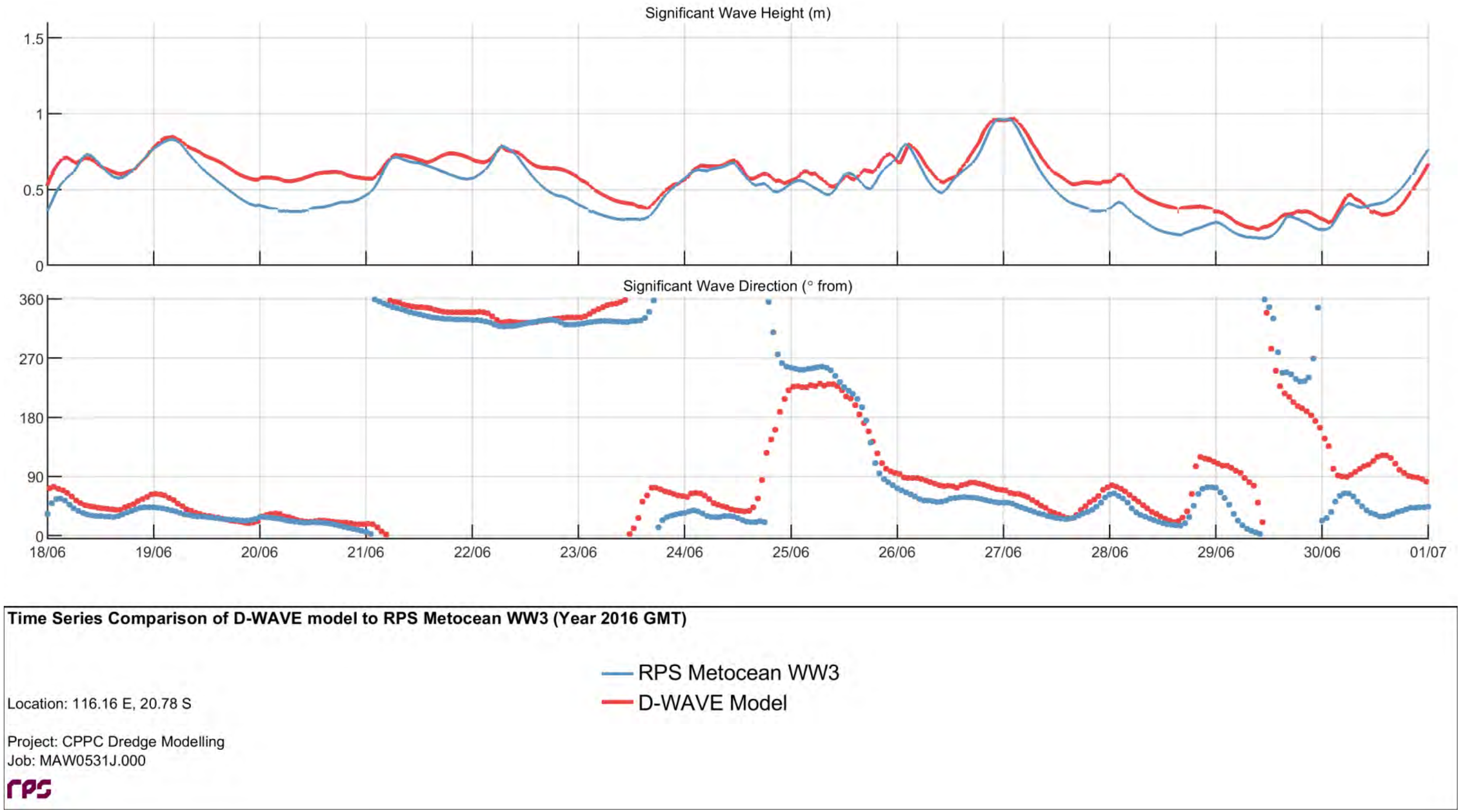

Figure 2.4 Validation of wave predictions for the D-WAVE model framework applied in this study.

3 SEDIMENT FATE MODELLING

3.1 General Approach

Estimates for the three-dimensional distribution of sediments suspended by dredging and disposal operations have been derived for the full duration of each proposed dredging program using numerical modelling. The approach of modelling dredging operations in full and in three dimensions is in line with best practice for sediment dispersion modelling in Western Australia as outlined by WAMSI Dredging Science Node guidance (Sun *et al.*, 2016).

This modelling relied upon specification of sediment discharges over time for each of the expected sources of sediment suspension, and predicted the evolution of the combined sediment plumes via current transport, dispersion, sinking and sedimentation. The model allowed for the subsequent resuspension of settling sediments due to the erosive effects of currents and waves. Thus, the fate of sediments was assessed beyond their initial settling.

Forcing was provided using predictions of three-dimensional current fields and two-dimensional wave fields for the study area, which are described in Section 2.

3.2 Model Description

Modelling of the dispersion of suspended sediment resulting from the dredging and disposal operations was undertaken using an advanced sediment fate model, Suspended Sediment FATE (SSFATE), operating within the RPS DREDGEMAP model framework. This model computes the advection, dispersion, differential sinking, settlement and resuspension of sediment particles. The model can be used to represent inputs from a wide range of suspension sources, producing predictions of sediment fate both over the short-term (minutes to days following a discharge source) and longer term (days to years following a discharge source).

SSFATE allows the three-dimensional predictions of TSSC and seabed sedimentation to be assessed against allowable exposure thresholds. Sedimentation thresholds often relate to burial depths or rates, while TSSC thresholds are usually more complicated, involving tiered exposure duration and intensities. As a result, assessing the project-generated sediment distributions against these thresholds in both three-dimensional space and time is a computationally intensive task. A variety of TSSC threshold formulations have recently been applied in Western Australian coastal waters and at present there are no general guidelines.

SSFATE is a computer model originally developed jointly by the US Army Corps of Engineers (USACE) Engineer Research and Development Center (ERDC) and RPS to estimate TSSC generated in the water column and deposition patterns generated due to dredging operations in a current-dominated environment, such as a river (Johnson *et al.*, 2000; Swanson *et al.*, 2000, 2004). RPS has significantly enhanced the capability of SSFATE to allow the prediction of sediment fate in marine and coastal environments where wave forcing becomes important for reworking the distribution of sediments (Swanson *et al.*, 2007).

SSFATE is formulated to simulate far-field effects (~25 m or larger scale) in which the mean transport and turbulence associated with ambient currents are dominant over the initial turbulence generated at the discharge point. A five-class particle-based model predicts the transport and dispersion of the suspended material. The classes include the 0-130 µm range of sediment grain sizes that typically result in plumes. Heavier sediments tend to settle very rapidly, remain more stable over time and are not relevant over the longer durations (>1 hour) and larger spatial scales (>25 m) of interest here. Table 3.1 shows the standard material classes used in SSFATE for suspended sediment.

Table 3.1 Material size classes used in SSFATE.

Material class description	Particle size range (µm)
Clay	<7
Fine silt	8-34
Coarse silt	35-74
Fine sand	75-130
Coarse sand	>130

Particle advection is calculated using three-dimensional current fields, obtained from hydrodynamic modelling, thus the model can account for vertical changes in the currents within the water column. For example, as particles sink towards the seabed they will tend to be moved at slower speeds due to the slowing of currents by friction at the seabed. Particle diffusion is assumed to follow a random walk process using a Lagrangian approach of calculating transport, which uses a grid-less space to remove limitations of grid resolution, artefacts due to grid boundaries, and also maintain a high degree of mass conservation.

Following release into the model space, the sediment cloud evolves according to the following processes:

- Advection due to the three-dimensional current field.
- Diffusion by a random walk model with the mass diffusion rate specified, ideally, from measurements at the site. As particles represent an ensemble of real particles, each particle in the model has an associated Gaussian distribution governed by particle age and the mass diffusion properties of the surrounding water.
- Settlement or sinking of the sediment due to buoyancy forces. Settlement rates are determined from the particle class sizes and include allowance for flocculation and other concentration-dependent behaviour, following the model of Teeter (2000).
- Potential deposition to the seabed determined using a model that couples the deposition across particle classes (Teeter, 2000). The likelihood and rate of deposition depends on the shear stress at the seabed. High shear inhibits deposition, and in some cases excludes it altogether with sediment remaining in suspension. The model allows for partial deposition of individual particles according to a practical deposition rate, thereby allowing the bulk sediment mass to be represented by fewer particles.
- Potential resuspension from the seabed, if previously deposited, at a rate governed by exceedance of a shear stress threshold at the seabed due to the combined action of waves and currents. Different thresholds are applied for resuspension depending upon the size of the particle and the duration of sedimentation, based on empirical studies that have demonstrated that newly settled sediments will have higher water content and are more easily resuspended by lower shear stresses (Swanson *et al.*, 2007). The resuspension flux calculation also accounts for armouring of fine particles within the interstitial spaces of larger particles. Thus, the model can indicate whether deposits will stabilise or continue to erode over time given the shear forces that occur at the site. Resuspended material is released back into the water column to be affected by the processes defined above.

SSFATE formulations and proof of performance have been documented in a series of USACE Dredging Operations and Environmental Research (DOER) Program technical notes (Johnson *et al.*, 2000; Swanson *et al.*, 2000), and published in the peer-reviewed literature (Andersen *et al.*, 2001; Swanson *et al.*, 2004; Swanson *et al.*, 2007). SSFATE has been applied and validated by RPS against observations of sedimentation and suspended sediments at multiple locations in Australia, notably Cockburn Sound for Fremantle Ports and Mermaid Sound for the Pluto LNG Foundation Project dredging program.

3.3 Model Limitations

There are inherent limitations to the accuracy of numerical models. The possible sources of uncertainty within the modelling conducted for the sediment fate assessment include:

- *The equations and algorithms applied in the model*. The formulations included in the model, as discussed in Section 3.2, were selected to achieve the best possible representation of the relevant processes and have been proven to be valid over a range of projects.

- *The accuracy of the physical (current and wave) inputs to the model*. Current and wave forcing inputs were provided from validated three-dimensional hydrodynamic and wave models created and customised for the study area. The accuracy of these models is suitable, as good correlations with field measurements and independent model predictions have been achieved, with the uncertainties minimised and quantifiable. The hydrodynamic and wave models are described in Section 2. It should be noted that the model inputs are a hindcast of past metocean conditions; the overall trends reflected in this data will be broadly reflected in future conditions, but conditions on any given day during the actual dredging operations may be quite different.
- *The accuracy of dredge methodology inputs to the model*. Specification of the proposed dredge and disposal methodologies was provided by CPPC after consultation with Hall Contracting, the dredging consultants. The scenarios modelled include a range of potential production rates and durations of operations, which reflect uncertainties in the material types and address sensitivities of results to the production rates. Any assumptions made to achieve a realistic representation of the dredging and disposal activities are outlined in Section 3.5 and were based on extensive past project experience.
- *The accuracy of the material properties input to the model*. Geotechnical information obtained during previous site investigations was provided by the client (AECOM, 2018, 2019b) and is discussed in Section 3.6. From this data, the properties of the *in situ* material to be dredged are reasonably well-known. However, it is not possible to determine how the material properties will be changed by the action of the dredge. Therefore, assumptions were made in the model with regard to the material that is released into the water column from dredging and the material properties of the sediments that are to be placed at the offshore disposal area.
- *The accuracy of the dredging and disposal sediment source terms input to the model*. The source definition in the model is flexible and can be applied to any sediment source by specifying the time-varying flux rate, particle size distribution (PSD) and vertical profile in the water column. This information will be specific to the equipment used and the material encountered at the site, and therefore can only be determined with confidence from a pilot study at the site or field measurements during dredging. In the absence of such data, assumptions were made with regard to these parameters. The assumptions are outlined in Section 3.7 and were based on literature review, including the recent WAMSI Dredging Science Node reports – such as the review of contemporary practice conducted by Kemps & Masini (2017) – and extensive past project experience.

The major sources of uncertainty for the sediment fate modelling are the modelled dredging methodology and sediment source inputs to the model. The assumptions made were based on literature review and experience, and aimed to give a good representation of the sources of suspended sediment that will result from the proposed dredging and disposal activities. However, as there were uncertainties in the inputs to the model, the results should be considered as indicative of the expected ranges in magnitude and distribution of suspended sediments and sedimentation, rather than an exact prediction.

3.4 Model Domain and Bathymetry

The DREDGEMAP model domain established for the dredging works extended approximately 28 km north-south by 57 km east-west (Figure 3.1). The model grid covers the section of the Western Australian coastline from James Point in the south to just south of West Intercourse Island (the south-western edge of the Dampier Archipelago) in the north. The offshore boundaries of the domain were imposed at a reasonable distance from the proposed dredging areas, to allow potential sediment drift patterns alongshore and in offshore directions to be adequately captured.

This region lies within the model domain of the Delft3D hydrodynamic and wave models that provide the current and wave inputs to DREDGEMAP (see Section 2). A grid resolution of 40 m by 40 m was selected to ensure that existing features in the domain, including the Cape Preston Port breakwaters and infrastructure, and the many bays and islands, were adequately defined.

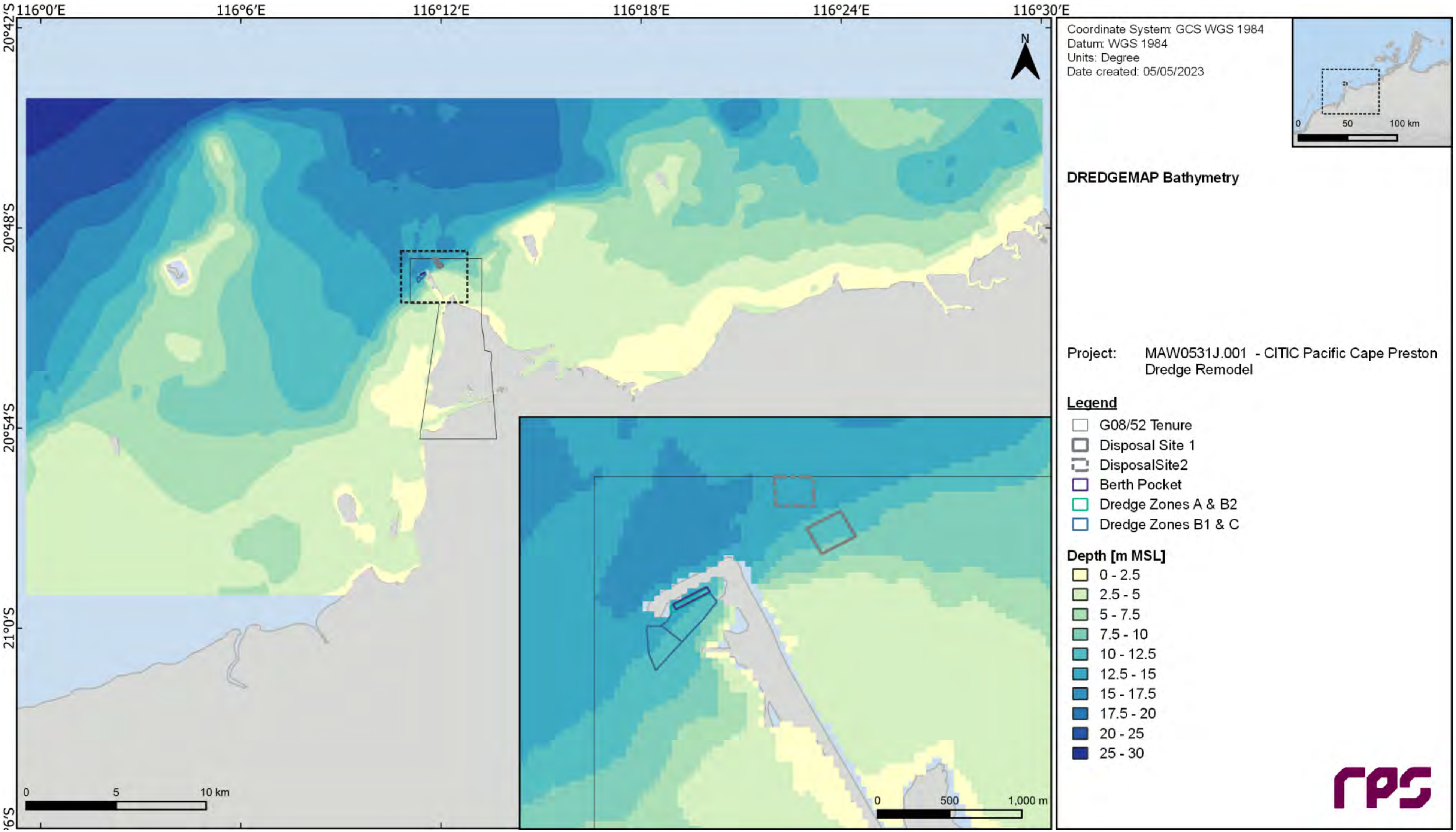

Figure 3.1 DREDGEMAP model domain and bathymetry (m MSL), with outlines of the major components of the proposed maintenance dredging program overlain.

3.5 Dredging Project Description and Model Operational Assumptions

3.5.1 Overview

Information outlining the dredging and disposal operations for the proposed maintenance dredging program has been drawn from several sources (AECOM, 2017, 2022; BG&E Resources, 2022; Hall Contracting, 2020; ASL Marine, 2015) and related email discussions. At the time of commencement of modelling, the collated information represented the best available data with regard to geotechnical properties of the project areas, the dredging methodologies expected to be used within these areas, and the characteristics of the vessel planned to be contracted for the work.

The material types over the project area were broken into three broad categories based on available geotechnical information from recent and past site investigations. The material categories are based on the type and strength of the material with respect to method and difficulty of dredging, and are defined as follows:

- *Sediments*: up to very weak rock (unconfined compressive strength; UCS < 1.25 MPa), defined as 'easy' dredging.
- *Calcareous sedimentary rock*: weak to moderately strong (UCS = 1.25 to 30 MPa), defined as 'moderate' dredging.
- *Andesite igneous rock*: moderately strong to very strong (UCS = 30 to >100 MPa), defined as 'drill and blast' dredging.

Note the proposed maintenance dredging program requires **no** removal/dredging of andesite igneous rock. Additional details for each of these material categories is contained in AECOM (2017). The following sections outline the details of the dredging operations and highlight any assumptions that were made.

3.5.2 Methods and Equipment

3.5.2.1 Dredging

The maintenance dredging works will involve a dredge volume of around 36,000 m^3, with all dredging being handled by a BHD. Two different durations for dredging have been modelled based on a range of estimated production rates provided by the dredging contractor. Scenarios 1, 2 and 4 have an estimated maximum duration of dredging works of 14 days based on all material being sediment (i.e. 'easy' dredging), while Scenarios 3 and 5 have an estimated maximum duration of dredging works of 41 days (5.9 weeks) based on the material being a mixture of sediment and calcareous sedimentary rock (i.e. 'easy and moderate' dredging). Both durations include allowances for downtimes.

The dredging operations have been divided into three sections as shown on Figure 3.1 and Figure 3.2 and outlined in Table 3.2. The dredging in each section was assumed to be completed with a BHD (Liebherr P-9350 with engine power of ~1,120 kW; Hall Contracting, 2020).

It was assumed that the BHD will be equipped with an 8 m^3 bucket (Hall Contracting, 2020). The BHD will use a large excavator arm fitted with an open bucket and will be mounted on the breakwater or upon a barge. The quantities of each material type for each dredge duration modelled are detailed in Section 3.5.3. It has been specified that dewatering of the split hopper barge (SHB) that accompanies the BHD will not be permitted.

Table 3.2 Dredging zone definitions and methods.

Zone	Dredging location	Vessel	Task description	Disposal location
A & B2	West berth pocket	BHD	All material to be removed by BHD. Material disposal to offshore disposal areas.	One of two proposed offshore disposal areas
A & B2	East berth pocket			
B1 & C	Inner harbour turning area			

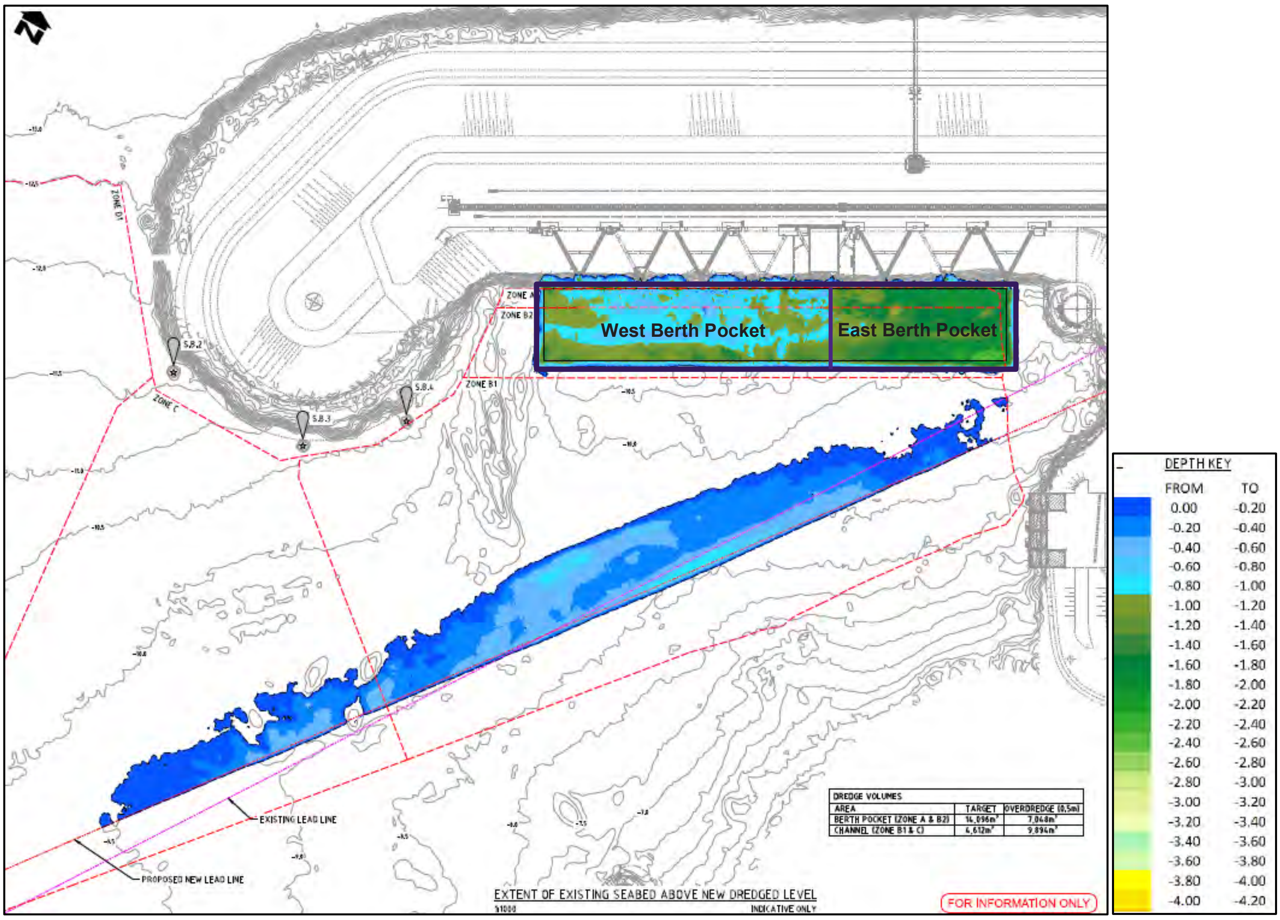

Figure 3.2 Dredging areas, depths and volumes within the dredge zones (source: extract of BG&E Resources, 2022).

3.5.2.2 Disposal

As outlined in Table 3.2, it was assumed that all material dredged by the BHD will be placed into a waiting 1,500 m^3 SHB and transported (by harbour tug) to one of two proposed offshore disposal sites (Figure 3.1). Note that only one of the disposal site options for dredge spoil placement is used in each scenario. Material discharge from the SHB was assumed to occur at a depth of 3.8 m below mean sea level, this being the depth of the hopper doors. Spoil disposal site 1 has an average depth of approximately 8.7 m CD (11.0 m MSL), and spoil disposal site 2 has an average depth of approximately 11.8 m CD (14.1 m MSL).

At both offshore disposal sites, it was assumed that the broad aim of the spoil disposal patterns will be to evenly distribute the total volume of allocated material across the entire spoil ground area by the conclusion of all activities, so the spacing of individual disposal operations (which are restricted to a comparatively small area within the spoil ground) was designed to achieve this.

3.5.3 Quantities and Production Rates

For dredging of each section, the proposed dredge depths, quantities for each material type, and production rates were specified for input to the modelling (Table 3.3; AECOM, 2022). For Scenarios 1, 2 and 4 the production rates assume that only “soft” material (sediment) makes up the volume to be dredged, while for Scenarios 3 and 5 the production rates assume a mixture of “soft” and “moderate” material (sediments and sedimentary rock) will be dredged. The modelled quantities include the indicated over-dredge volumes.

It is understood that:

- The estimated material quantities were based on the latest surveyed bathymetry and a geotechnical model incorporating existing geotechnical data.
- The estimated production rates were based on the material type and equipment that may be used for dredging.
- The estimated production rates were average values inclusive of expected downtime estimates (excluding coral spawning stand-down time).

Table 3.3 Modelled dredge depths, quantities of each material type, and production rates for each material type for dredging of each zone.

Zone	Dredge depths (m CD)		Dredged quantities including over-dredge (m^3) †			Production rates (m^3/week)	
	Target	Over-dredge	Sediments	Sed. rock	Total	Scenario 1/2/4	Scenario 3/5
A & B2 West	12.0	12.5	7,412	3,775	11,187	17,830	5,888
A & B2 East	12.0	12.5	2,667	7,289	9,956	17,830	4,293
B1 & C	9.5	10.0	14,018	488	14,506	17,830	8,533
		Totals	**24,097**	**11,552**	**35,649**	-	-

† Due to rounding errors, total quantities are accurate to within ±1 m^3.

3.5.4 Schedules

For dredging of each section, the proposed duration and sequencing of operations has been specified for input to the modelling (Table 3.4). The table has two material categories, sediments and sedimentary rock, as described in Section 3.5.3.

The proposed sequence of dredging and related activities was assumed to start in Zone A and B2 (the berth pocket) and then move to Zone B1 and C, working outwards from the Port.

Table 3.4 Modelled durations of dredging and disposal operations for each zone.

Zone	Duration of operations (weeks) †		Production rates (m^3/week)	
	Scenario 1/2	Scenario 3	Scenario 1/2	Scenario 3
A & B2 West	0.79	1.9	17,830	5,888
A & B2 East	0.40	2.3	17,830	4,293
B1 & C	0.81	1.7	17,830	8,533
Totals	**2.0**	**5.9**		

† Due to rounding errors, total durations are accurate to within ±0.01 weeks.

3.5.5 Scenario Summary

The indicative start date for the dredging works is not known at present, and therefore a nominal start date within each season was chosen for model simulation purposes: 1 June 2017 (winter) and 1 January 2017 (summer). The simulations are representative of either winter (May to October) conditions or summer (November to April) conditions at the project site, with the most significant seasonal variability in terms of sediment dispersion being the direction of drift currents between summer (northerly) and winter (southerly). Analysis of wind data in the region from 1993-2017 has shown that the period of 2016-2017 is likely to be representative of typical conditions, and the dredge modelling simulations were conducted using hydrodynamic and wave data drawn from this period.

An ecological window of stand-down time is often considered if dredging activities are located near coral habitats and operational timings are expected to coincide with spawning season. This window is typically a week or longer in duration. In the project area, mass coral spawning typically occurs approximately 7-10 days after the full moon in late March to early April. None of the scenarios described below involved the simulation of dredging activities during this period, and so there was no need to accommodate a stand-down period in any scenario.

A summary of the scenarios that were modelled is as follows:

- Dredging works to commence on 1 June 2017 (representative of winter conditions).
  - A 2-week dredging program using spoil disposal site 1 (Scenario 1).
    - BHD dredging operations were programmed to occur between 1 June and 14 June 2017.
    - SHB disposal operations were programmed to occur between 1 June and 14 June 2017, coinciding with BHD dredging operations.
    - A further 2-week simulation run-on period was assumed to occur between 15 June and 29 June 2017.
  - A 2-week dredging program using spoil disposal site 2 (Scenario 2).
    - BHD dredging operations were programmed to occur between 1 June and 14 June 2017.
    - SHB disposal operations were programmed to occur between 1 June and 14 June 2017, coinciding with BHD dredging operations.
    - A further 2-week simulation run-on period was assumed to occur between 15 June and 29 June 2017.
  - A 6-week dredging program using spoil disposal site 2 (Scenario 3).
    - BHD dredging operations were programmed to occur between 1 June and 12 July 2017.
    - SHB disposal operations were programmed to occur between 1 June and 12 July 2017, coinciding with BHD dredging operations.
    - A further 4-week simulation run-on period was assumed to occur between 13 July and 9 August 2017.
- Dredging works to commence on 1 January 2017 (representative of summer conditions).
  - A 2-week dredging program using spoil disposal site 1 (Scenario 4).
    - BHD dredging operations were programmed to occur between 1 January and 14 January 2017.
    - SHB disposal operations were programmed to occur between 1 January and 14 January 2017, coinciding with BHD dredging operations.
    - A further 2-week simulation run-on period was assumed to occur between 15 January and 29 January 2017.
  - A 6-week dredging program using spoil disposal site 2 (Scenario 5).
    - BHD dredging operations were programmed to occur between 1 January and 11 February 2017.

- ○ SHB disposal operations were programmed to occur between 1 January and 11 February 2017, coinciding with BHD dredging operations.
- ○ A further 4-week simulation run-on period was assumed to occur between 12 February and 11 March 2017.

During each simulation run-on period, sediments suspended in the water column during previous operations were subject to settlement and progressively reducing levels of resuspension.

The outcomes of the five scenarios have been analysed and presented separately, for comparison, in Section 5.

3.6 Geotechnical Information

The critical geotechnical information required as input to the modelling is PSD data for the sediments to be dredged within the footprint of the maintenance dredging program.

A number of relatively detailed geotechnical site investigations were conducted during previous phases of the Cape Preston Port development, initially by Coffey (2007, 2008a, 2008b) and with additional data collected in 2018 by AECOM (2018). These studies had limited PSD data sites within the inner harbour, however in 2019 further geotechnical investigation was completed which focused on the inner harbour (AECOM, 2019b). Therefore, the properties of the *in situ* material to be dredged are reasonably well known.

An analysis of the range of available geotechnical studies and data provided by the client was conducted by RPS. The most recent geotechnical data was compiled and used to determine PSDs for input to the dredge dispersion modelling for each dredge zone. PSD curves for a number of samples within each dredge zone were used to calculate average distributions for each dredge zone. Figure 3.3 shows relevant locations of the boreholes where PSD data was measured by lab analysis during the most recent site investigations. The resultant PSDs for each dredge zone, redistributed to match the material size classes used in the DREDGEMAP model, are summarised in Table 3.5.

In addition to PSD information, information from laboratory testing of borehole samples from a number of previous site investigations was collated to determine an average dry bulk density of the material to be dredged in the model. The average dry bulk density derived from the available geotechnical information is 2,150 kg/m^3.

Table 3.5 ***In situ*** **PSDs broken down into DREDGEMAP material classes for each zone to be dredged, derived from the latest geotechnical information.**

Sediment grain size class	Size range (µm)	PSD (%) – Zones A-& B2	PSD (%) – Zones B1 & C
Clay	<7	0.4	0.1
Fine silt	7-34	2.1	0.5
Coarse silt	35-74	7.2	3.2
Fine sand	75-130	3.2	2.2
Coarse sand	>130	87.1	94.0

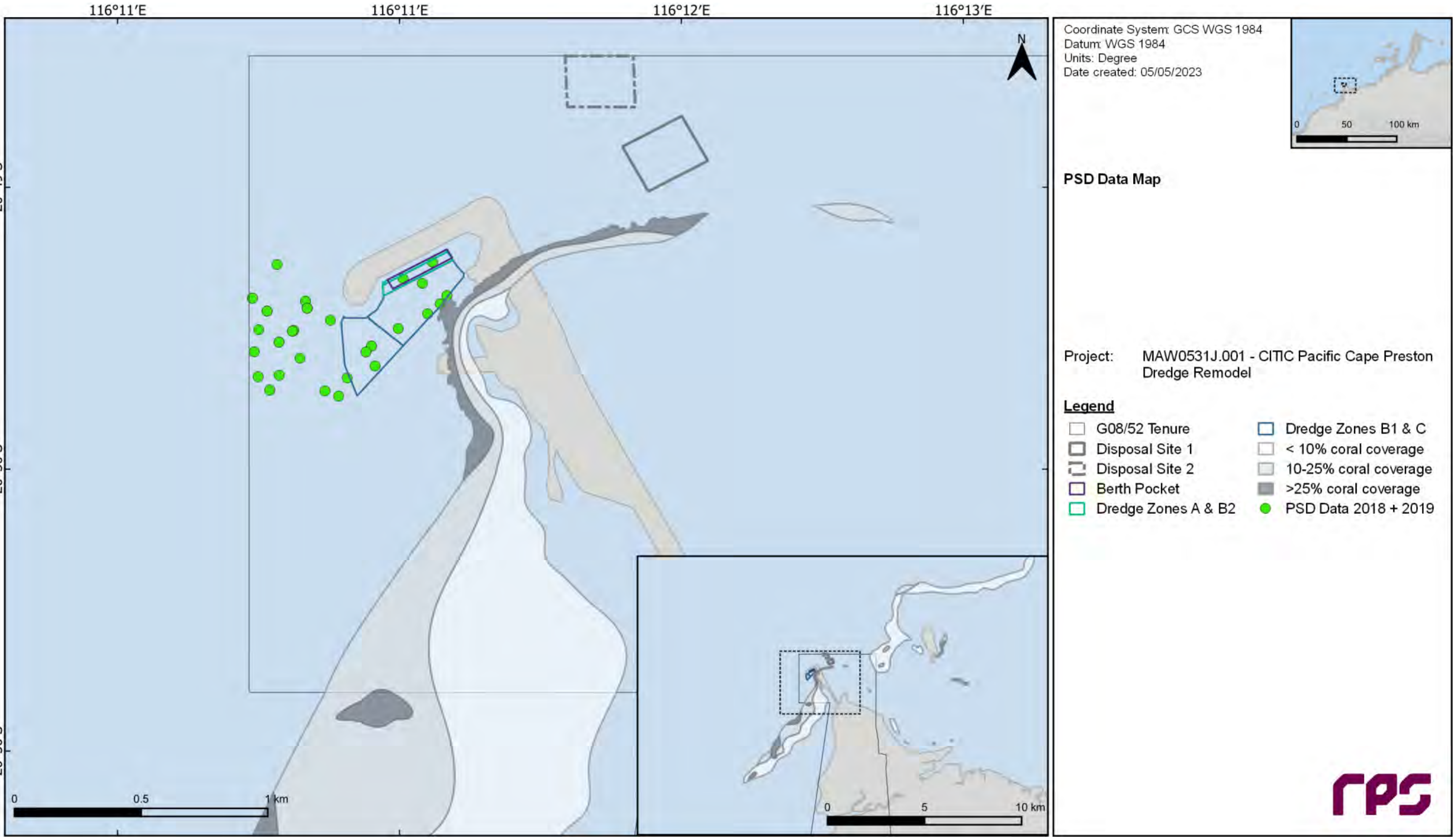

Figure 3.3 **Locations of relevant boreholes where PSD data was measured by lab analysis during the most recent site investigations (AECOM, 2018, 2019b), with outlines of the major components of the proposed maintenance dredging program overlain.**

3.7 Model Sediment Sources

3.7.1 Overview

To accurately represent the dredging operations in DREDGEMAP, a range of information was defined for the proposed operations, including dredge methodology, production rates, sediment/rock types and quantities (refer to Section 3.5). It is evident that there will be two different sources of suspended sediment plumes during dredging operations, which can be broadly defined as:

- Direct suspension of material from the BHD bucket, from grabbing and lifting sediments through the water column,
- Disposal of sediment excavated by the BHD from the SHB to the offshore disposal area.

Each of these sources of suspended sediment plumes varies in strength and persistence depending on the nature of the operations. In the DREDGEMAP model, each source is defined by specifying the time-varying flux rate, PSD and vertical profile in the water column. The following sections outline how the information provided has been used to represent the dredging operations in the model and explain any assumptions that have been made to supplement the available information.

3.7.2 Representation of BHD Dredging

A BHD will be used to excavate all material from all zones (A, B2, B1, C). The BHD will use a large excavator arm fitted with an open bucket of (nominally) 8 m^3 capacity (Hall Contracting, 2020) and will be mounted on the breakwater or upon a barge. The excavator will lift material in the bucket and deliver it to a waiting SHB – assumed for the purposes of modelling to be 1,500 m^3 in capacity – for transport to the proposed offshore disposal site.

Sources of sediment suspension from this type of operation include:

- Disturbance of the seabed sediments by the excavator bucket.
- Dewatering of the SHB, resulting in the discharge of water and entrained sediments (assumed not to be permitted and therefore not included in the modelling).

Past observations have shown that material is suspended due to the initial grab at the seabed. Further suspension is generated as sediment spills from the bucket as it is lifted through the water column. Spillage of water and sediment also occurs as the bucket breaks free of the water surface and drains freely. Only sediments <130 µm in diameter are considered “lost” (i.e. suspended into the water column), because the coarser material spilled from the bucket while being lifted to the surface will fall immediately to the bottom where it will be re-dredged during subsequent grabs. As such, the distribution of material suspended by the bucket spillage is assumed to be distributed across the four smaller sediment size classes in the model.

For the dredging of the sediments, the PSD used in the model is based on PSDs from nearby boreholes (see Section 3.6), with the proportion >130 µm removed and the remaining distribution normalised to 100% by scaling up the proportions in the four remaining size classes (Table 3.6). The same PSD is used for the sedimentary rock component, assuming that due to the excavation action of the BHD the rock will break down into similar proportions of fines. As the PSDs are within the areas to be dredged, and from previous site investigations (Coffey, 2007, 2008a, 2008b, AECOM, 2018) the sediments were found to be interspersed with layers of sedimentary rock/gravel, it is believed that this assumption is reasonable. Because the dredging action of the excavator involves no cutting or hydraulic pumping, this is also a conservative assumption.

Table 3.7 shows the assumed vertical distribution of the suspended material during the BHD operations. The distribution is higher at the seabed and water surface, to represent the larger loss rate of material during the initial grab and as the bucket breaks free of the water column.

Table 3.6 Assumed PSDs of sediments initially suspended into the water column during BHD dredging operations.

Sediment grain size class	Size range (µm)	PSD (%) for sediment removal – Zones A & B2	PSD (%) for sediment removal – Zones B1 & C
Clay	<7	2.9	1.6
Fine Silt	8-34	16.3	9.0
Coarse Silt	35-74	56.1	52.6
Fine Sand	75-130	24.7	36.8
Coarse Sand	>130	0.0	0.0

Table 3.7 Assumed vertical distribution of sediments initially suspended into the water column during BHD dredging operations.

Elevation	Example elevation (m ASB) – 10 m water depth	Vertical distribution (%) of sediments
Surface/water depth	10.0	23.0
0.8 x water depth	8.0	16.0
0.5 x water depth	5.0	14.0
0.3 x water depth	3.0	19.0
0.1 x water depth	1.0	28.0

Loss rates from similar operations are known to vary based on such factors as the size and type of bucket (i.e. open or closed), nature of the seabed material, presence of debris, current speed and depth of water, as well as the care of the operator (Hayes & Wu, 2001; Anchor Environmental, 2003). Reported rates compared by Anchor Environmental (2003) varied from 0.1% to 10%, with a mean of 2.1%. In the absence of measurements for the specific situation and equipment, the mean of 2.1% of production rate is assumed for all BHD operations.

3.7.3 Representation of Disposal from SHB

All material dredged by the BHD will be placed into a waiting 1,500 m^3 SHB and transported (by harbour tug) to one of the proposed offshore disposal sites. No dewatering of the SHB will be permitted to occur during dredging works.

For the disposal of the sediments dredged by BHD, the PSD used in the model is based on PSDs from nearby boreholes (see Section 3.6). This PSD is adjusted by removal of the component treated as suspended during dredging (see Section 3.7.2), but as this represents only 2.1% of the mass for the minor components, the modified PSD is not significantly different to the *in situ* PSD (Table 3.8). This PSD is also adjusted to represent the higher proportion of fine material that will make up the 5% of the deposited material that remains in suspension.

Once at the disposal site, the SHB will open to release the sediments from the bottom of the hull at a depth of approximately 3.8 m below sea level (ASL Marine, 2015). Previous observations of sediment dumping from hopper vessels (CSMW, 2005) have shown that there is an initial rapid descent of solids, with the heavy particles tending to entrain lighter particles, followed by a billowing of lighter components back into the water column after contact with the seabed (Figure 3.4). A proportion of the lighter components will also remain suspended and may be trapped by density layers, if present.

Because simulations in this study focused on the far-field fate of sediment particles due to transport and sinking after the initial dump phase, simulations were run with the initial vertical distribution specified to represent the post-collision phase for a case where a high proportion of the sediments are resuspended after collision with the seabed. To represent this, an assumed vertical distribution for the sediments (Table 3.9) has been specified following published information from previous hopper disposal operations (CSMW, 2005; NEPA, 2001). This vertical distribution, with the majority of the material input near the seabed and only 7% of the material released in the upper half of the water column, is in line with values quoted in the recent literature review by Mills & Kemps (2016), which found that sediment resuspension from individual dredged material disposal events was generally less than 10% of the disposed material load.

It is estimated that 95-99% of the bulk load deposits directly onto the seabed in a typical case, with the remainder released into the water column (CSMW, 2005, NEPA, 2001). It is difficult to find other definitive source values in the literature, but a value of 5% of each load agrees well with past experience and appears to be a conservative estimate based on the values quoted above. Accordingly, 5% of each hopper load was placed in suspension in the water column in the sediment fate model.

In addition to the proportion of material immediately suspended in the water column, disposal from the SHB will result in the stockpiling of sediment as a mound on the seabed that will be subject to resuspension by tidal and wave forces. Because fine sediments in the deposited mass may be subject to ongoing resuspension and dispersion over time, it was necessary to specify the deposits as a further source of sediment potentially subject to resuspension. For this purpose, it was assumed that 5% of the deposited mass – representing the upper surface layer – would be subject to resuspension. It should be noted that the model maintains a mass balance estimate of the remaining sediment of each size class within each grid cell to derive an estimate of the median particle size in the surface-layer sediments. In turn, the potential for ongoing resuspension of fines is calculated. In this way, the model represents the increased armouring of sediments as the average particle size increases.

The disposal time for the SHB within each dredging cycle was assumed to be 10 minutes. The disposal location within the spoil ground was varied for each trenching cycle in a randomised manner, with the aim of ensuring an even distribution of dredged material within the spoil ground by the conclusion of activities.

Table 3.8 Assumed PSDs of sediments initially suspended into the water column during SHB disposal operations.

Sediment grain size class	Size range (µm)	PSD (%) for sediment disposal – Zones A & B2	PSD (%) for sediment disposal – Zones B1 & C
Clay	<7	3.1	0.7
Fine Silt	8-34	17.5	3.3
Coarse Silt	35-74	31.0	20.8
Fine Sand	75-130	1.4	14.3
Coarse Sand	>130	47.0	60.9

Table 3.9 Assumed vertical distribution of sediments initially suspended into the water column during SHB disposal operations.

Elevation	Example elevation (m ASB) – 10 m water depth	Vertical distribution (%) of sediments
Surface/water depth	10.0	5.0
0.7 x water depth	7.0	10.0
0.5 x water depth	5.0	20.0
0.3 x water depth	3.0	30.0
0.15 x water depth	1.5	35.0

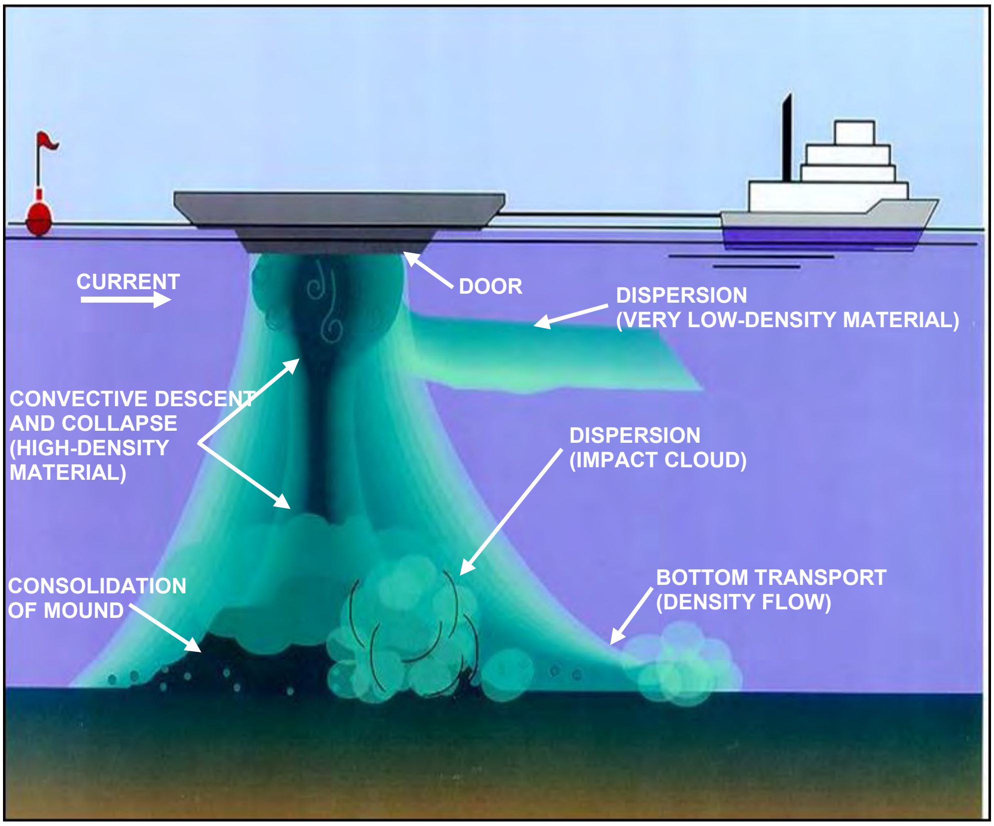

Figure 3.4 Conceptual diagram showing the general behaviour of sediments dumped from a barge/SHB in open water and the vertical distribution of material set up by entrainment and billowing (Source: Moritz & Randall, 1992).

3.8 Summary of Source Rates and Volumes

For each source of suspended sediment plumes during dredging and disposal operations, as described in the preceding sections, Table 3.10 summarises the associated loss rates and approximate volumes of suspended sediment expected.

A total of approximately 2,532 m^3 of sediment is expected to be initially suspended in the water column over the course of the modelled program. This volume represents approximately 7.1% of the *in situ* dredged volume. If all deposited material assumed to be available for potential resuspension following disposal operations is actually resuspended, a total of 4,315 m^3 of sediment will be suspended in the water column over the program duration; this will represent approximately 12.1% of the *in situ* dredged volume.

Table 3.10 Summary of sediment sources applied in the model.

Operation	Source rate (% production rate)	Dredged volume (m^3)	Suspended volume (m^3)
Dredging by BHD excavator bucket	2.1	35,649	749
Disposal from hopper barge	5 (water column) 5 (seabed; *potential*)		1,783 *1,783*
	Totals	**35,649**	**2,532** ***4,315***

4 ENVIRONMENTAL THRESHOLD ANALYSIS

Predictions of TSSC for each scenario were assessed against a series of water quality thresholds to categorise the modelled outcomes into management zones of influence and impact, defined with regard to environmental sensitivities in the study region. The sensitive benthic communities that are of concern in the Port area are coral habitats. The appropriate thresholds for corals and the approach to be applied to the project are based on a long term set of baseline turbidity monitoring data, undertaken at over 20 locations near the Port, and on the Environmental Protection Authority (EPA) technical guidance for environmental impact assessment (EIA) of marine dredging proposals (EPA, 2021).

Note that no environmental thresholds were specified with respect to the sedimentation model outputs. As stated in the EPA guidelines, high levels of sediment deposition are generally localised to the dredging operational areas and are associated with areas of very high TSSC (EPA, 2021), whereas dredge related elevation of TSSC and/or effects on benthic light availability can be widespread. Sediment dispersion modelling results for the project confirm this statement; refer to Section 5.1. This results in the areas that exceed the sedimentation thresholds typically lying within the larger areas where the TSSC thresholds are exceeded (i.e. the TSSC thresholds are more conservative).

4.1 Management Zone Definitions

Three management zones were defined in the approach recommended by the EPA (2021), based on varying levels of impact on sensitive receptor communities: a Zone of High Impact (ZoHI); a Zone of Moderate Impact (ZoMI); and a Zone of Influence (ZoI). The definition of each of these management zones is presented in the following sections.

4.1.1 Zone of High Impact

The ZoHI is defined as the area where serious damage to benthic communities is predicted or where impacts are considered irreversible (EPA, 2021). The ZoHI typically includes the areas within and immediately adjacent to the dredging and disposal footprints where direct removal of substrate or smothering of substrate occurs. This zone includes the top width of the dredged footprint and disposal area with a buffer extending outwards from these areas. The results from the sediment dispersion modelling will have no effect on the outline of the ZoHI as it is defined here, and as such this zone is not presented in this report.

4.1.2 Zone of Moderate Impact

The ZoMI is defined as the area where predicted impacts on benthic communities are sub-lethal, and the impacts are recoverable within a period of 5 years following completion of dredging activities (EPA, 2021).

4.1.3 Zone of Influence

The ZoI is defined as the area where changes in environmental quality associated with dredge plumes are predicted and anticipated during the dredging operations, but where these changes would not result in a detectible impact on benthic communities (EPA, 2021).

4.2 Threshold Values

4.2.1 Zone of Moderate Impact

Threshold TSSC values for the ZoMI were provided by O2Marine (2024), based on the values outlined for corals in the EPA technical guidance for EIA of marine dredging proposals (EPA, 2021). These thresholds identify the tolerance of the corals to TSSC across acute and chronic timeframes using different values for the following number of days: 3, 7, 10, 14 and 28. Two concentrations are provided in the guidelines for defining moderate impact:

1. ZoMI – Possible Effects: This lower concentration threshold represents a value where impacts are possible (but unlikely) and is recommended for use to define the worst case boundary.

2. ZoMI – Probable Effects: This higher concentration threshold represents a value where corals are known to show effects but will still likely recover following disturbance.

As the model output is dredge-excess TSSC (i.e. does not include background TSSC) the threshold values were recalculated by O2Marine (2024) to remove appropriate background TSSC values for summer months (January, February, March) and winter months (June, July August). Appropriate background TSSC values for each of the months were defined from the baseline turbidity data set. Table 4.1 presents the threshold TSSC values outlined in the EPA guideline (2021) – and the recalculated values excluding background TSSC – applied to the model outputs for each season for the ZoMI – Possible Effects and ZoMI – Probable Effects thresholds. Note the seasonal threshold values applied to the analysis were the minimum values observed at any of the 21 monitoring sites within the three relevant months in each season, to be conservative.

Table 4.1 Threshold TSSC values defined for corals on a seasonal basis, following EPA guidelines, and modified to exclude background TSSC using median baseline turbidity data over all measurement sites.

Season	Averaging period (days)	ZoMI – Possible (mg/L)	ZoMI – Probable (mg/L)	ZoMI – Possible, excluding background (mg/L)	ZoMI – Probable, excluding background (mg/L)
Summer	3	19.4	35.7	16.3	32.6
Winter				17.1	33.4
Summer	7	14.7	24.5	11.6	21.4
Winter				12.4	22.2
Summer	10	13.1	20.9	10.0	17.8
Winter				10.8	18.6
Summer	14	11.7	18.0	8.6	14.9
Winter				9.4	15.7
Summer	28	9.3	9.3	6.2	6.2
Winter				7.0	7.0

4.2.2 Zone of Influence

Within the ZoI benthic communities may at some time experience detectable elevations in TSSC (beyond expected background levels). Using the baseline turbidity data, O2Marine (2024) specified a threshold of 1 mg/L for the project area as a detectable elevation above background. This detectable TSSC threshold has no timeframe associated with it, which means that any TSSC value above this value, in any model cell at any time during the dredging and disposal operations, will trigger an exceedance.

4.3 Calculation of Management Zones

The following sections outline how the thresholds have been applied to the sediment dispersion modelling results to determine the predicted ZoMI – Possible Effects, ZoMI – Probable Effects and ZoI for each dredging scenario.

4.3.1 Zone of Moderate Impact

The predicted ZoMI – Possible Effects and ZoMI – Probable Effects, based on exceedances of the thresholds for TSSC, were evaluated over the duration of each dredging scenario by:

1. Creating a three-dimensional time series (hourly) of dredge-excess TSSC values in each model grid cell for the entire dredging program.

2. Applying a moving average to the time series of TSSC values of each cell for each averaging period outlined in Table 4.1.
3. Assessing the moving average TSSC data against the appropriate seasonal threshold TSSC values for both the ‘possible’ and ‘probable’ effects for each averaging period.
4. Calculating the overall predicted ‘possible’ and ‘probable’ effects zones for each scenario by combining the predicted ZoMIs from TSSC threshold exceedances for each averaging period.

The calculations have been conducted for both depth-averaged TSSC (typical method for impact on light climate for corals) and maximum-in-water-column TSSC (worst case method) outputs from the model.

4.3.2 Zone of Influence

The predicted ZoI, based on exceedances of the threshold for TSSC, was evaluated over the duration of each dredging scenario by:

1. Creating a three-dimensional time series (hourly) of dredge-excess surface layer TSSC values in each model grid cell for the entire dredging program.
2. Calculating the maximum value of the surface layer time series TSSC values in each cell over the entire dredging program.
3. Assessing the maximum surface layer TSSC data against the ZoI threshold TSSC value.

5 RESULTS OF SEDIMENT FATE MODELLING

5.1 Spatial Distributions of TSSC and Sedimentation

5.1.1 Discussion

Simulations indicated that there may be significant spatial patchiness in the distribution of TSSC and sedimentation at any point in time during the dredging and disposal operations because of variability in the flux from each of the sediment suspension sources, and the varying dynamics of the transport, settlement and resuspension processes affecting the sediments.

The TSSC results presented in the following sections are depth-averaged. It should be noted, however, that there is significant variability in the vertical distributions of TSSC in the water column, with a distinct increase in concentration towards the seabed. Most material will initially be suspended low in the water column, and material suspended higher in the water column will sink as it moves away from the source. Frequent resuspension of material will also mostly affect the lower reaches. Thus, the spatial area affected above a given concentration is typically greater in the near-seabed layer than in the near-surface layer. Nonetheless, there are instances throughout the simulations where elevated concentrations will occur in the near-surface layers – during SHB disposal operations, or during strong resuspension events affecting sediments that have migrated to shallow areas – but these will typically not be sustained for extended periods of time.

The localised movement and dispersion of the dredge-generated suspended sediment is governed over short time scales by the tide, with strong tidal flows in the areas where dredging is planned to occur – particularly around Cape Preston and the Port breakwater. Superimposed on this motion is the gradual migration of sediment due to the wind-driven residual component of the current, which drives the overall drift patterns of the suspended sediments. There are distinct seasonal differences in the overall drift patterns of the suspended sediments at the Port, with sediment plumes extending northwards during ambient conditions in summer and southwards during ambient conditions in autumn and winter months. Some large sediment migration events are evident during the stormy summer months, where large volumes of suspended sediment drift towards the south. As a result, southward movement of plumes is more pronounced in the outcomes and the southerly drift trajectories are expected to be significantly more extensive than the northerly ones.

Given the extensive shallow bathymetry to the north and particularly to the south of the Port, and the strong tidal flows in the area, settlement of the dredge-generated sediment is minimal with material being continuously resuspended. This results in suspended sediment plumes having long drift trajectories with elevated levels of TSSC potentially extending over many kilometres. Sedimentation of >1 mm thickness is typically limited to the vicinity of the dredging and disposal operations, with deposited sediments at greater distances being more likely to consist of finer material that will be transported further before settling.

The results observed on any given day will not always be representative of the given season’s prevailing transport patterns, and plume concentrations and distributions are forecast to vary markedly throughout each scenario. To explore this variability, statistical distributions of TSSC and sedimentation for each scenario are examined. Percentile distributions will summarise the cumulative outcomes over an entire scenario and do not represent an instantaneous plume footprint at any point in time.

When examined over an entire scenario, the sediment percentile distributions reveal areas where recurrent elevations of near-seabed TSSC may be expected as a consequence of dredging operations. The forecast in each scenario is that the greatest concentrations will typically be found in the immediate vicinity of the berth pocket, with elevated concentrations also extending from the disposal grounds. Elevated patches are forecast to extend south along a stretch of mainland coastline up to 20 km from the Port during winter (Scenarios 1, 2 and 3), and extend north-east along the coastline up to 14 km from the Port during summer (Scenarios 4 and 5). The southerly drift trajectory of the plume in Scenarios 1, 2 and 3 is expected given the scenarios are simulated under winter conditions. However, there is significant seasonality to metocean conditions in the region and Scenarios 4 and 5 simulated under summer conditions result in more northerly drift trajectories.

Comparing the percentile results of Scenarios 1 and 2 (winter scenarios), lower TSSC values are predicted in the vicinity of the spoil ground in Scenario 2, while the same scenario predicts higher TSSC values along the coast to the south. At the Potter and Carey Islands, 95^{th} percentile (values exceeded 5% of the time) concentrations of >2 mg/L and >5 mg/L are seen in Scenarios 1 and 2, respectively. With both scenarios representing identical dredge programs, the factor driving this difference in plume outcome is the spoil ground location. The slightly more offshore location in Scenario 2 is subject to higher current speeds, which inhibit settling of material within the spoil ground and act to promote greater and more rapid dispersion.

In Scenario 3 (also a winter scenario), the longer, less intense dredging program with significantly lower production rates results in prediction of a generally more dilute plume, with TSSC values in the vicinity of the spoil ground lower than in Scenario 2 (which uses the same spoil ground) and with 95th percentile concentrations of >0.5 mg/L reaching the Potter and Carey Islands. A similar comparison is found between Scenarios 4 and 5 (summer scenarios), where the longer less intense dredging program of Scenario 5 results in significantly lower TSSC values and smaller spatial extents at each contour value.

The potential to observe elevated TSSC levels around the Port itself is an expected consequence of localised dredging works to excavate and dispose of material in a tidally dominated area where suspended sediments could become trapped for periods of time. The sediment plumes expected to be observed in the shallow waters to the south of the Port (winter) or to the north of the Port (summer), following the bathymetric contours along the mainland coastline, will consist mostly of fine dredged material and fine material placed in the disposal grounds. These areas are exposed to strong drift currents and, occasionally, extreme weather events that will drive sufficient wave energy to resuspend significant amounts of discharged sediment. Sediment plumes following these trajectories, and particularly the southern trajectory, will enter many shallow coastal locales where strong tidal flows both inhibit settlement of fine suspended sediments and stimulate significant levels of resuspension of sediments deposited after initial release in the water column.

Concentrations of suspended sediments in the dredging and disposal areas will represent the combined influence of new discharges and resuspension of fine sediments from earlier discharges. Temporal variations in intensity of the dredging operations, including the disposal cycle times and downtime periods, will also influence turbidity peaks and troughs. At progressively more distant areas, the importance of resuspension as a contributor to the distribution of TSSC values in general, and near-seabed concentrations in particular, becomes a greater factor. The areas forecast to receive elevated concentrations are dispersed far more widely than those affected only by plumes from the initial dredging sources. The plume extents tend to expand over the period of the dredging (2-6 weeks) in the direction of net drift, indicating the progressive transport of fine sediments through continuous patterns of settlement and resuspension.

Periodic high wave-energy events will be a major contributor to estimates of high TSSC in the near-seabed layer, particularly in shallow exposed areas. While these processes are forecast to extend the influence of dredging activities over a wider area, the longshore dispersal of finer sediments is indicated to be an important mechanism for limiting the trapping and build-up of fine sediments in the local region around the dredging and disposal areas.

5.1.2 TSSC Figure Index

Figures showing predicted TSSC extents for each scenario are presented in Section 5.1.4. Distributions of TSSC calculated at the 80th, 90th and 95th percentiles over the entire program of dredging and disposal operations are shown. All TSSC figures for each scenario are indexed in Table 5.1.

Table 5.1 Index of the TSSC figures for each scenario.

Figure content	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Dredge-excess TSSC at the 80th, 90th and 95th percentiles	Figure 5.1 Figure 5.2 Figure 5.3	Figure 5.4 Figure 5.5 Figure 5.6	Figure 5.7 Figure 5.8 Figure 5.9	Figure 5.10 Figure 5.11 Figure 5.12	Figure 5.13 Figure 5.14 Figure 5.15

5.1.3 Sedimentation Figure Index

Figures showing predicted sedimentation extents for each scenario are presented in Section 5.1.5. Distributions of bottom thickness calculated at the 50th (median), 90th and 95th percentiles over the entire program of dredging and disposal operations are shown, along with snapshots of instantaneous bottom thickness at selected times during each scenario. All sedimentation figures for each scenario are indexed in Table 5.2.

Table 5.2 Index of the sedimentation figures for each scenario.

Figure content	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Dredge-excess bottom thickness at the 50th, 90th and 95th percentiles	Figure 5.16 Figure 5.17 Figure 5.18	Figure 5.23 Figure 5.24 Figure 5.25	Figure 5.30 Figure 5.31 Figure 5.32	Figure 5.39 Figure 5.40 Figure 5.41	Figure 5.46 Figure 5.47 Figure 5.48
Snapshots of dredge-excess bottom thickness at selected times during the simulations	Figure 5.19 Figure 5.20 Figure 5.21 Figure 5.22	Figure 5.26 Figure 5.27 Figure 5.28 Figure 5.29	Figure 5.33 Figure 5.34 Figure 5.35 Figure 5.36 Figure 5.37 Figure 5.38	Figure 5.42 Figure 5.43 Figure 5.44 Figure 5.45	Figure 5.49 Figure 5.50 Figure 5.51 Figure 5.52 Figure 5.53 Figure 5.54

5.1.4 TSSC – Spatial Maps

5.1.4.1 Scenario 1: Winter Start for 2-Week Dredge Program Using Spoil Disposal Site 1

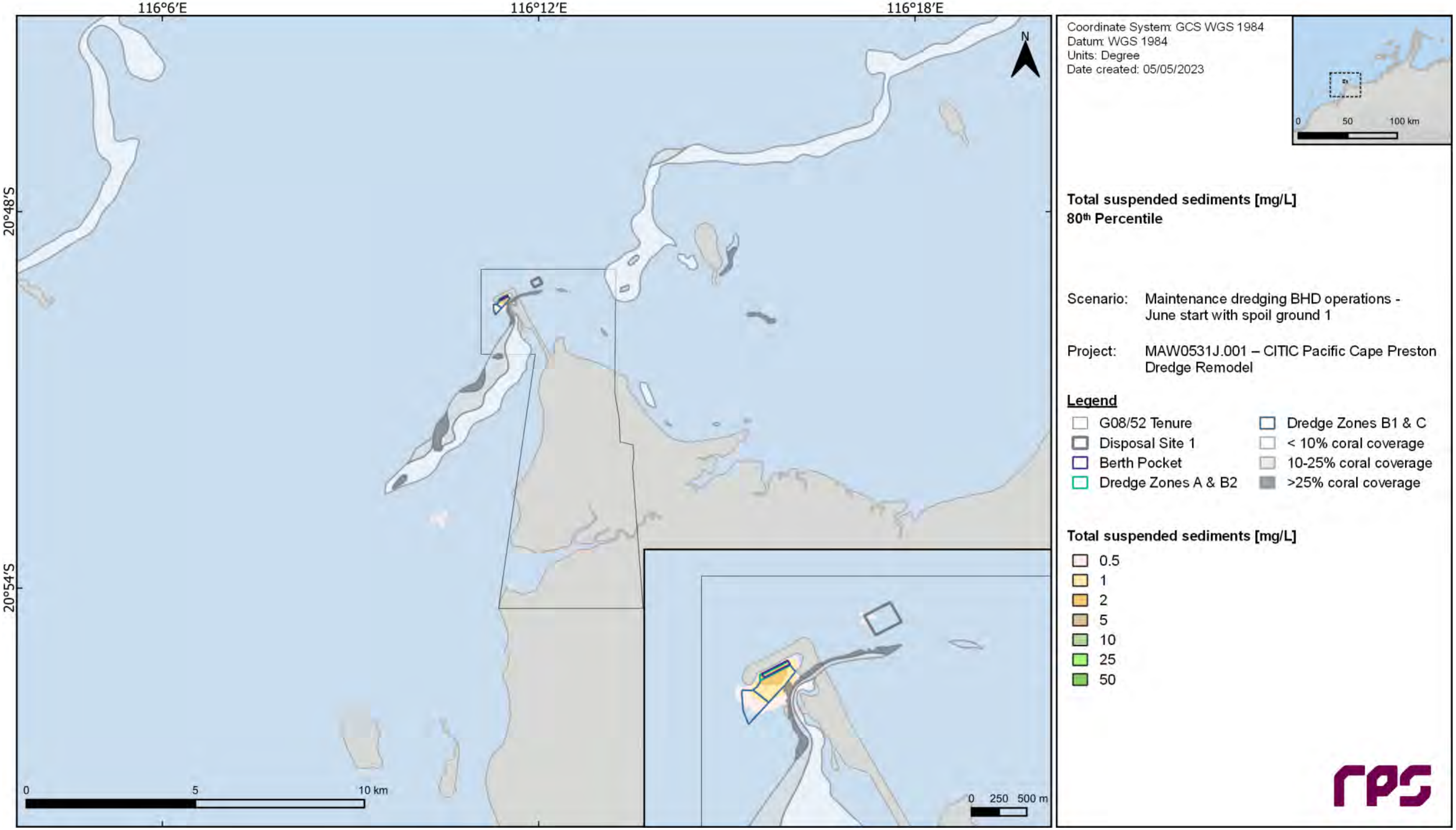

Figure 5.1 **Predicted dredge-excess TSSC (mg/L) at the 80th percentile throughout the entire Scenario 1 duration (1 to 29 June 2017).**

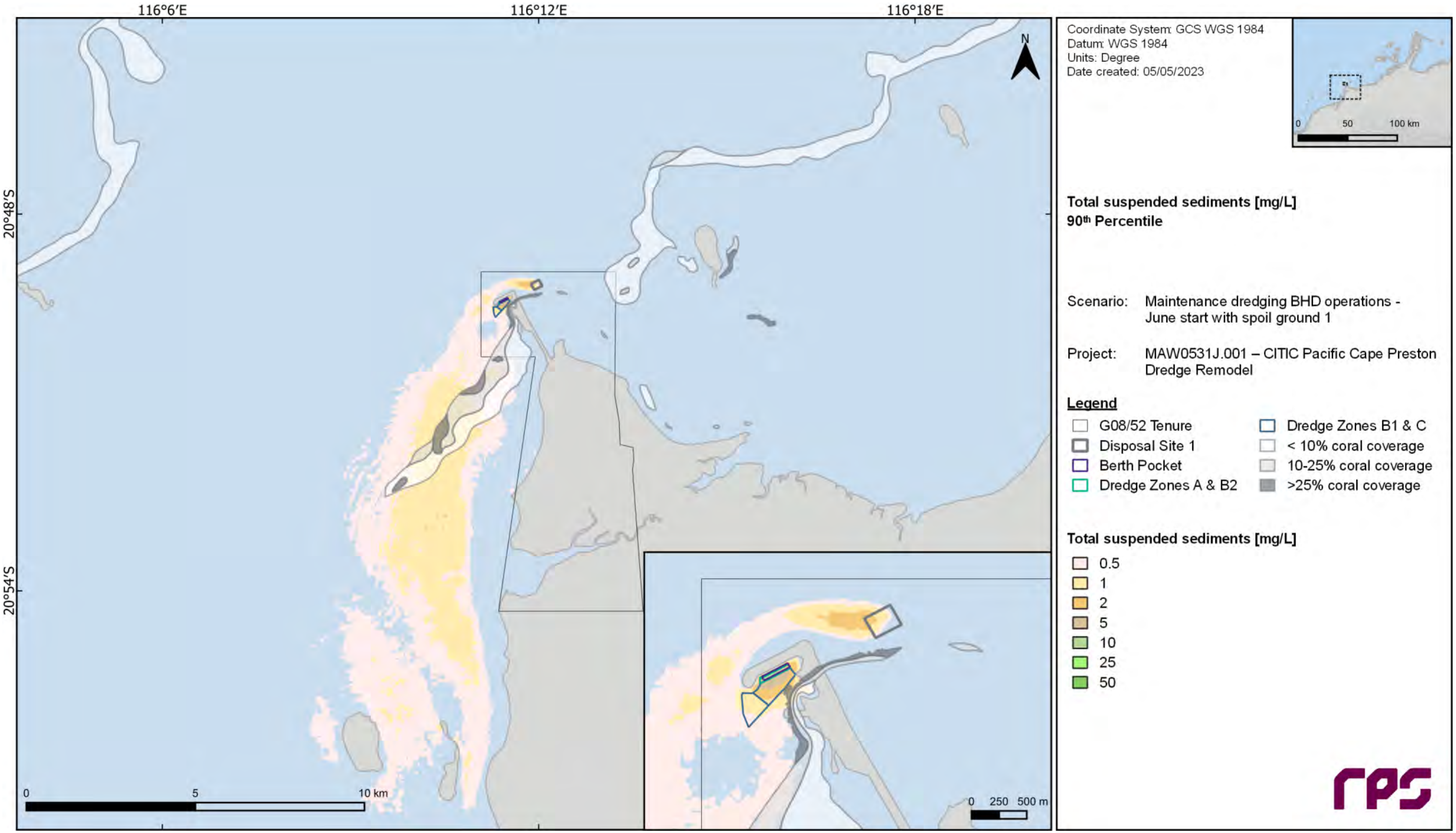

Figure 5.2 **Predicted dredge-excess TSSC (mg/L) at the 90th percentile throughout the entire Scenario 1 duration (1 to 29 June 2017).**

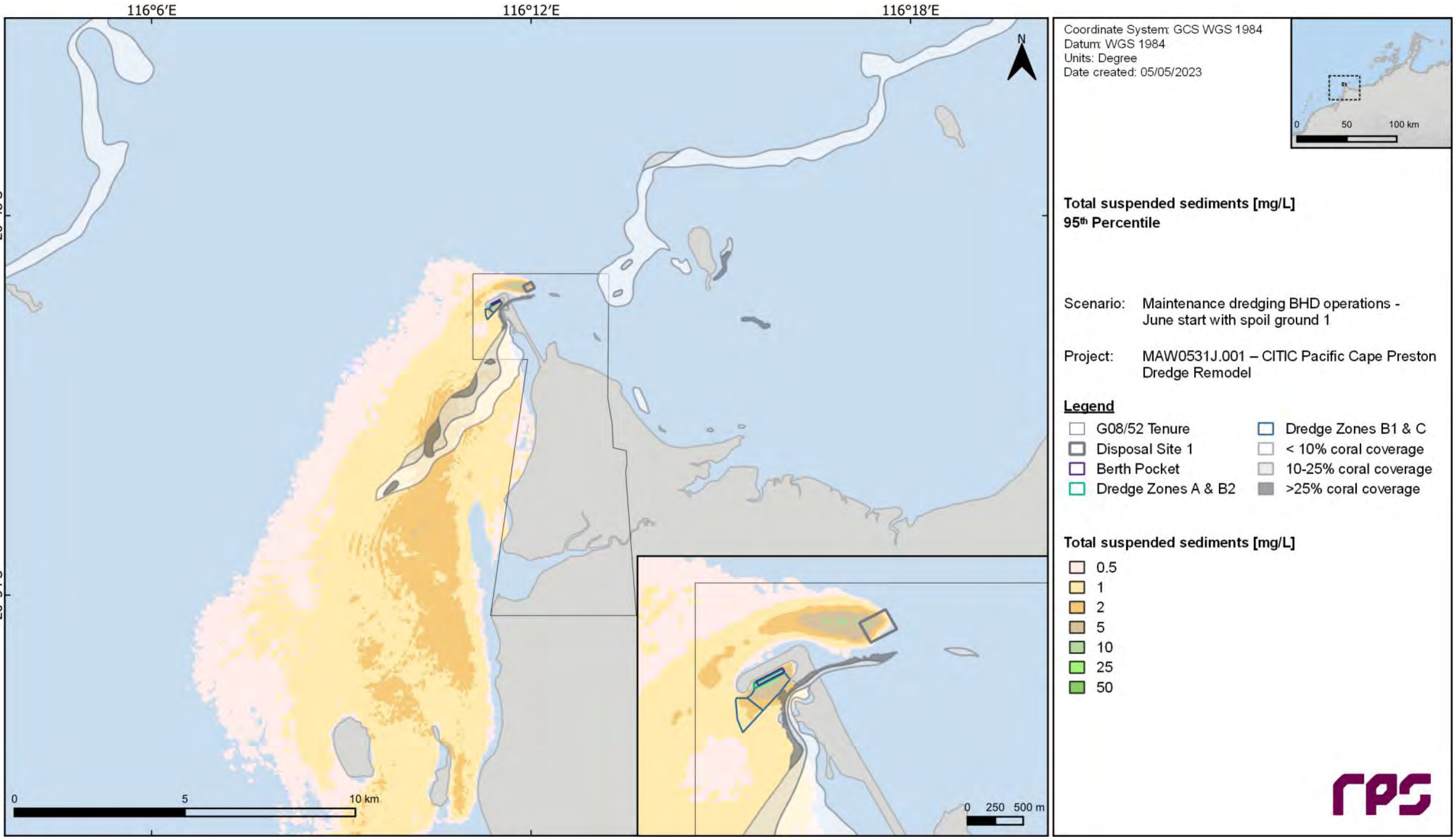

Figure 5.3 Predicted dredge-excess TSSC (mg/L) at the 95th percentile throughout the entire Scenario 1 duration (1 to 29 June 2017).

5.1.4.2 Scenario 2: Winter Start for 2-Week Dredge Program Using Spoil Disposal Site 2

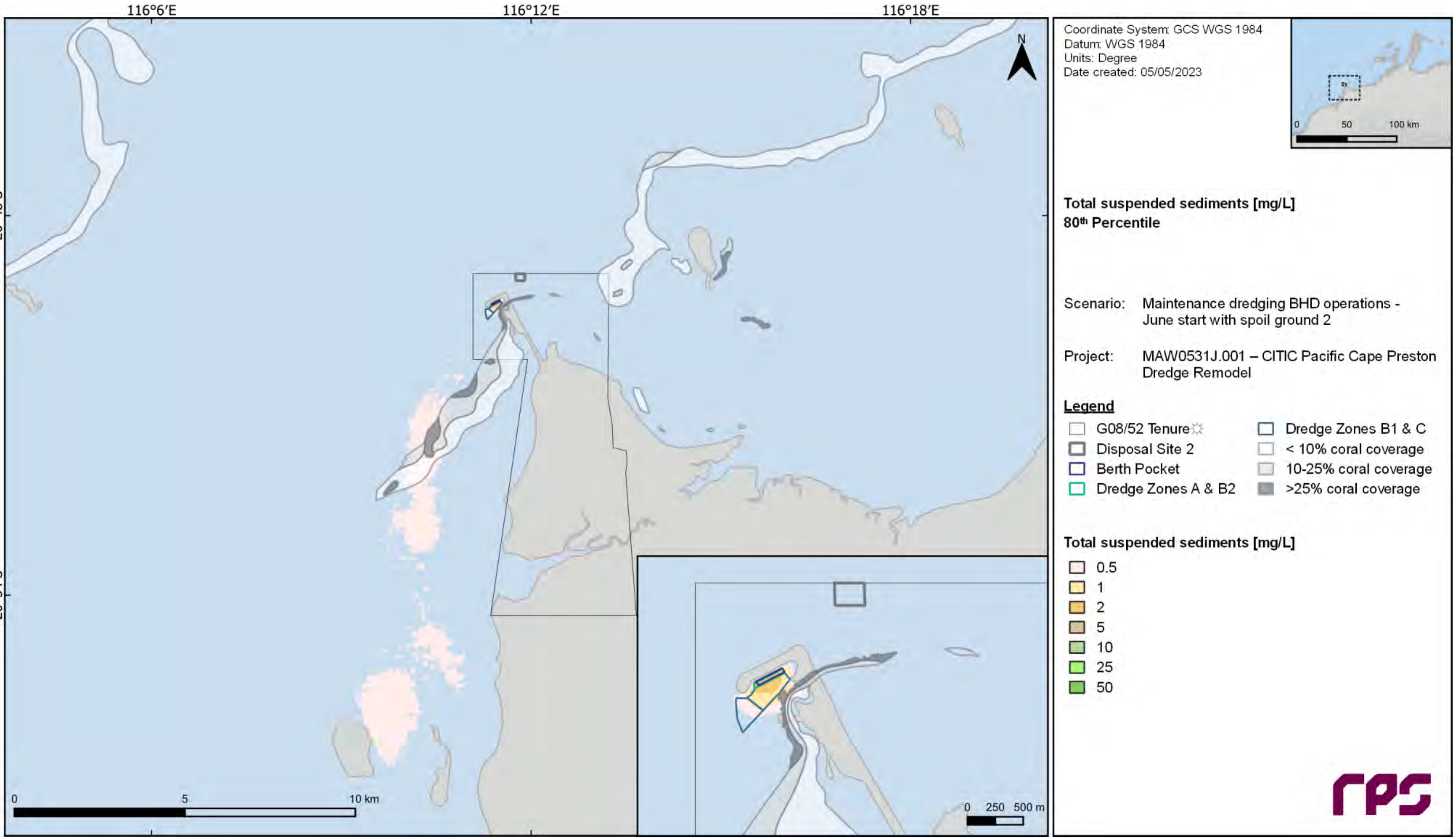

Figure 5.4 Predicted dredge-excess TSSC (mg/L) at the 80th percentile throughout the entire Scenario 2 duration (1 to 29 June 2017).

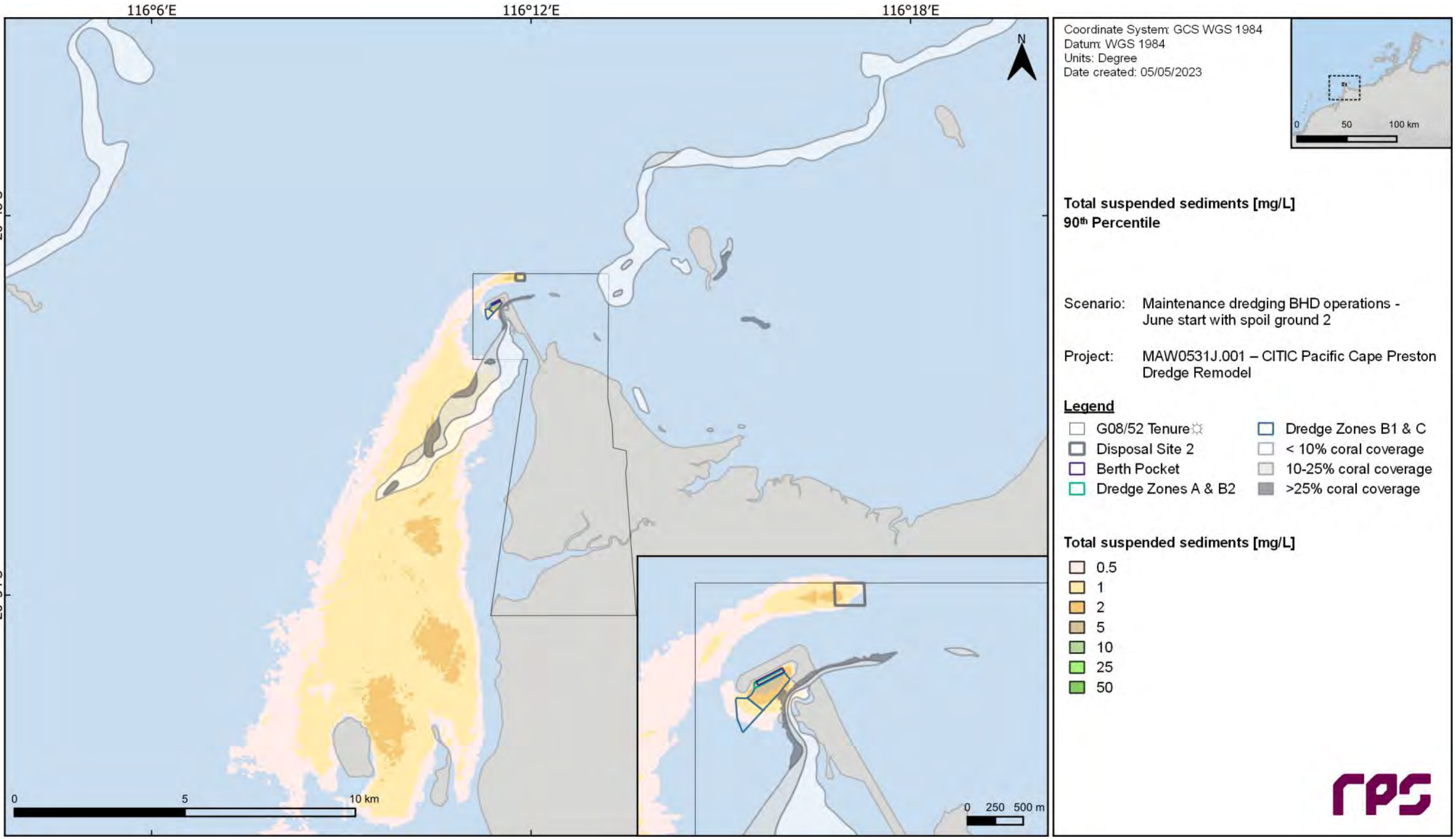

Figure 5.5 **Predicted dredge-excess TSSC (mg/L) at the 90th percentile throughout the entire Scenario 2 duration (1 to 29 June 2017).**

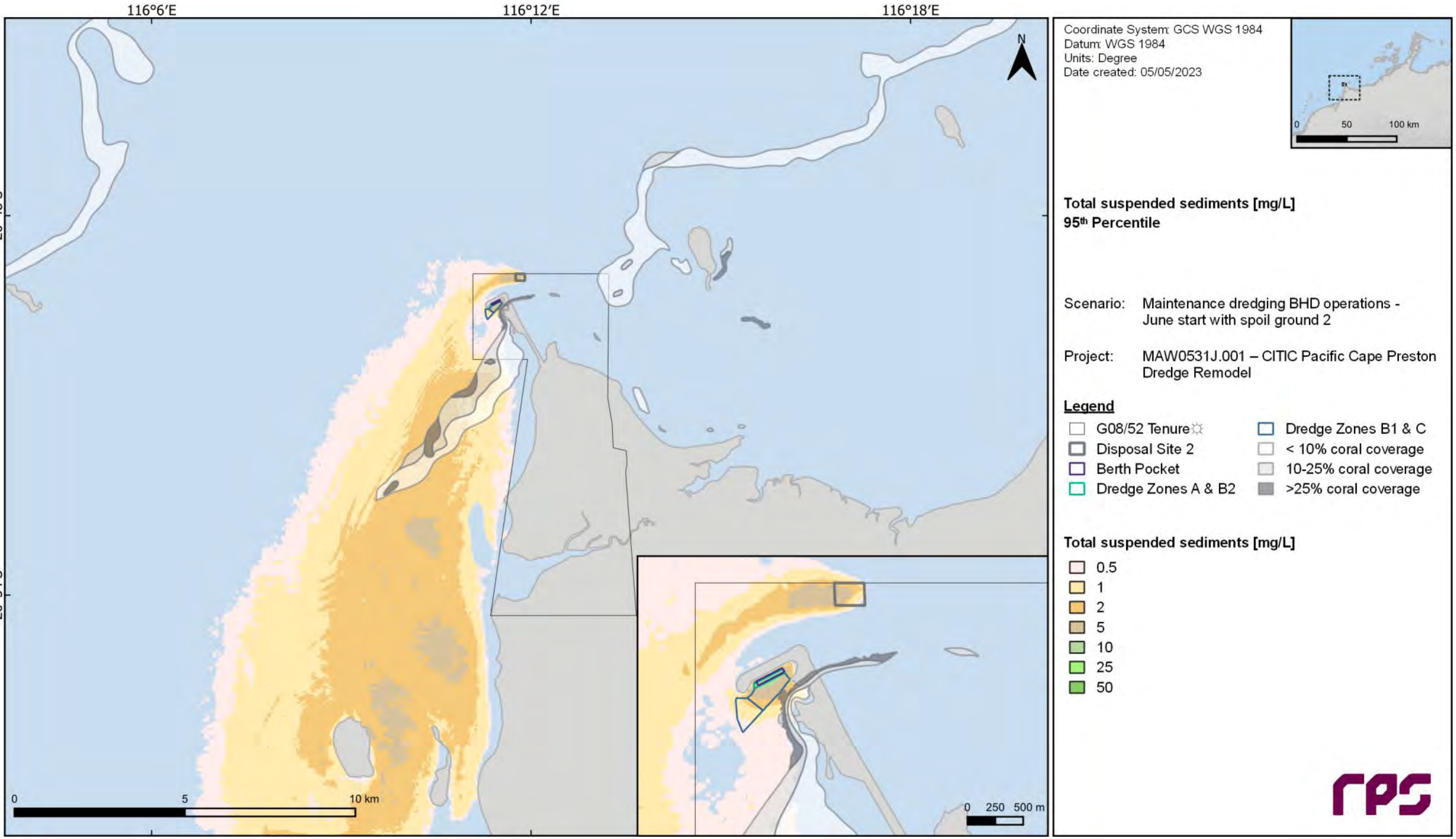

Figure 5.6 **Predicted dredge-excess TSSC (mg/L) at the 95th percentile throughout the entire Scenario 2 duration (1 to 29 June 2017).**

5.1.4.3 Scenario 3: Winter Start for 6-Week Dredge Program Using Spoil Disposal Site 2

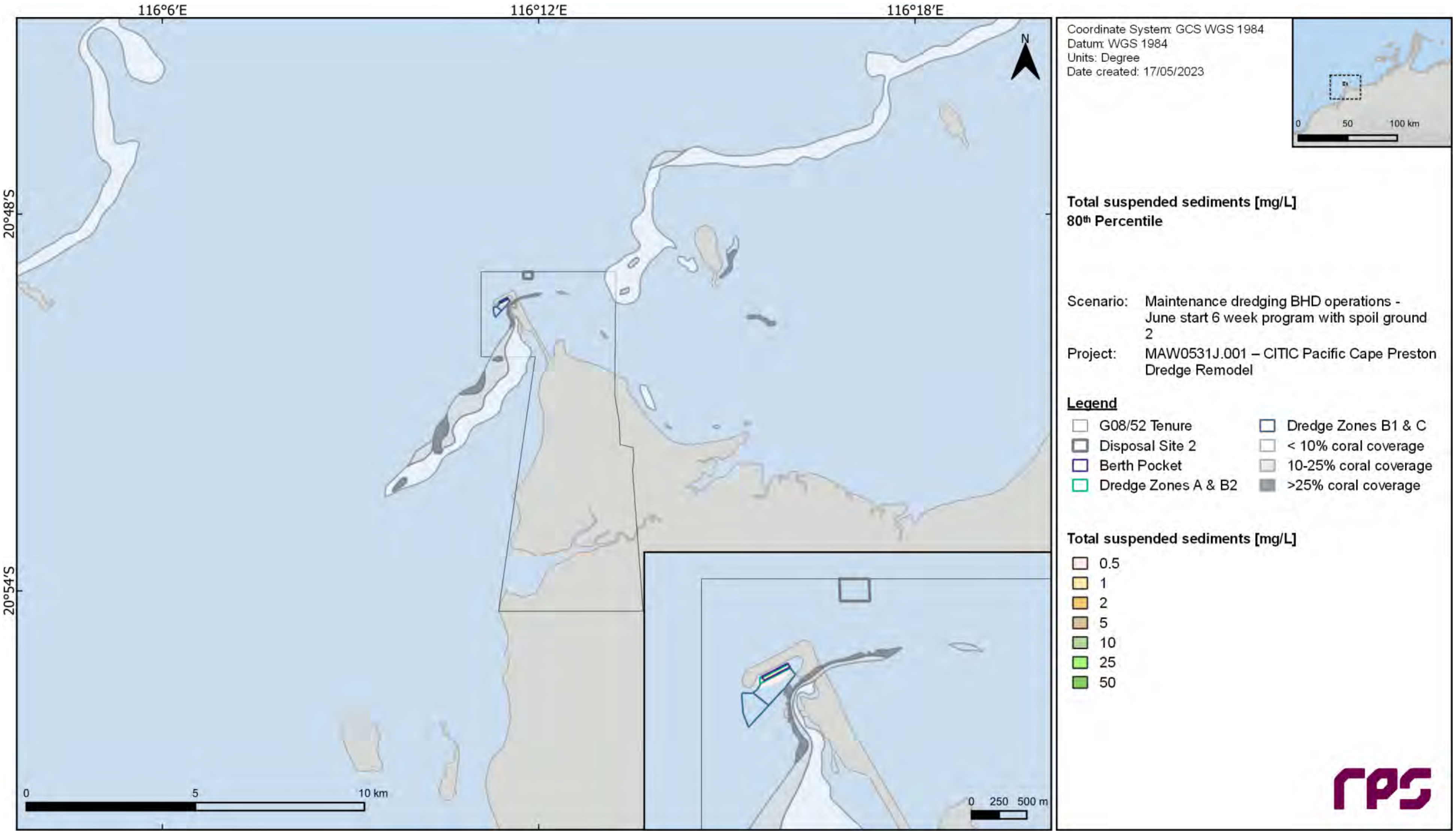

Figure 5.7 Predicted dredge-excess TSSC (mg/L) at the 80th percentile throughout the entire Scenario 3 duration (1 June to 9 August 2017).

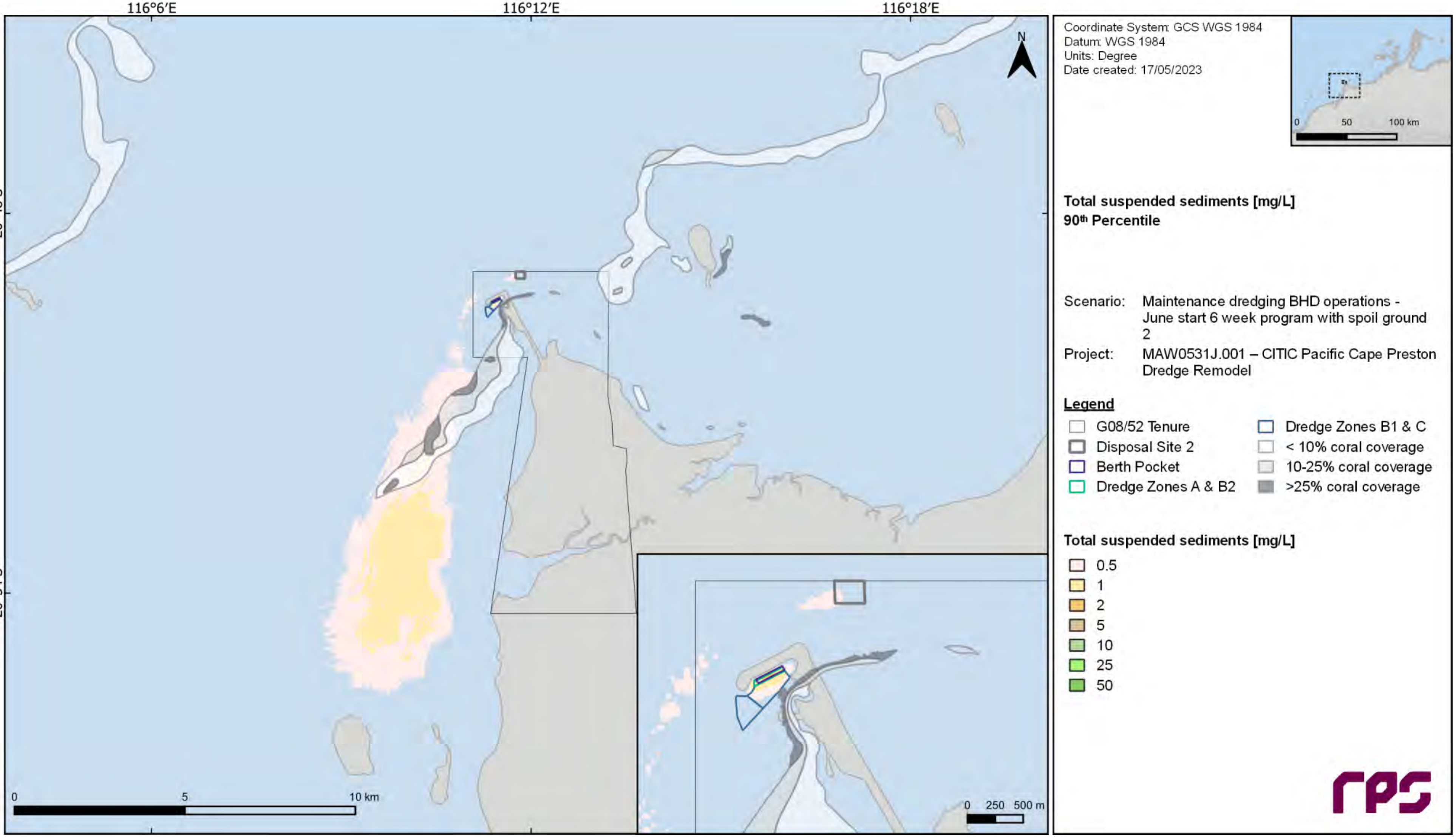

Figure 5.8 **Predicted dredge-excess TSSC (mg/L) at the 90th percentile throughout the entire Scenario 3 duration (1 June to 9 August 2017).**

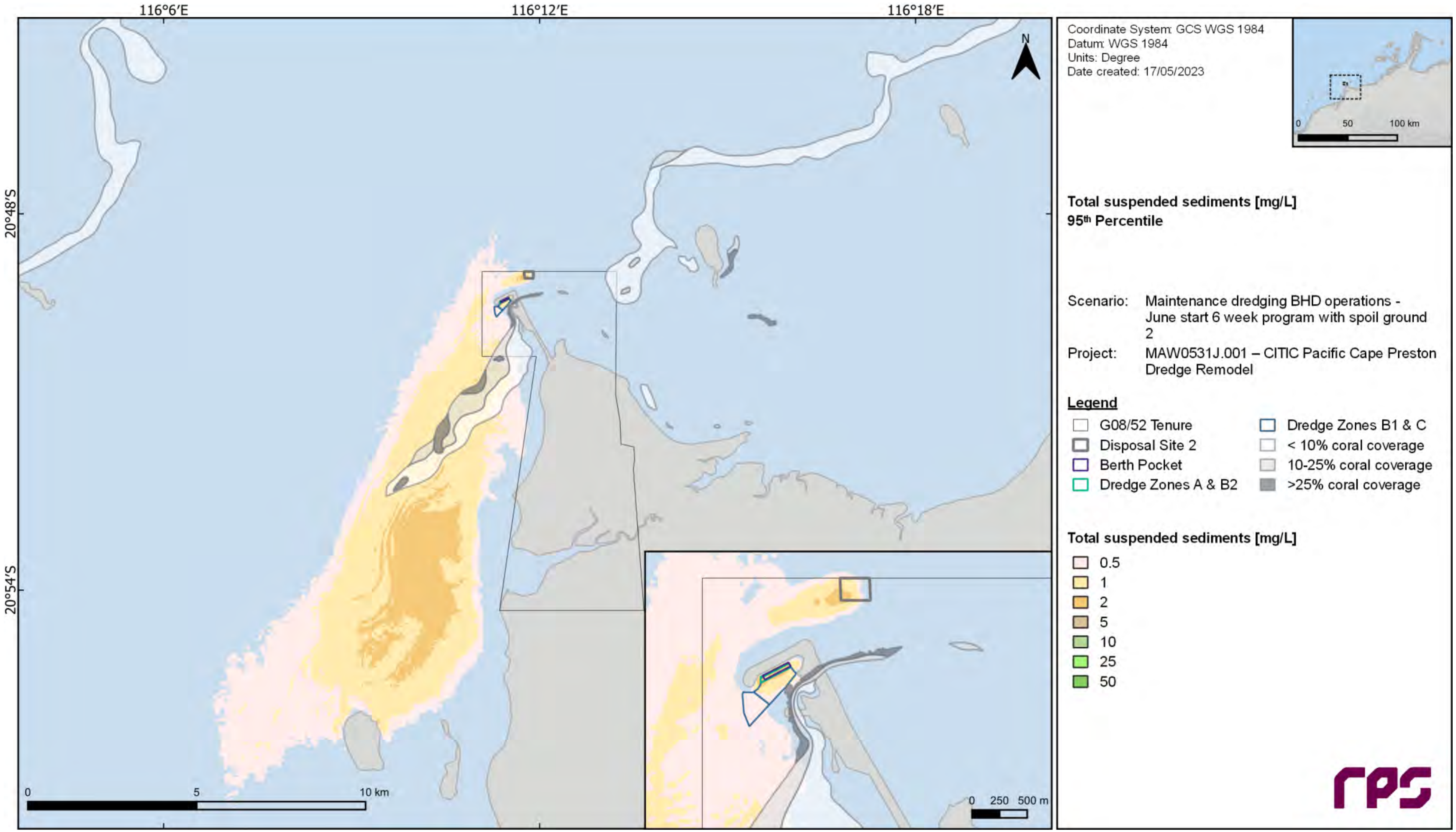

Figure 5.9 Predicted dredge-excess TSSC (mg/L) at the 95th percentile throughout the entire Scenario 3 duration (1 June to 9 August 2017).

5.1.4.4 Scenario 4: Summer Start for 2-Week Dredge Program Using Spoil Disposal Site 1

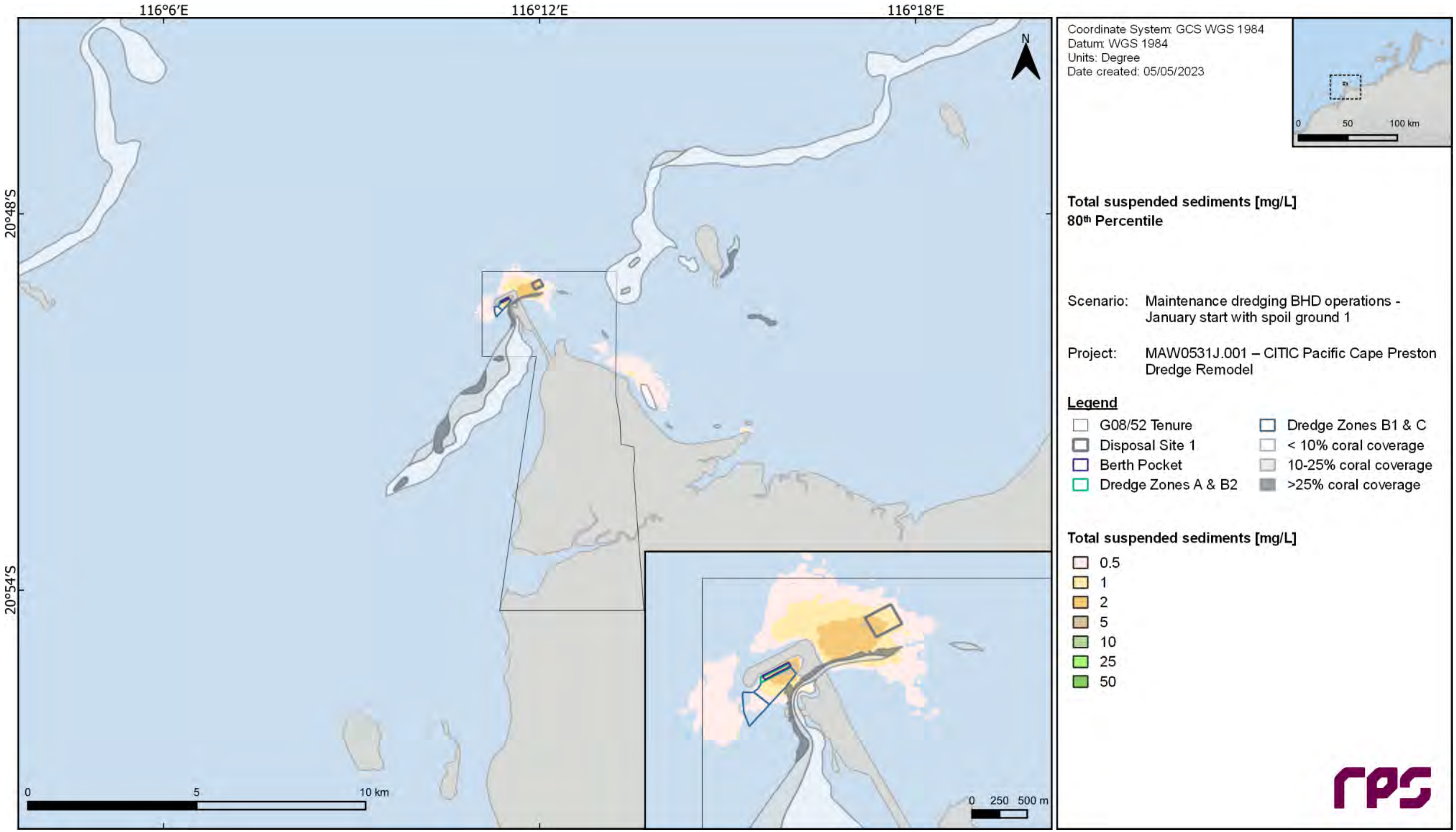

Figure 5.10 Predicted dredge-excess TSSC (mg/L) at the 80th percentile throughout the entire Scenario 4 duration (1 January to 29 January 2017).

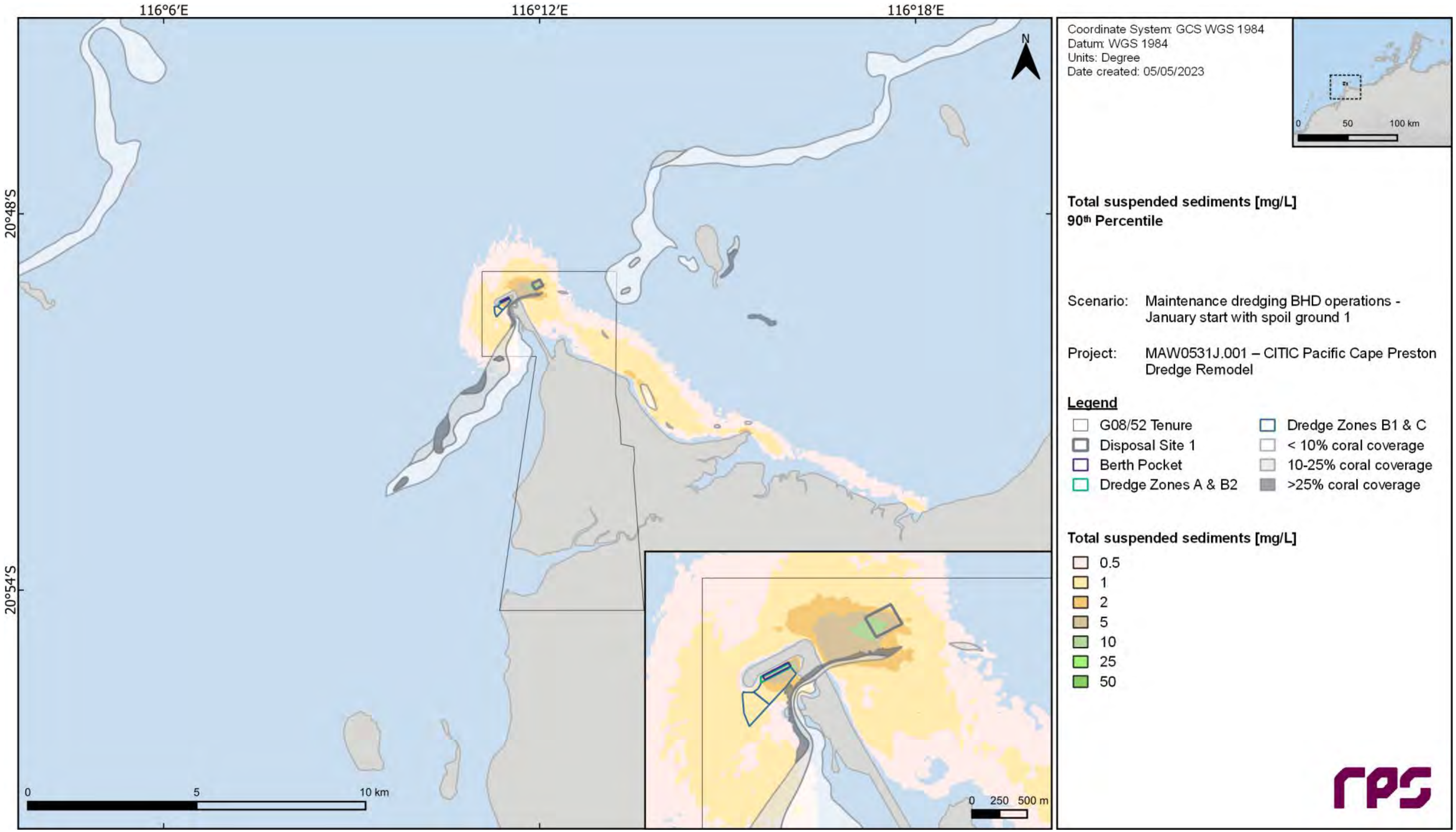

Figure 5.11 Predicted dredge-excess TSSC (mg/L) at the 90th percentile throughout the entire Scenario 4 duration (1 January to 29 January 2017).

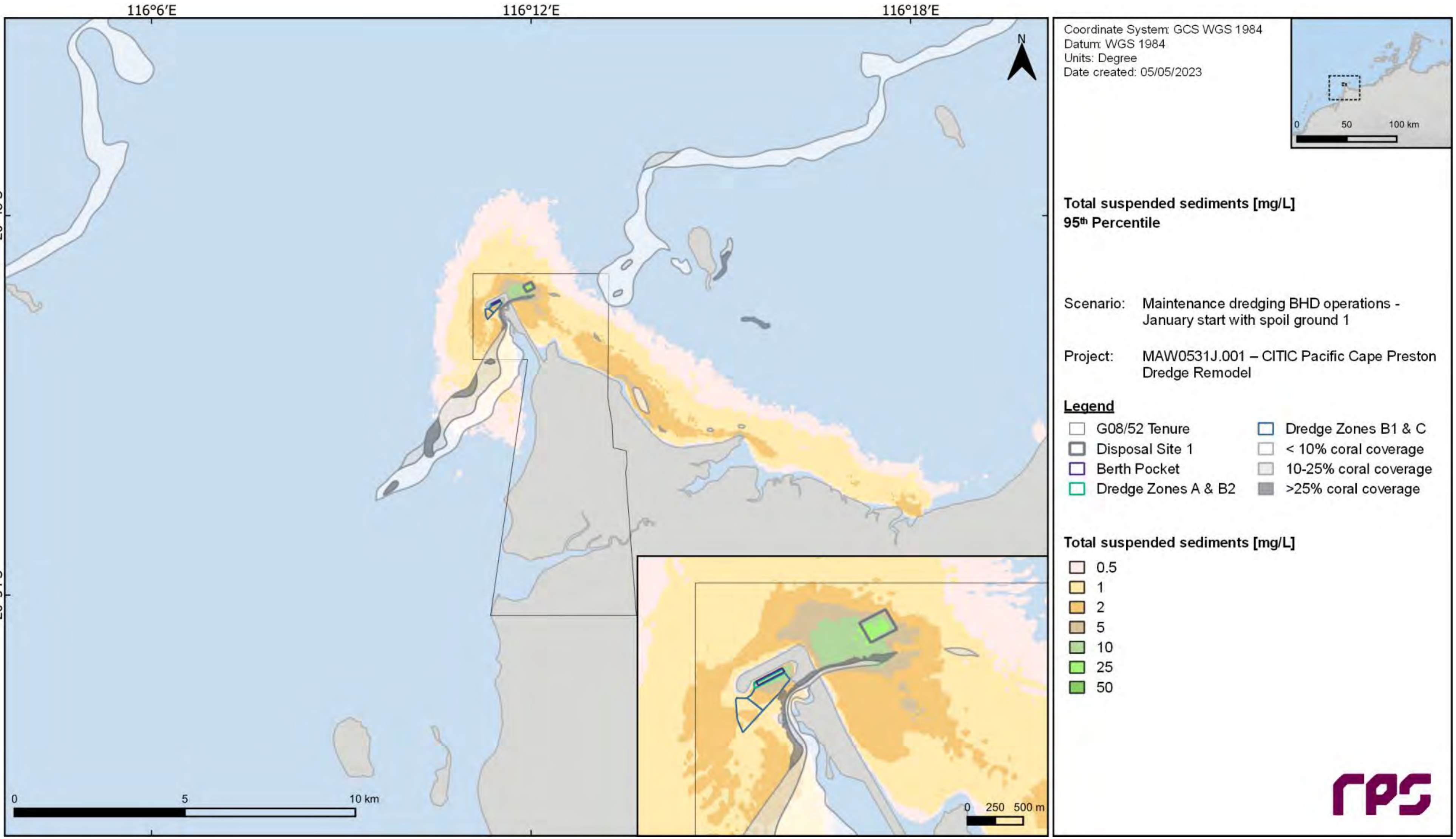

Figure 5.12 Predicted dredge-excess TSSC (mg/L) at the 95th percentile throughout the entire Scenario 4 duration (1 January to 29 January 2017).

5.1.4.5 Scenario 5: Summer Start for 6-Week Dredge Program Using Spoil Disposal Site 2

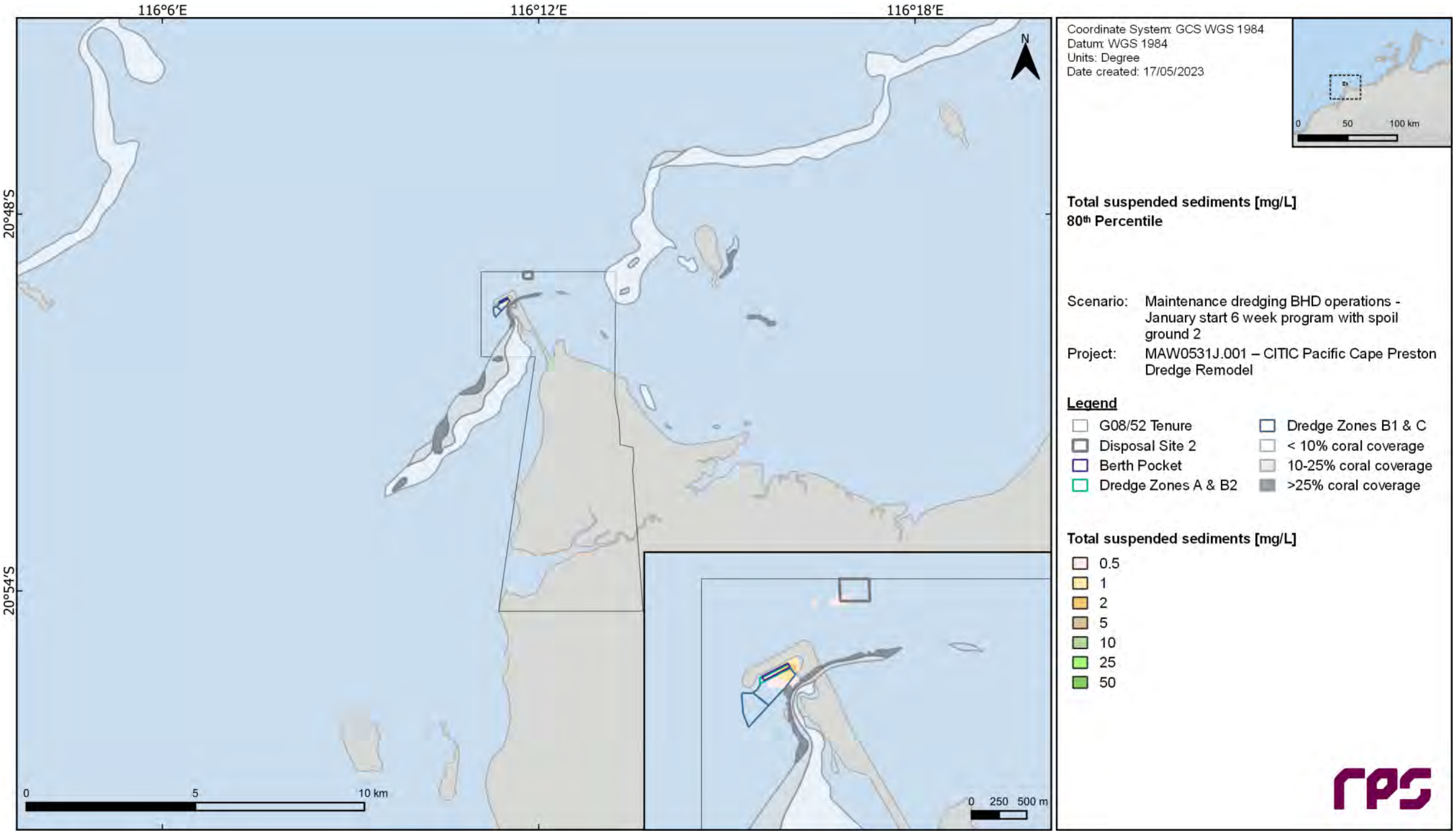

Figure 5.13 Predicted dredge-excess TSSC (mg/L) at the 80th percentile throughout the entire Scenario 5 duration (1 January to 11 March 2017).

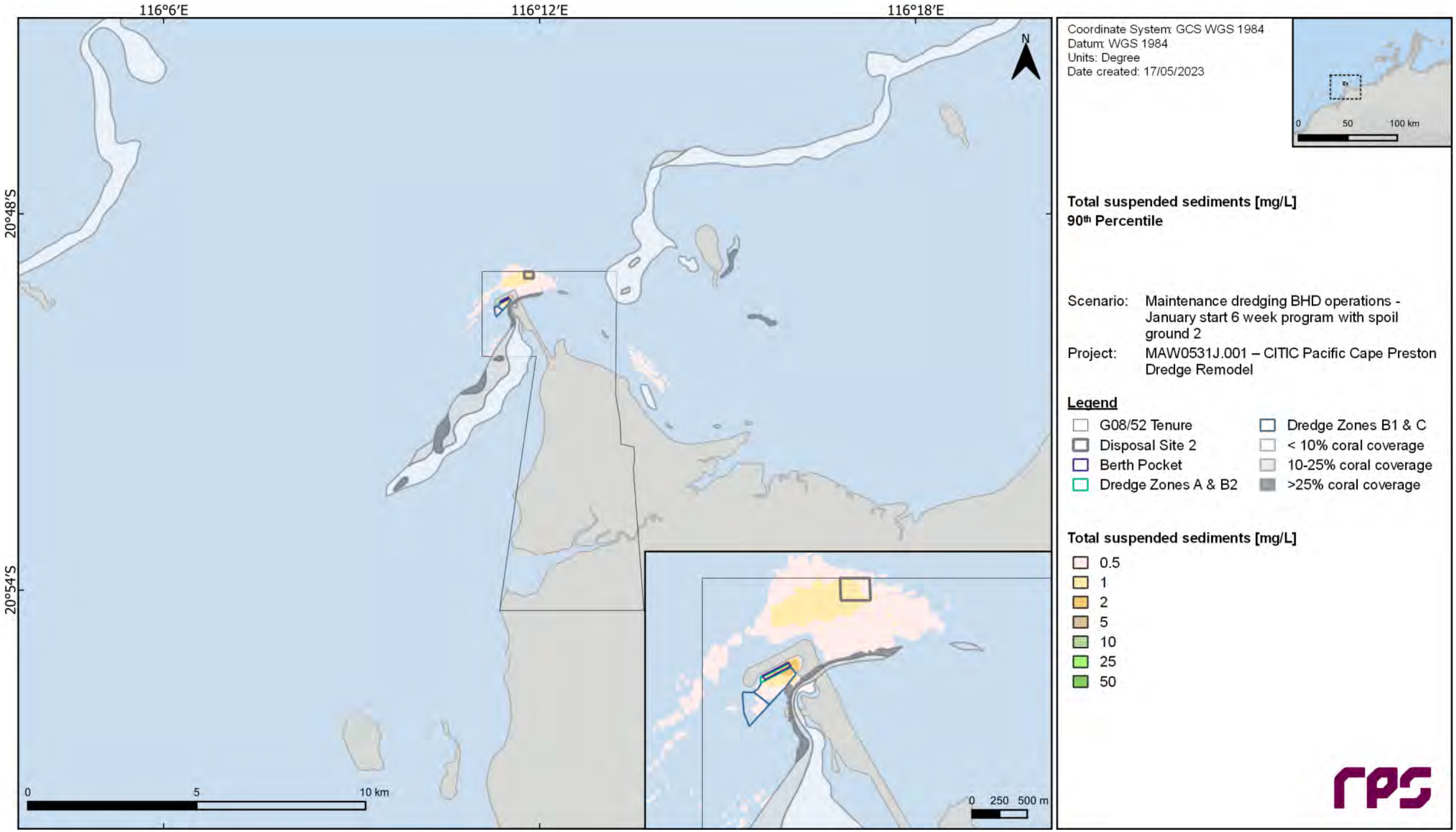

Figure 5.14 Predicted dredge-excess TSSC (mg/L) at the 90th percentile throughout the entire Scenario 5 duration (1 January to 11 March 2017).

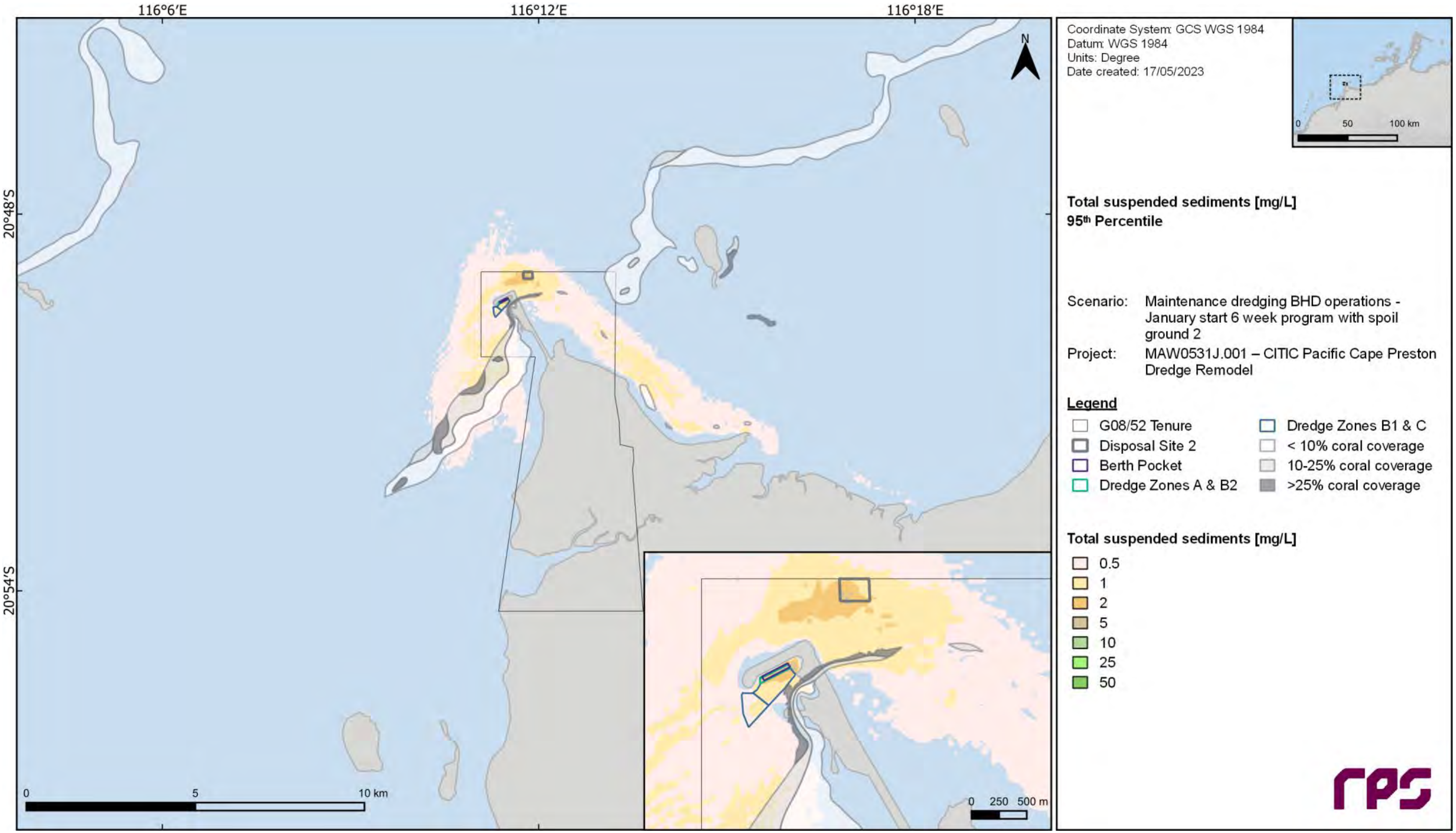

Figure 5.15 **Predicted dredge-excess TSSC (mg/L) at the 95th percentile throughout the entire Scenario 5 duration (1 January to 11 March 2017).**

5.1.5 Sedimentation – Spatial Maps

5.1.5.1 Scenario 1: Winter Start for 2-Week Dredge Program Using Spoil Disposal Site 1

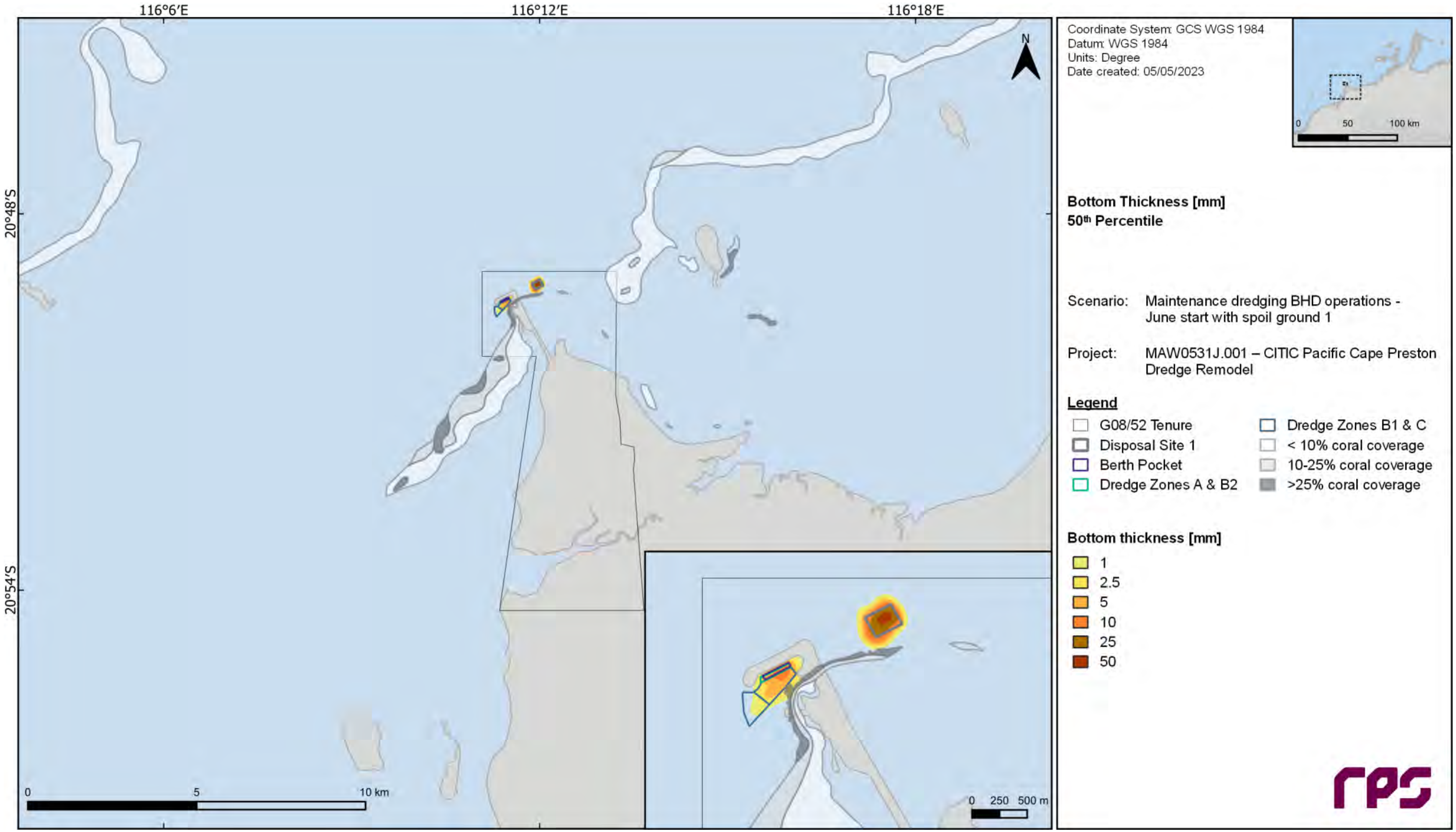

Figure 5.16 Predicted dredge-excess bottom thickness (mm) at the 50th percentile throughout the entire Scenario 1 duration (1 to 29 June 2017).

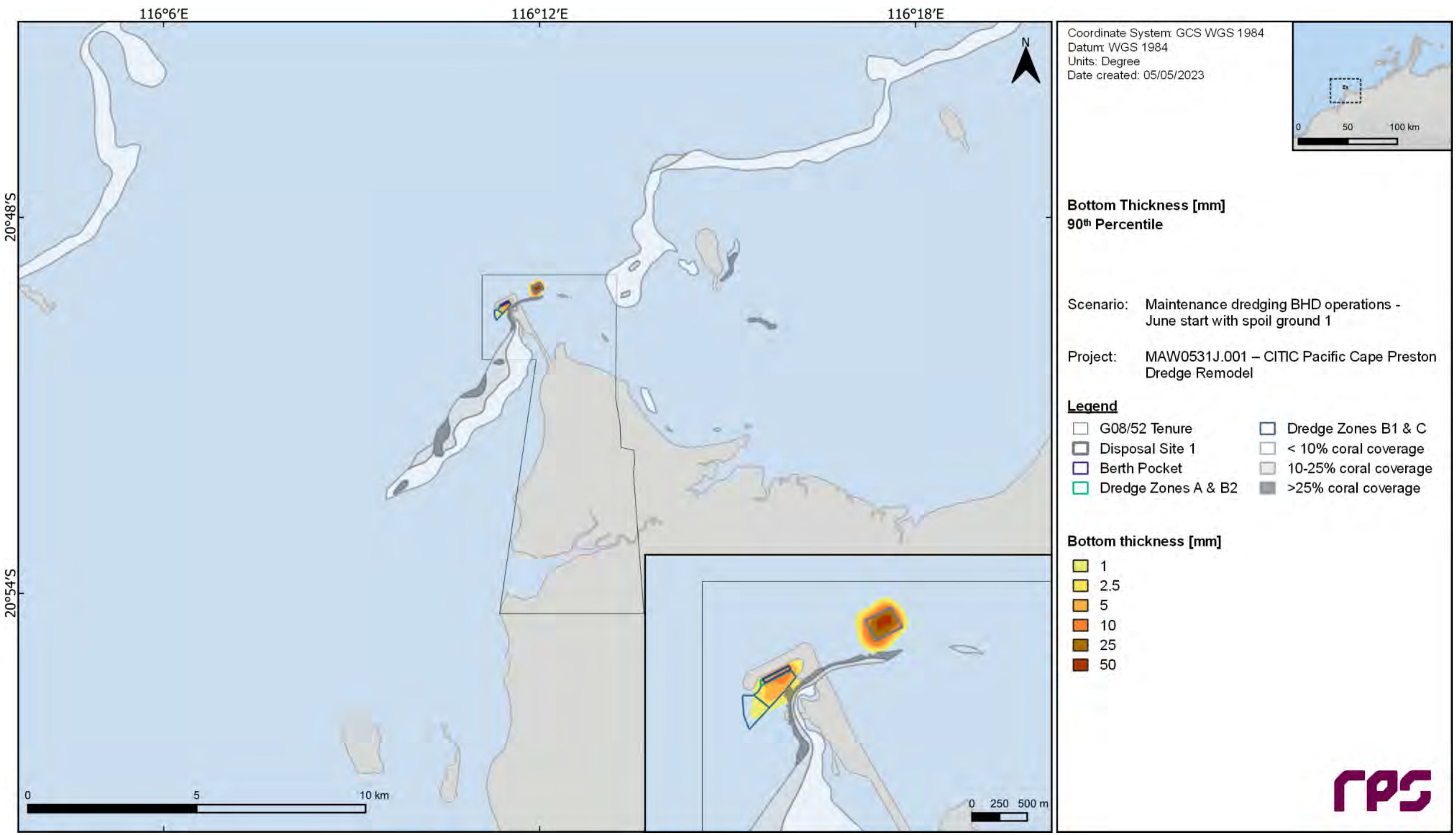

Figure 5.17 Predicted dredge-excess bottom thickness (mm) at the 90th percentile throughout the entire Scenario 1 duration (1 to 29 June 2017).

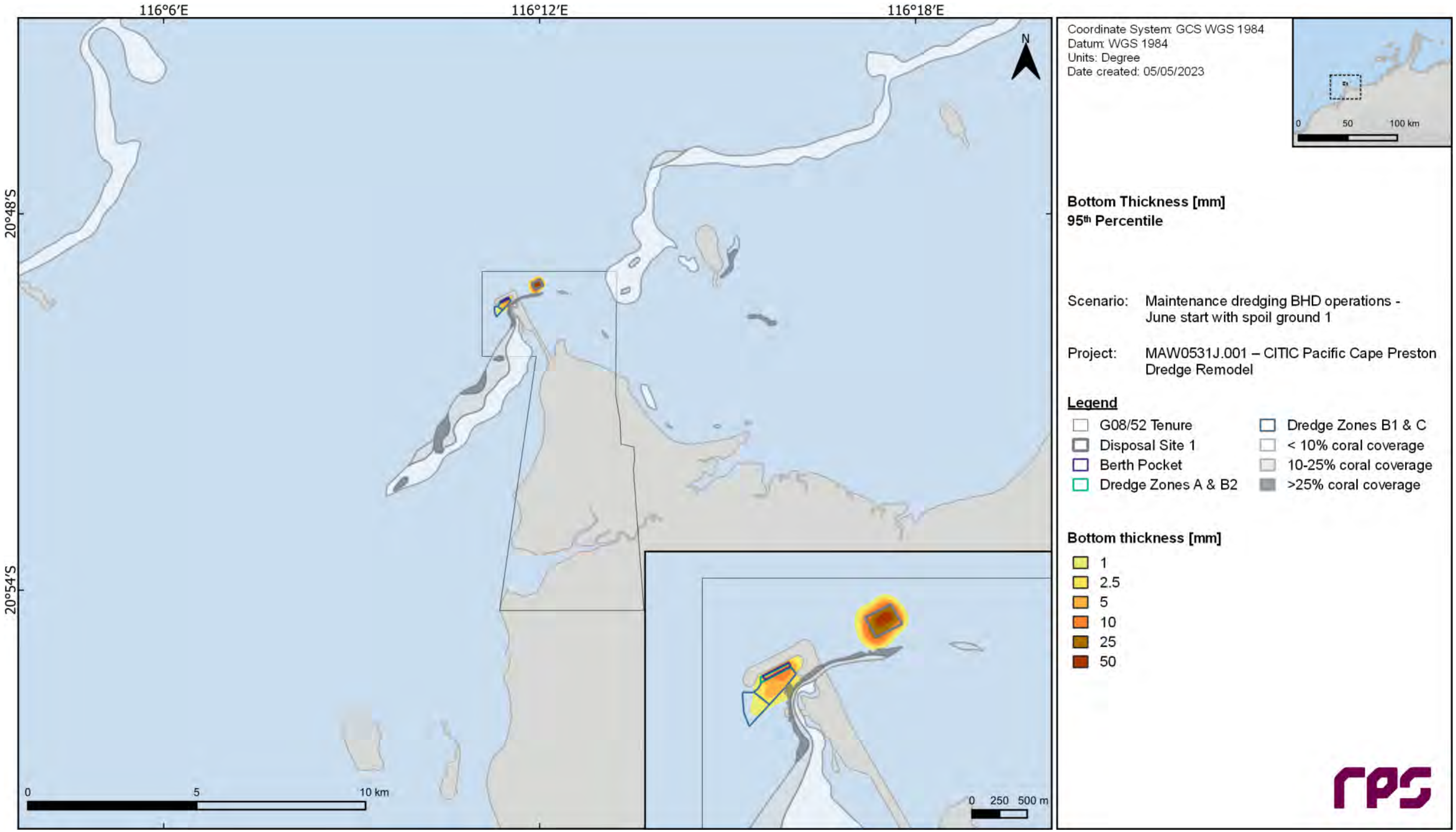

Figure 5.18 Predicted dredge-excess bottom thickness (mm) at the 95th percentile throughout the entire Scenario 1 duration (1 to 29 June 2017).

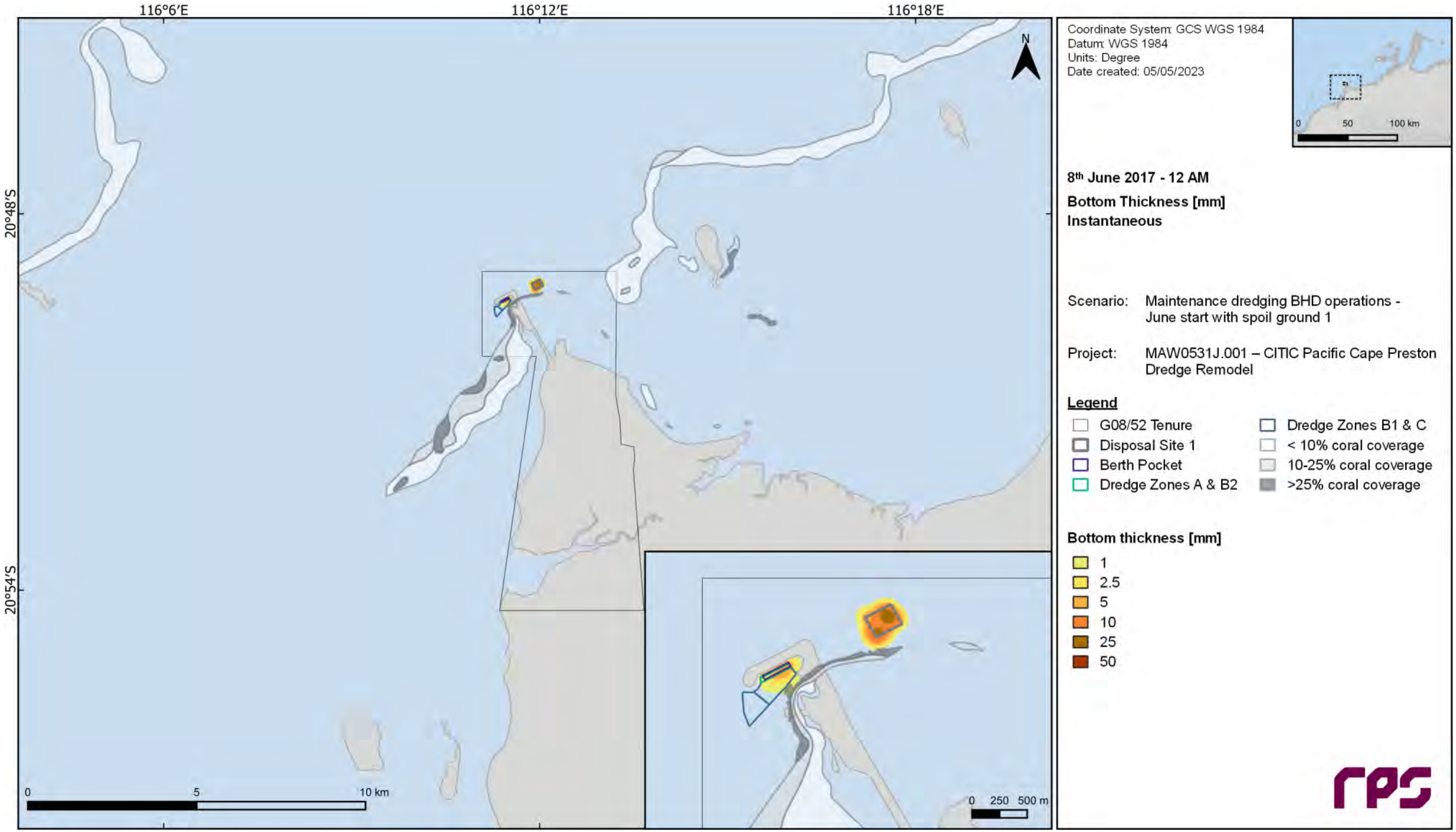

Figure 5.19 Snapshot of predicted dredge-excess bottom thickness (mm) at the end of Week 1 (8 June 2017) in Scenario 1.

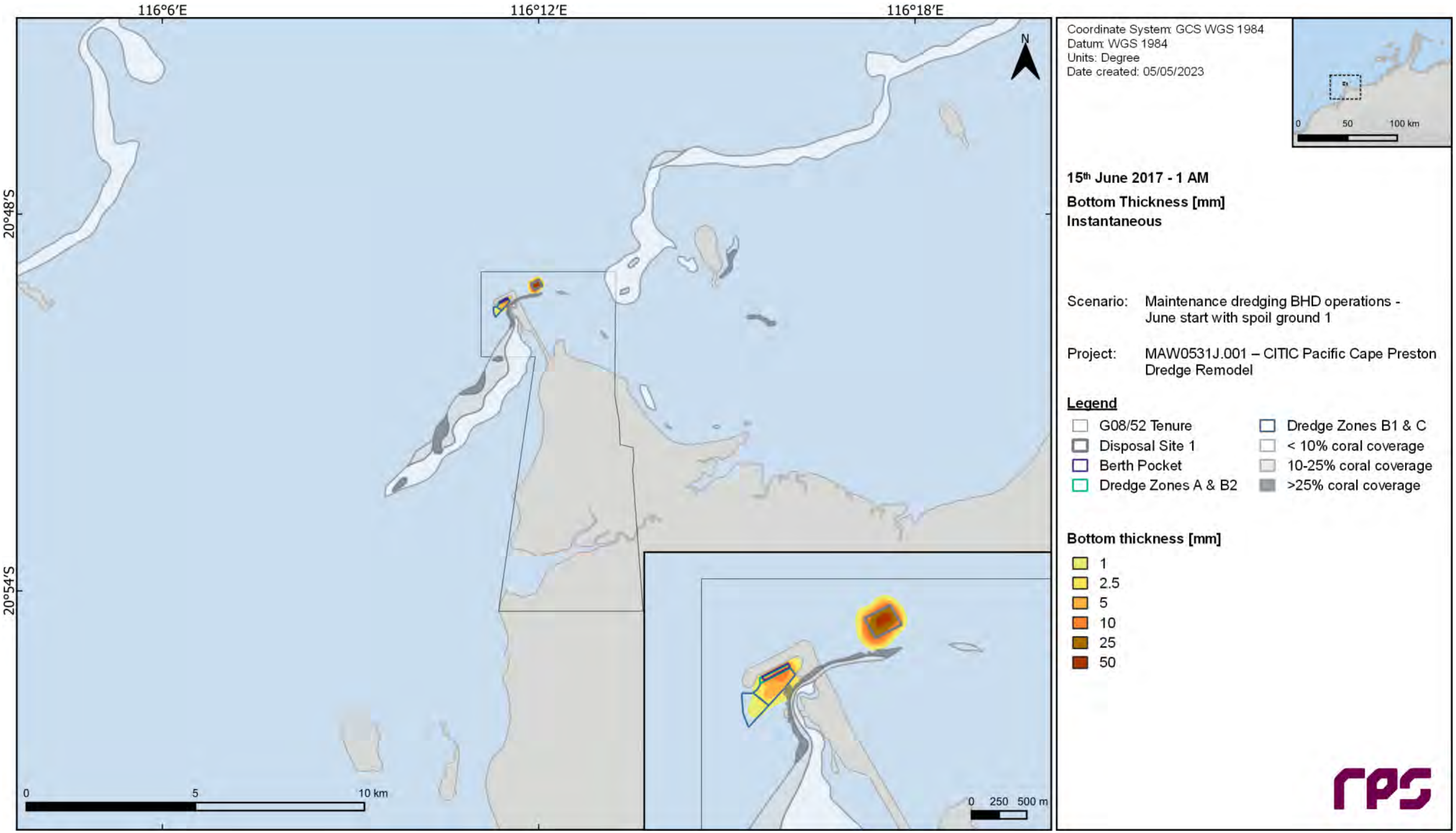

Figure 5.20 Snapshot of predicted dredge-excess bottom thickness (mm) at the end of Week 2 (15 June 2017) in Scenario 1.

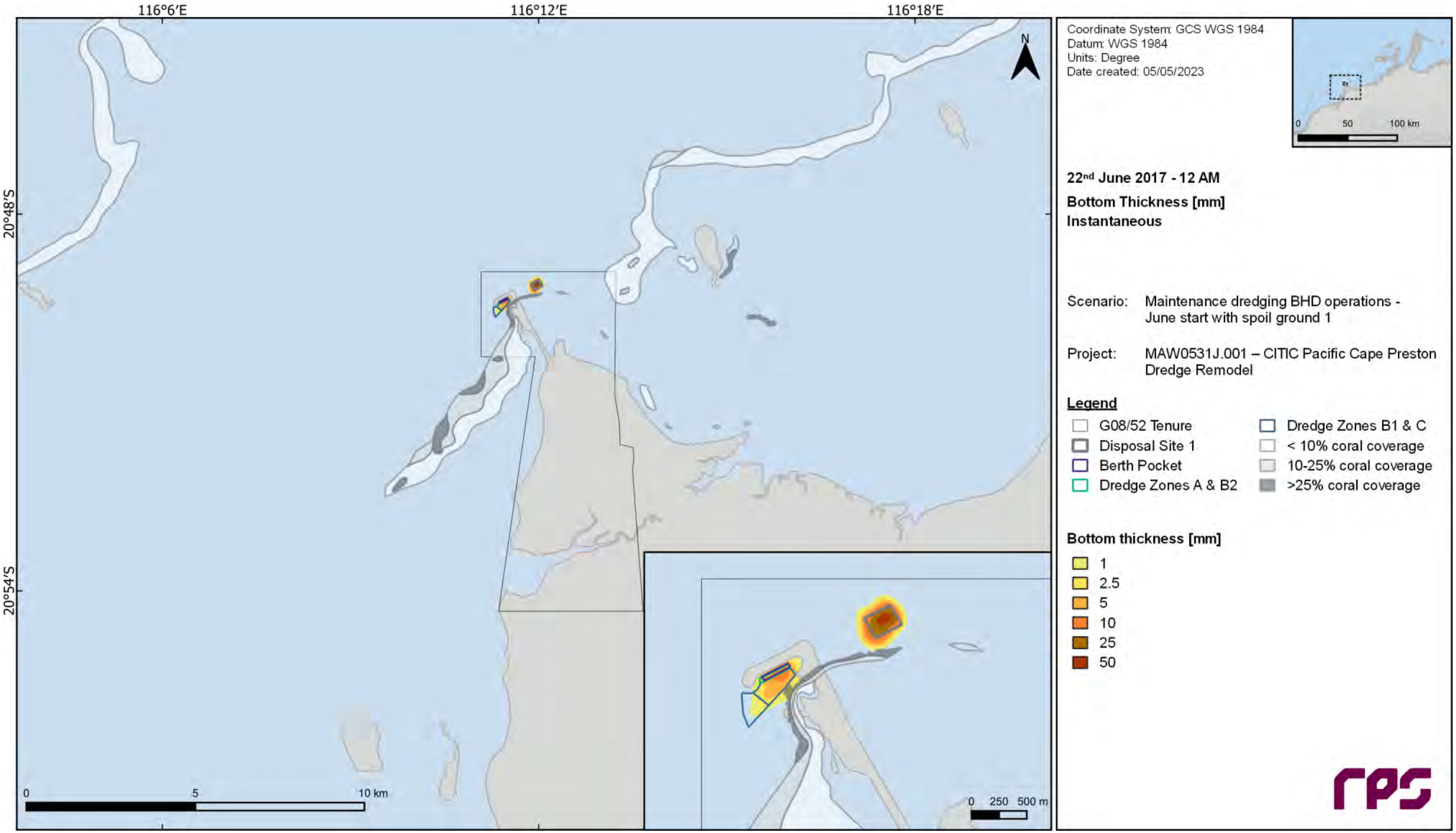

Figure 5.21 Snapshot of predicted dredge-excess bottom thickness (mm) at the end of Week 3 (22 June 2017) in Scenario 1.

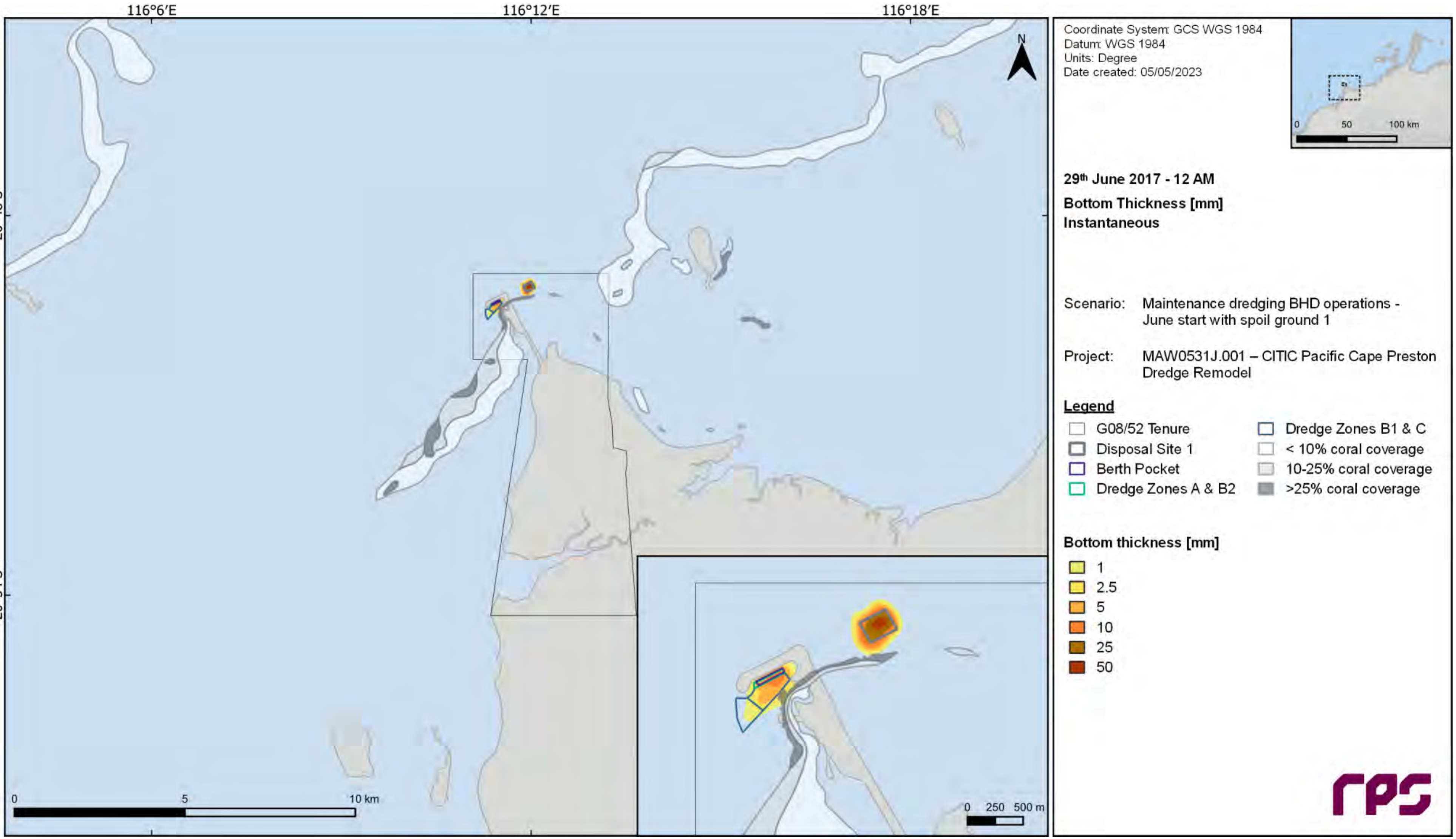

Figure 5.22 Snapshot of predicted dredge-excess bottom thickness (mm) at the end of the simulation (29 June 2017) in Scenario 1.

5.1.5.2 Scenario 2: Winter Start for 2-Week Dredge Program Using Spoil Disposal Site 2

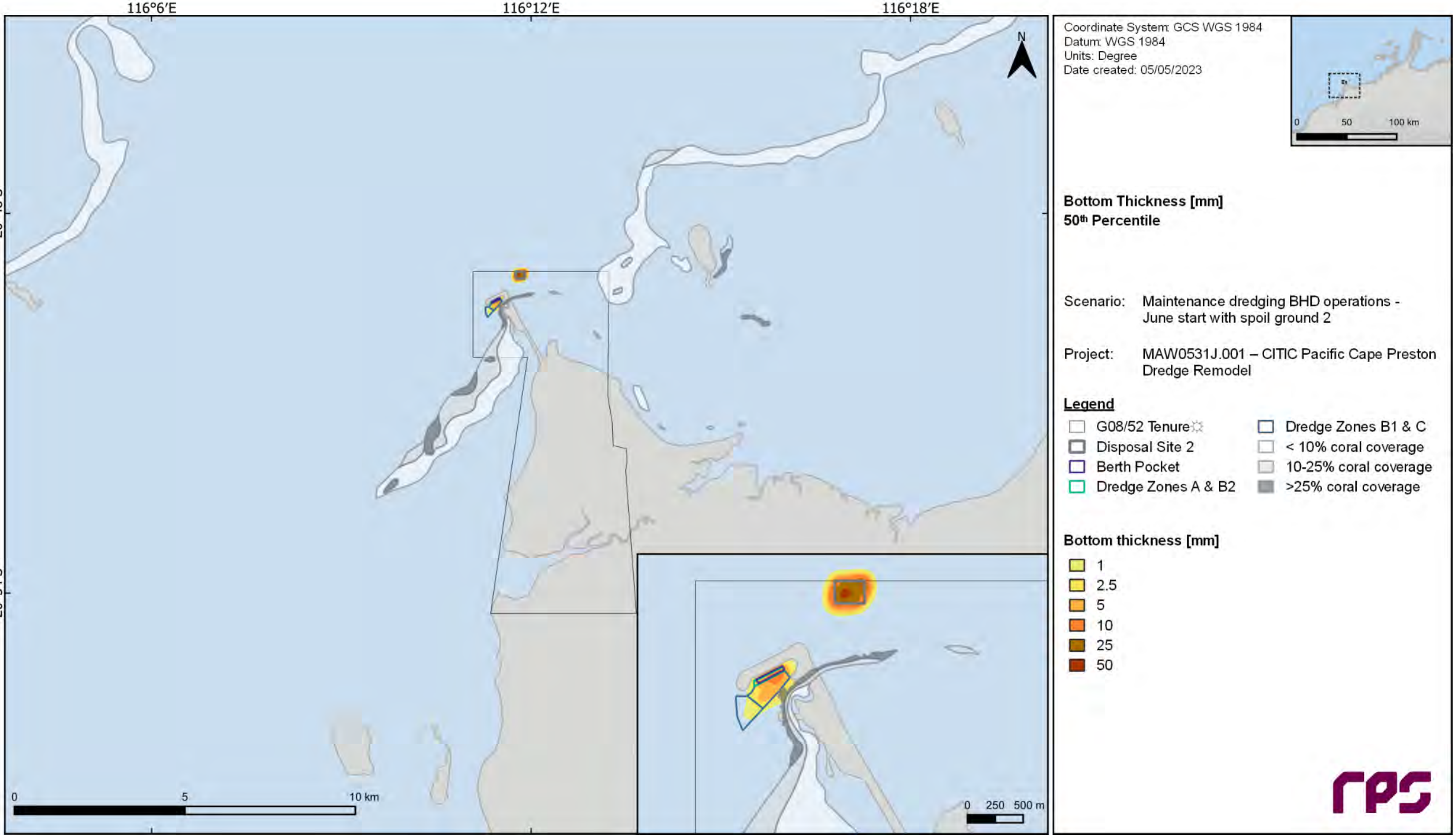

Figure 5.23 Predicted dredge-excess bottom thickness (mm) at the 50th percentile throughout the entire Scenario 2 duration (1 to 29 June 2017).

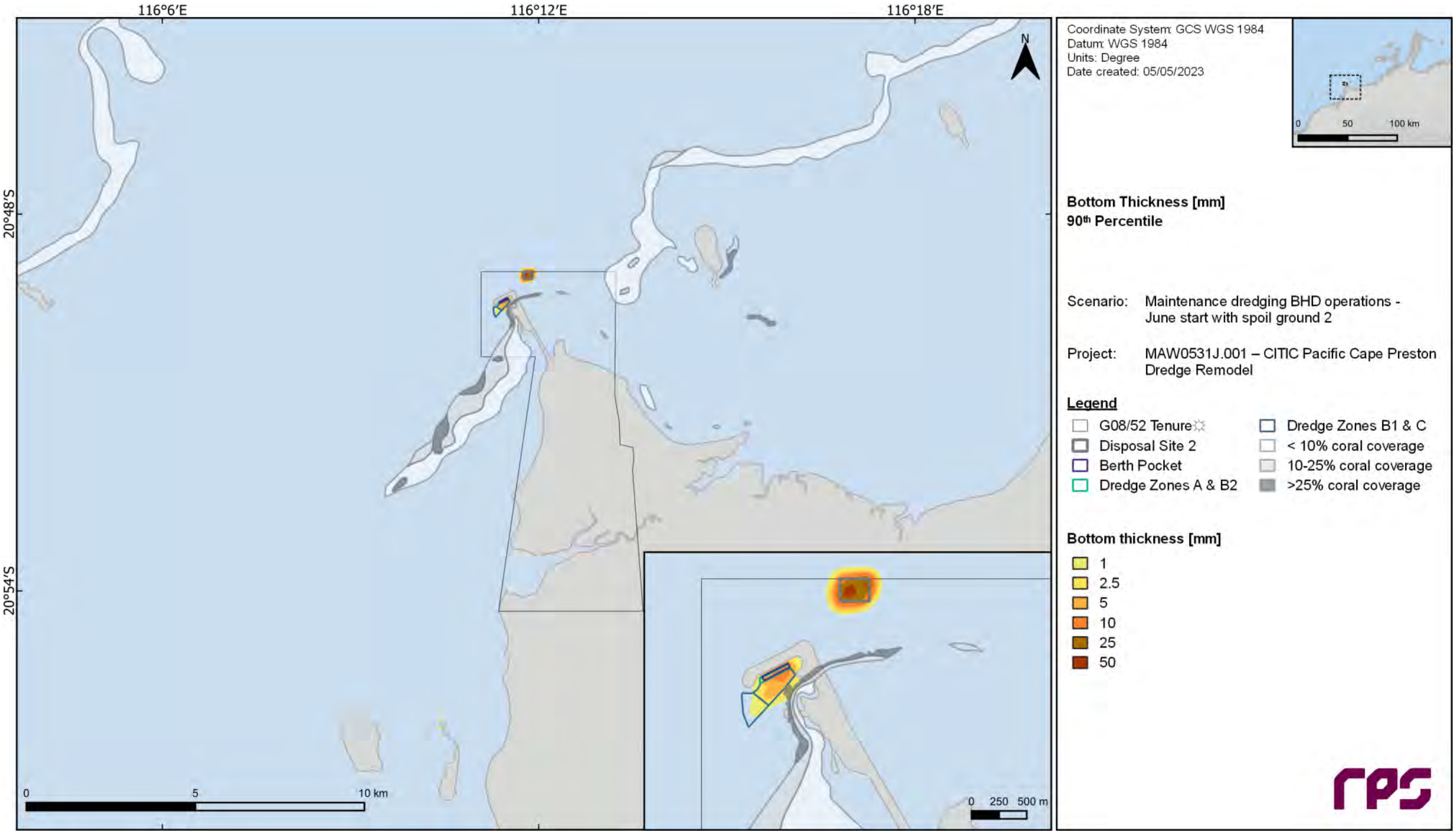

Figure 5.24 Predicted dredge-excess bottom thickness (mm) at the 90th percentile throughout the entire Scenario 2 duration (1 to 29 June 2017).

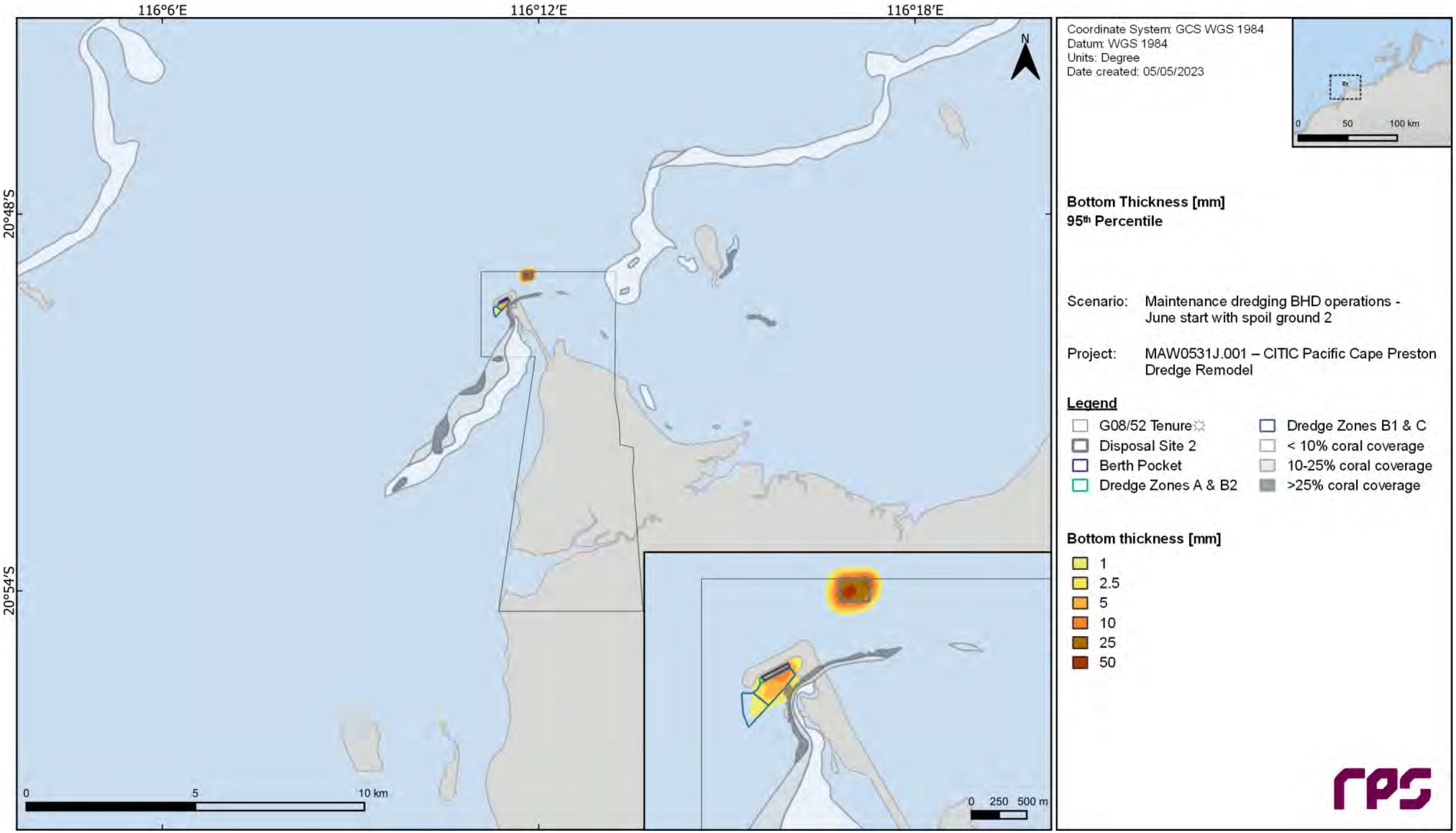

Figure 5.25 Predicted dredge-excess bottom thickness (mm) at the 95th percentile throughout the entire Scenario 2 duration (1 to 29 June 2017).

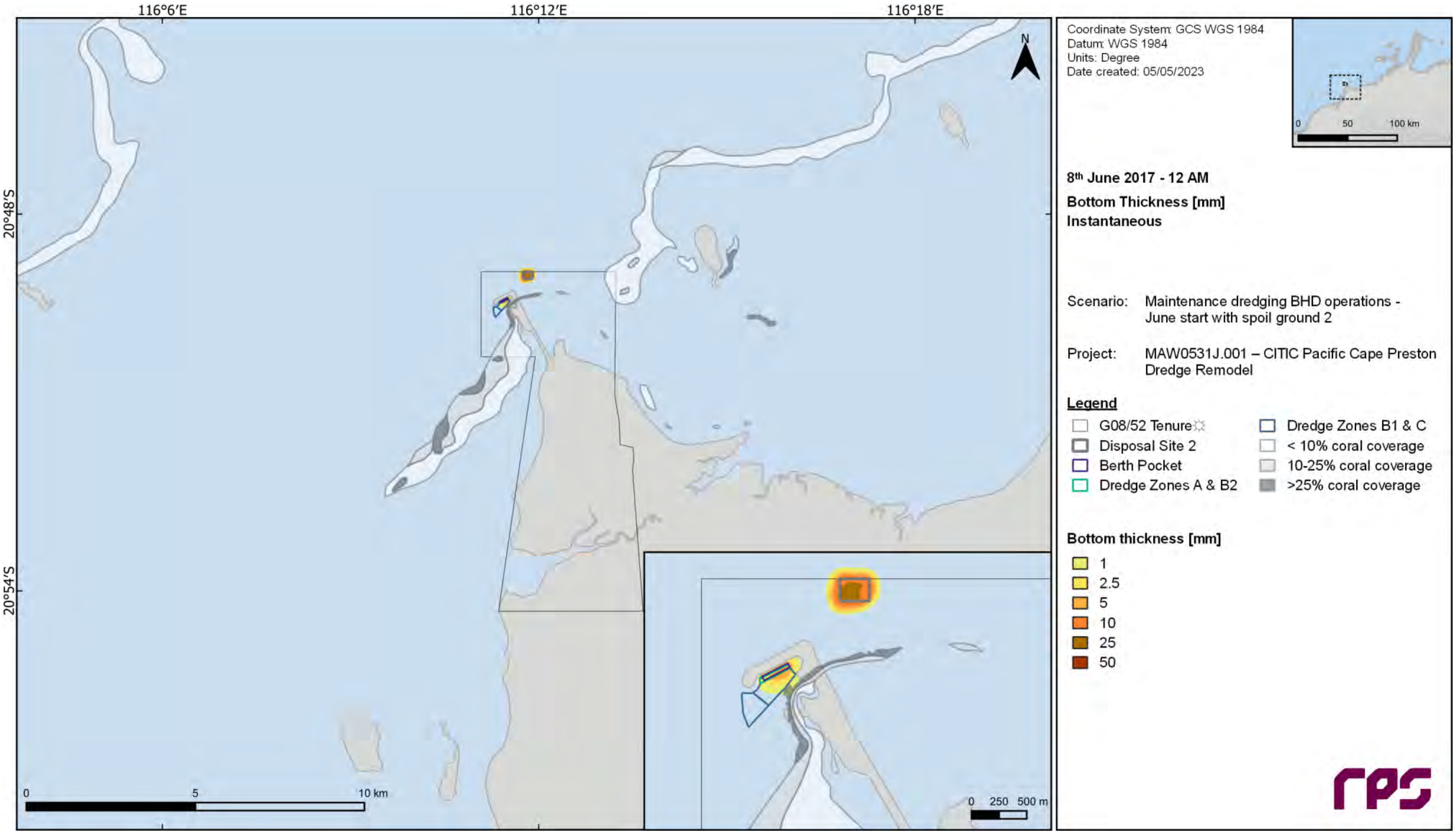

Figure 5.26 Snapshot of predicted dredge-excess bottom thickness (mm) at the end of Week 1 (8 June 2017) in Scenario 2.

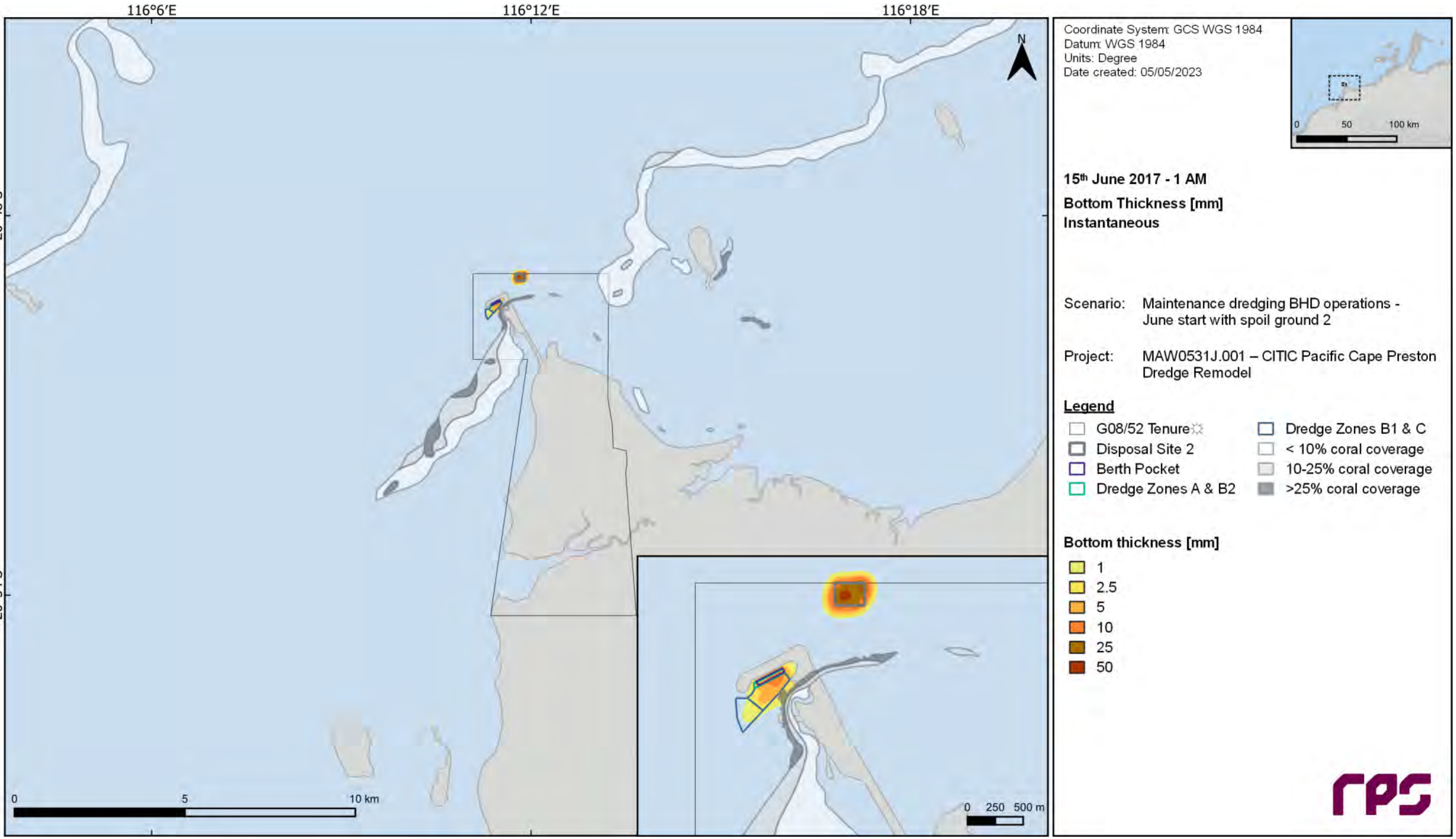

Figure 5.27 Snapshot of predicted dredge-excess bottom thickness (mm) at the end of Week 2 (15 June 2017) in Scenario 2.

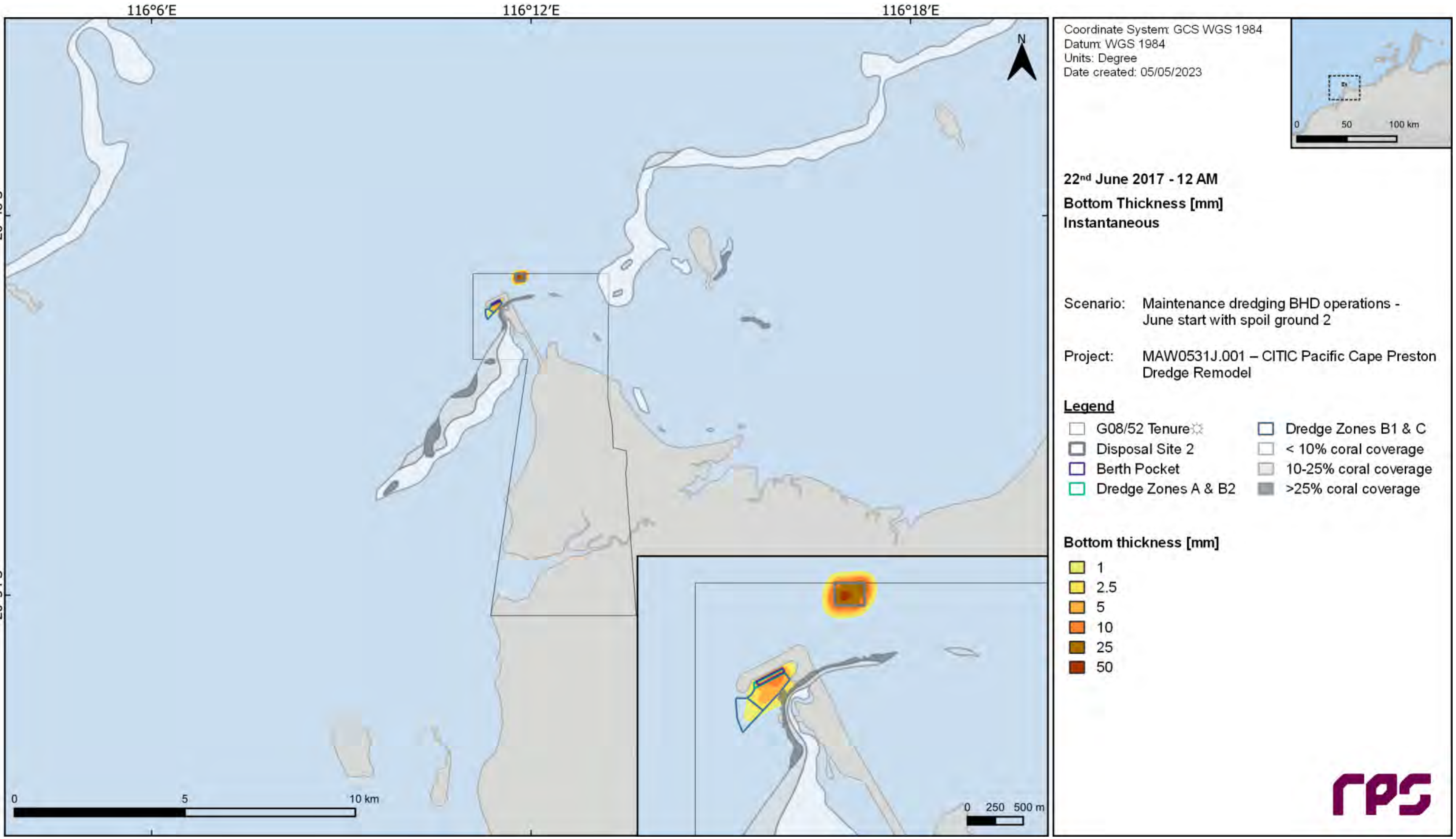

Figure 5.28 Snapshot of predicted dredge-excess bottom thickness (mm) at the end of Week 3 (22 June 2017) in Scenario 2.

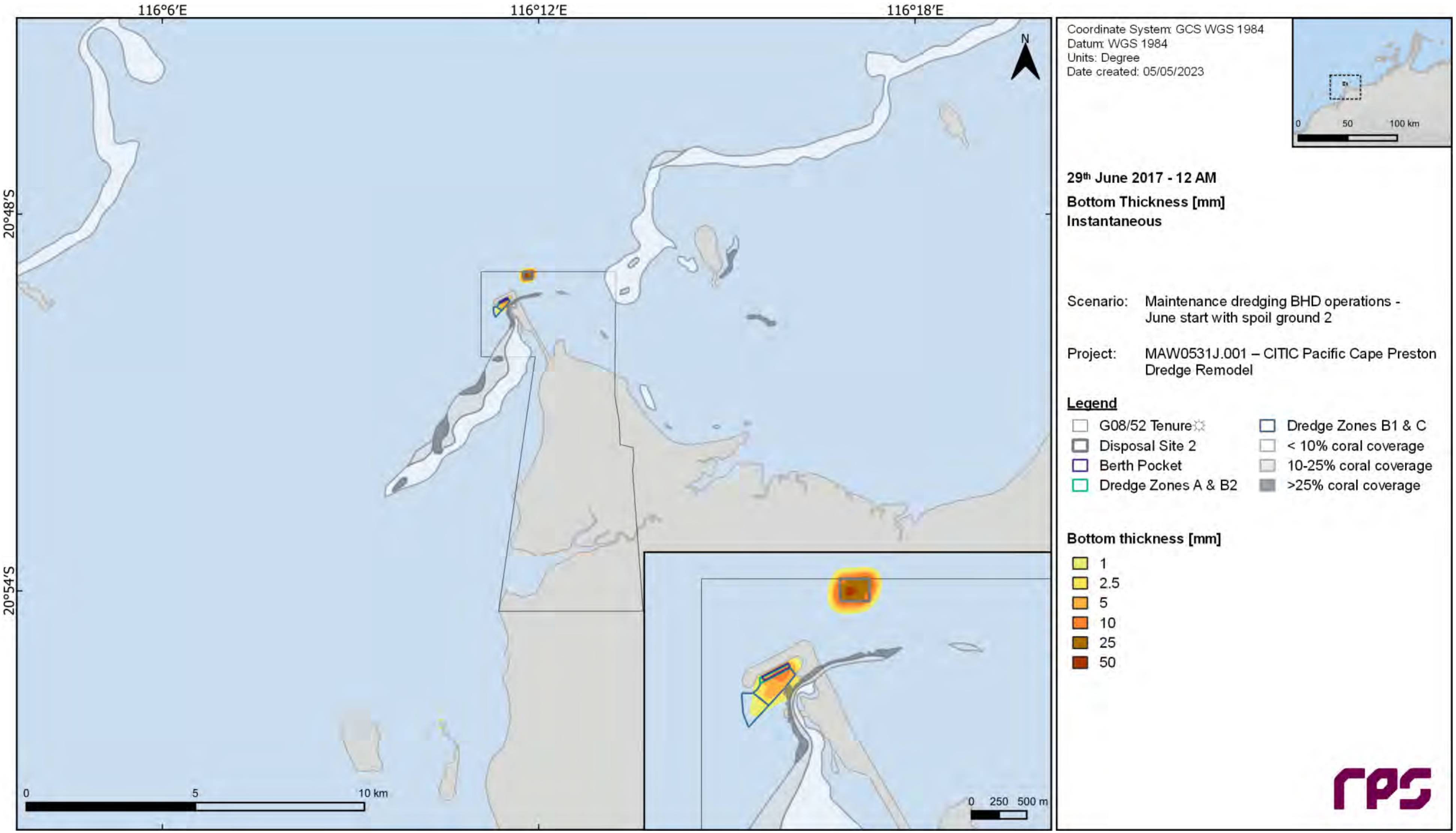

Figure 5.29 Snapshot of predicted dredge-excess bottom thickness (mm) at the end of the simulation (29 June 2017) in Scenario 2.

5.1.5.3 Scenario 3: Winter Start for 6-Week Dredge Program Using Spoil Disposal Site 2

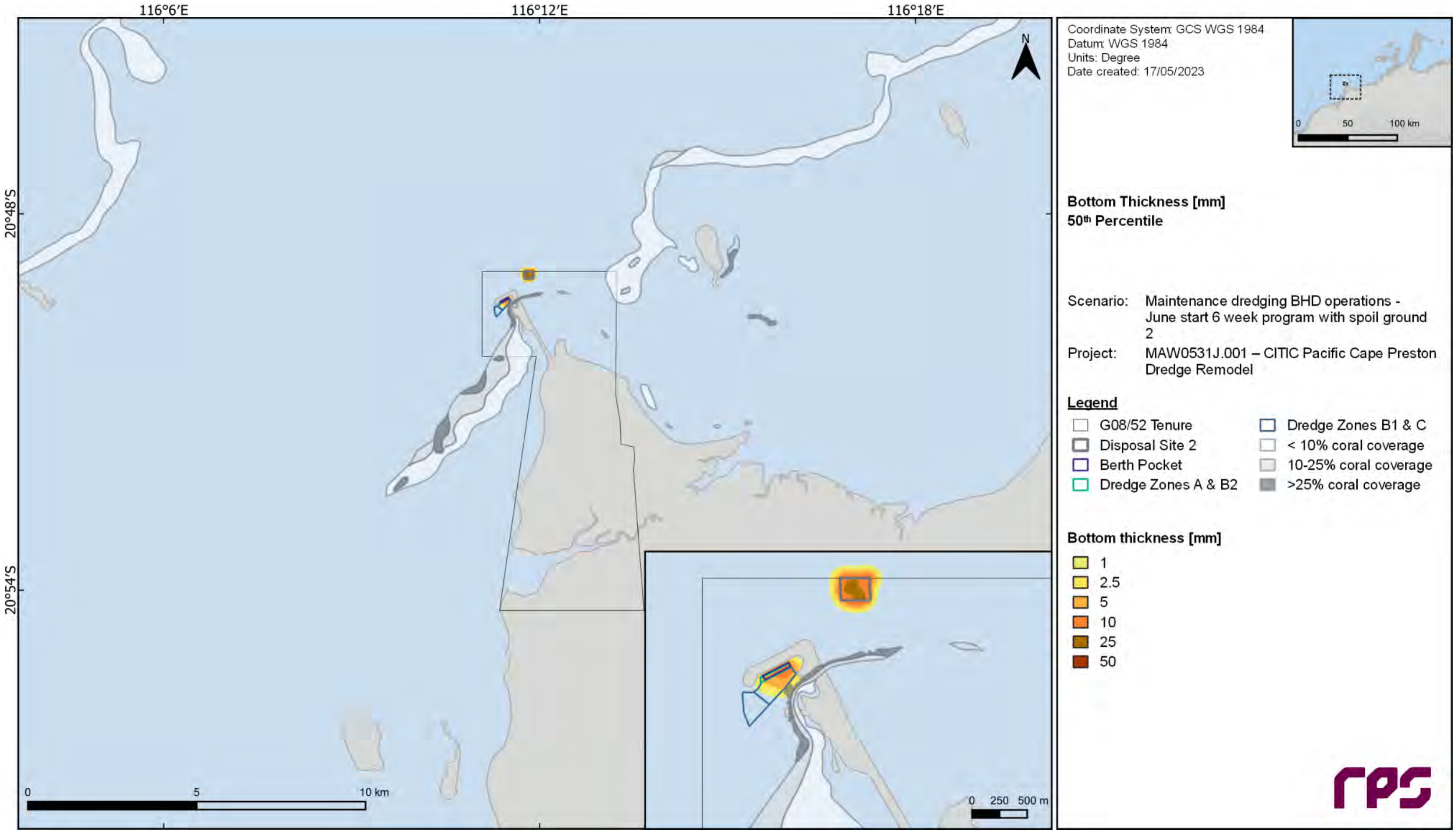

Figure 5.30 Predicted dredge-excess bottom thickness (mm) at the 50th percentile throughout the entire Scenario 3 duration (1 June to 9 August 2017).

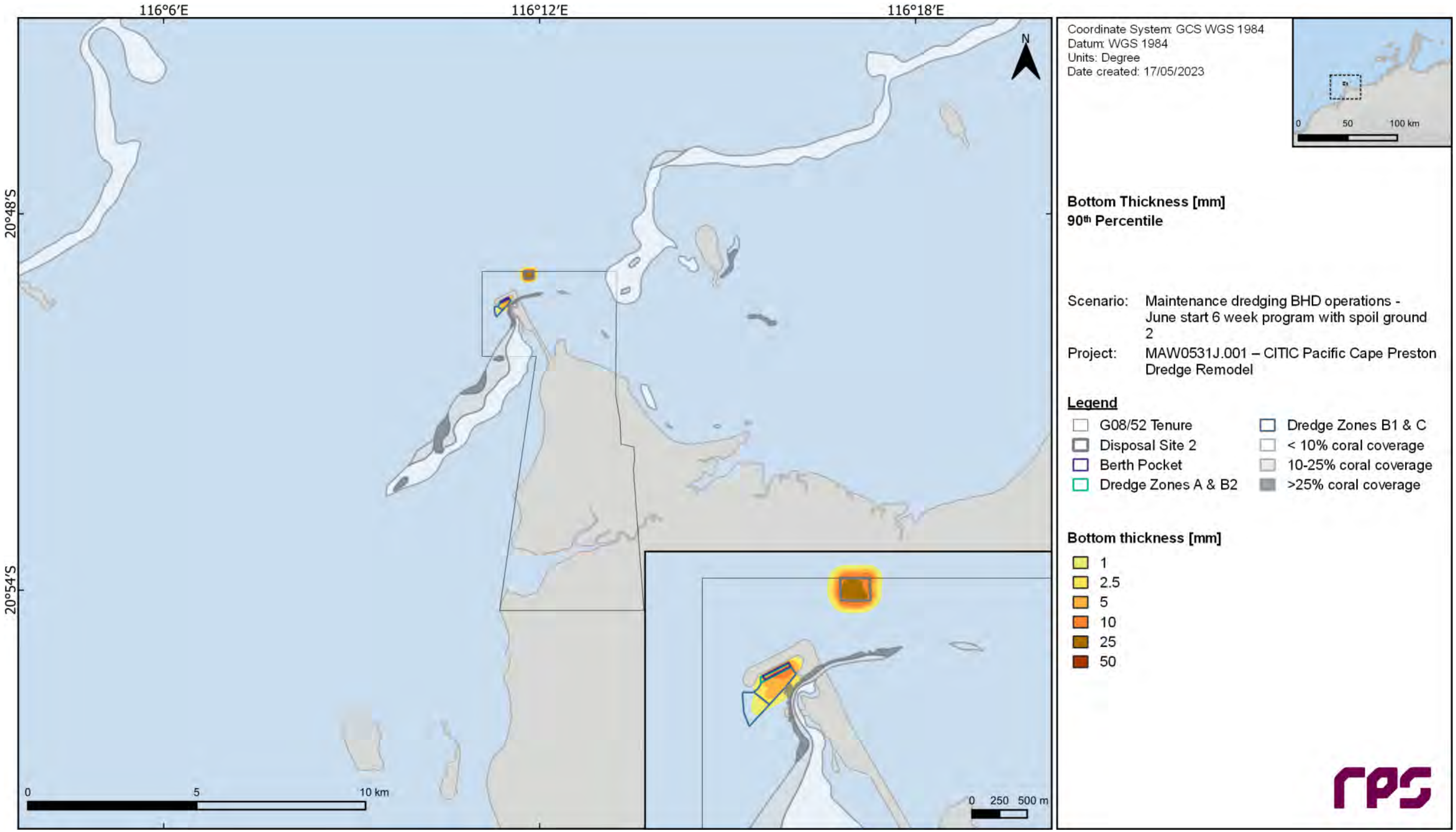

Figure 5.31 Predicted dredge-excess bottom thickness (mm) at the 90th percentile throughout the entire Scenario 3 duration (1 June to 9 August 2017).

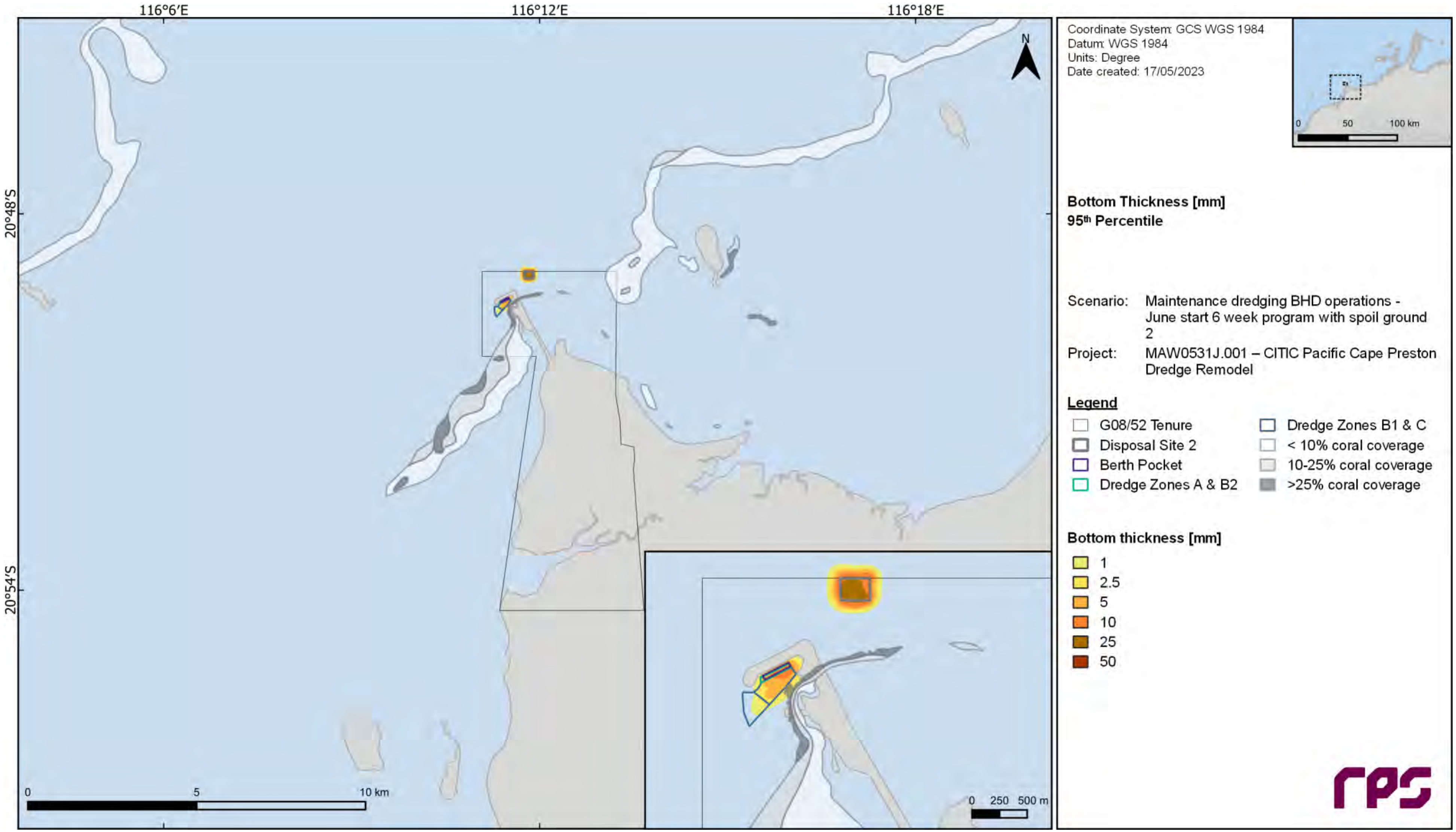

Figure 5.32 Predicted dredge-excess bottom thickness (mm) at the 95th percentile throughout the entire Scenario 3 duration (1 June to 9 August 2017).

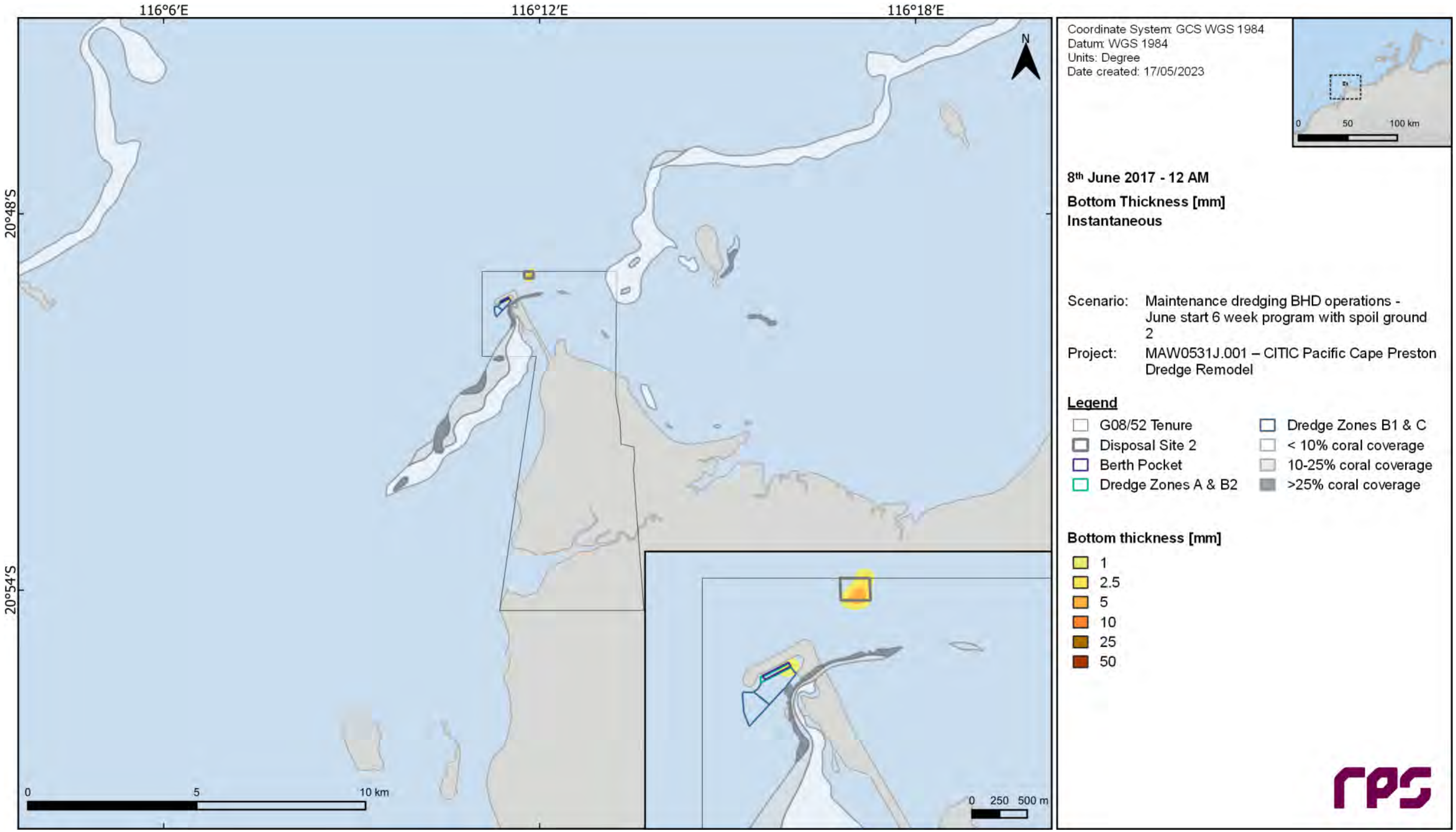

Figure 5.33 Snapshot of predicted dredge-excess bottom thickness (mm) at the end of Week 1 (8 June 2017) in Scenario 3.

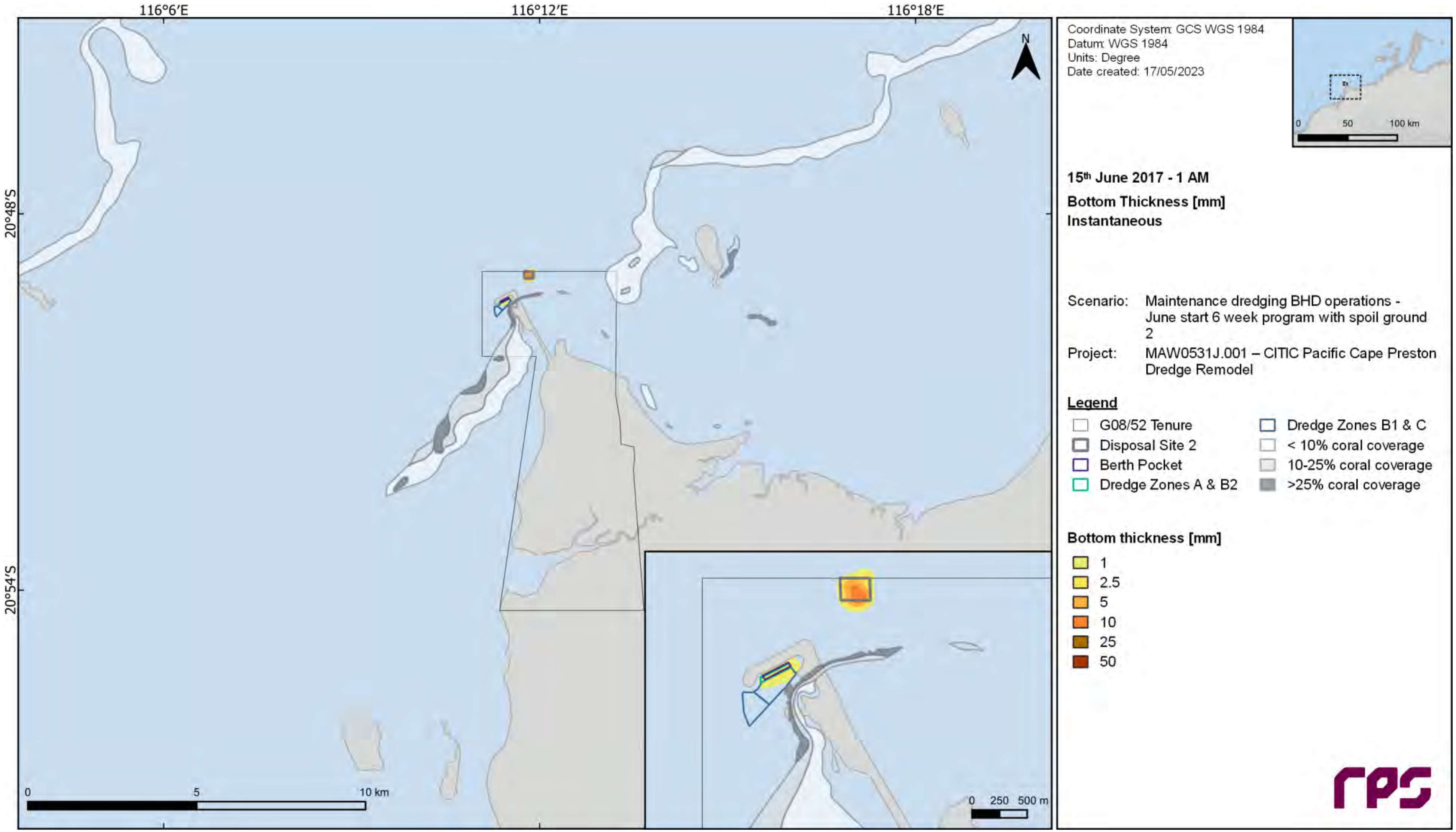

Figure 5.34 Snapshot of predicted dredge-excess bottom thickness (mm) at the end of Week 2 (15 June 2017) in Scenario 3.

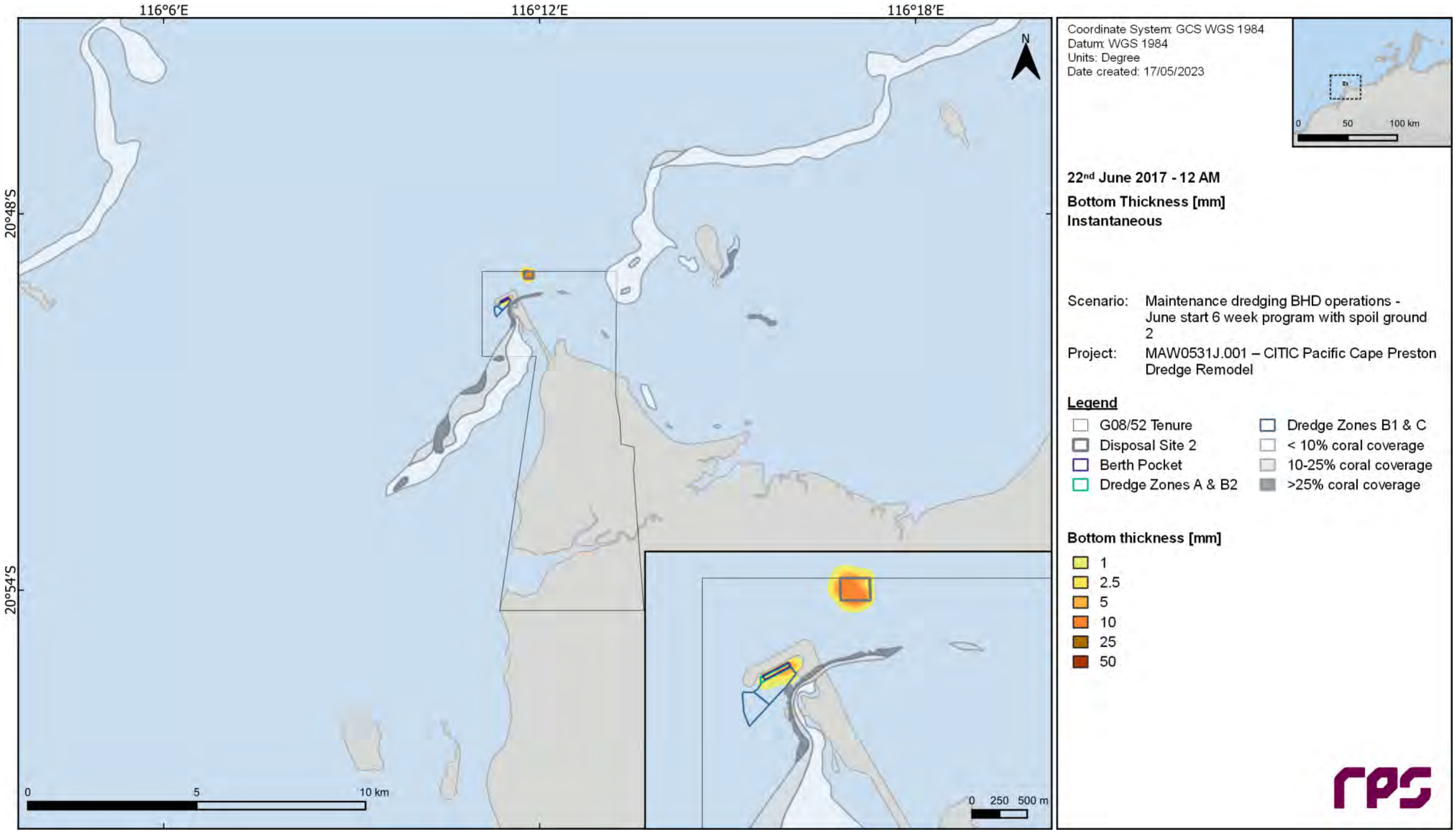

Figure 5.35 Snapshot of predicted dredge-excess bottom thickness (mm) at the end of Week 3 (22 June 2017) in Scenario 3.

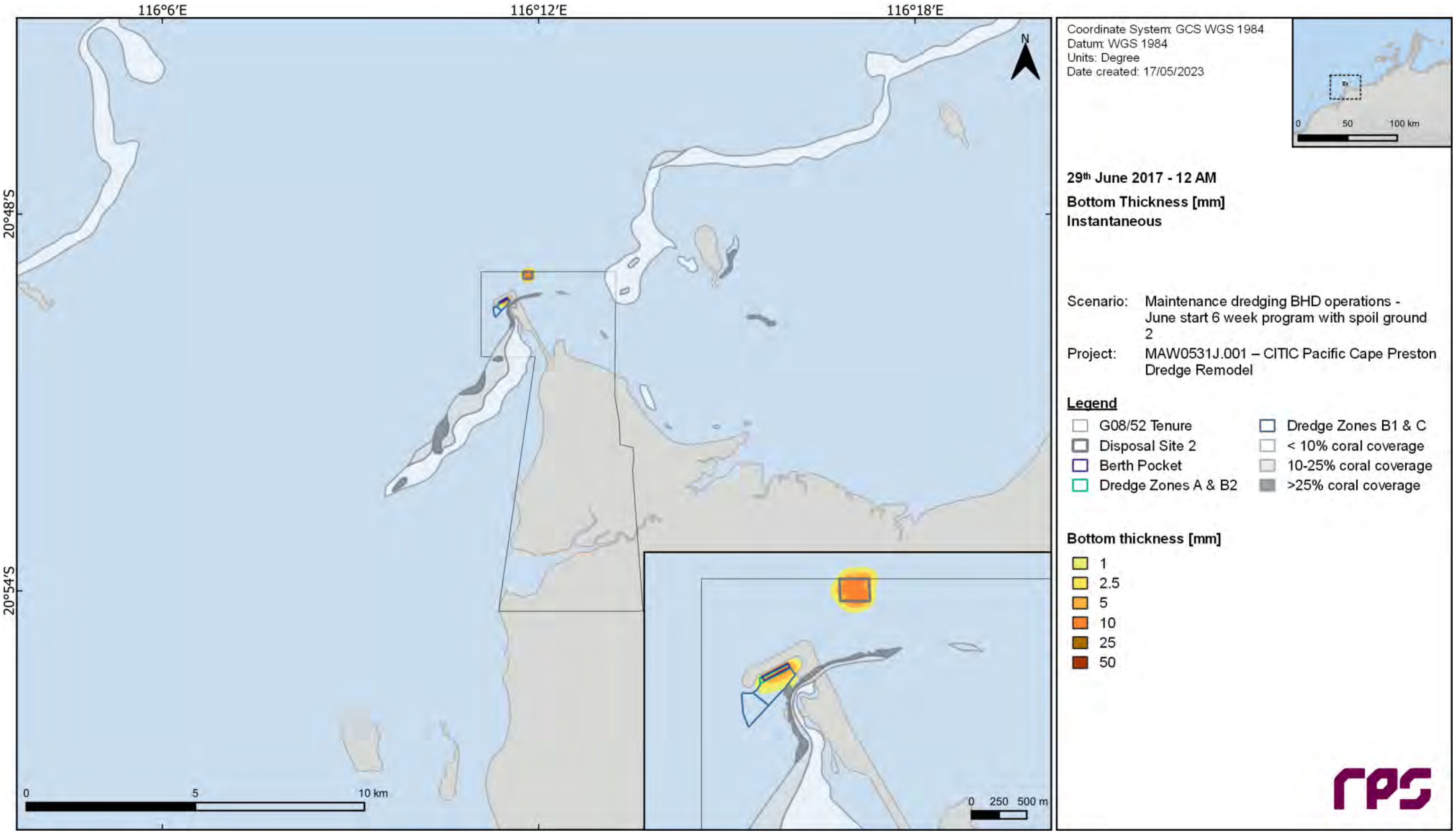

Figure 5.36 Snapshot of predicted dredge-excess bottom thickness (mm) at the end of Week 4 (29 June 2017) in Scenario 3.

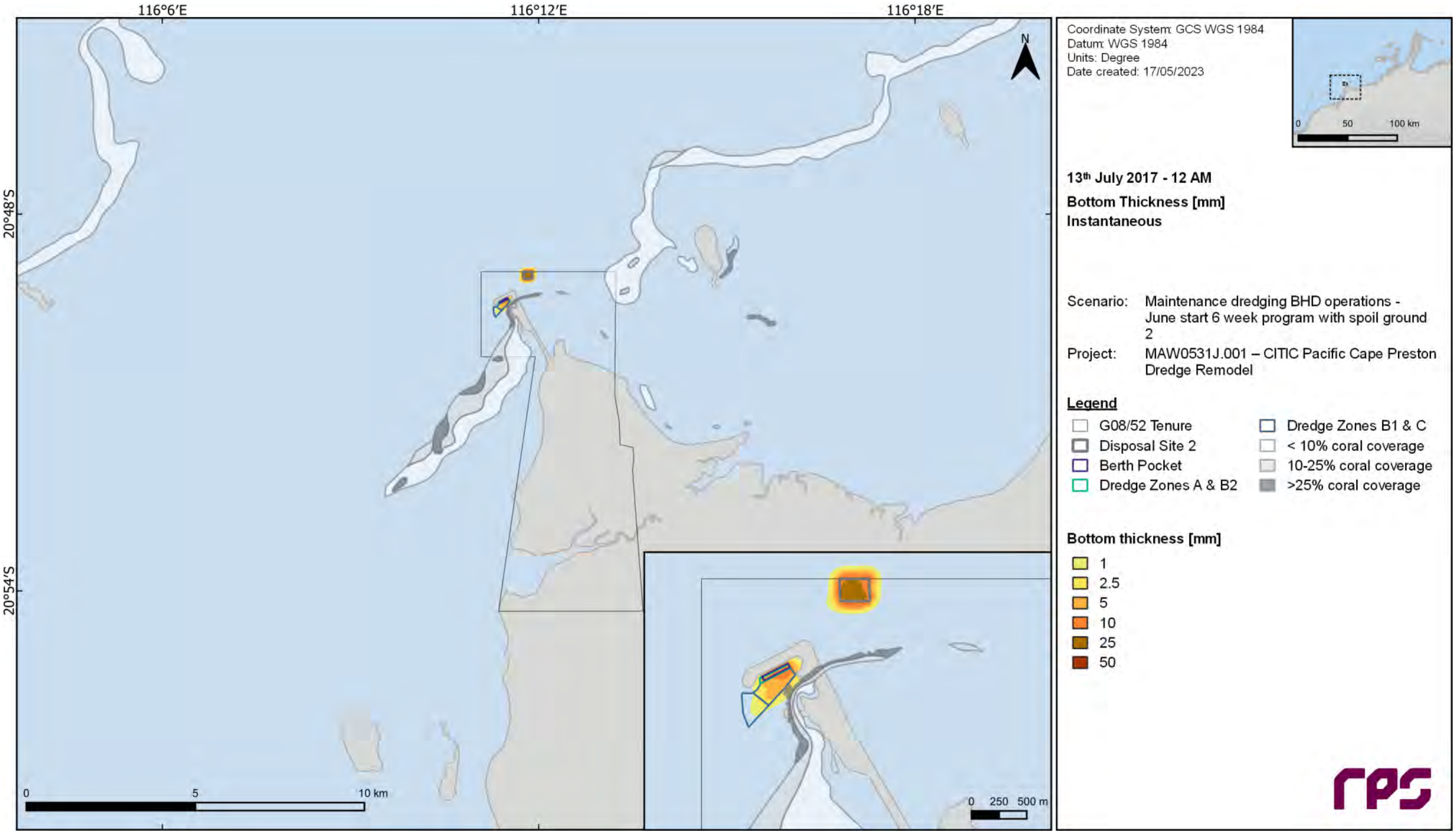

Figure 5.37 Snapshot of predicted dredge-excess bottom thickness (mm) at the end of dredging operations (end of Week 6; 13 July 2017) in Scenario 3.

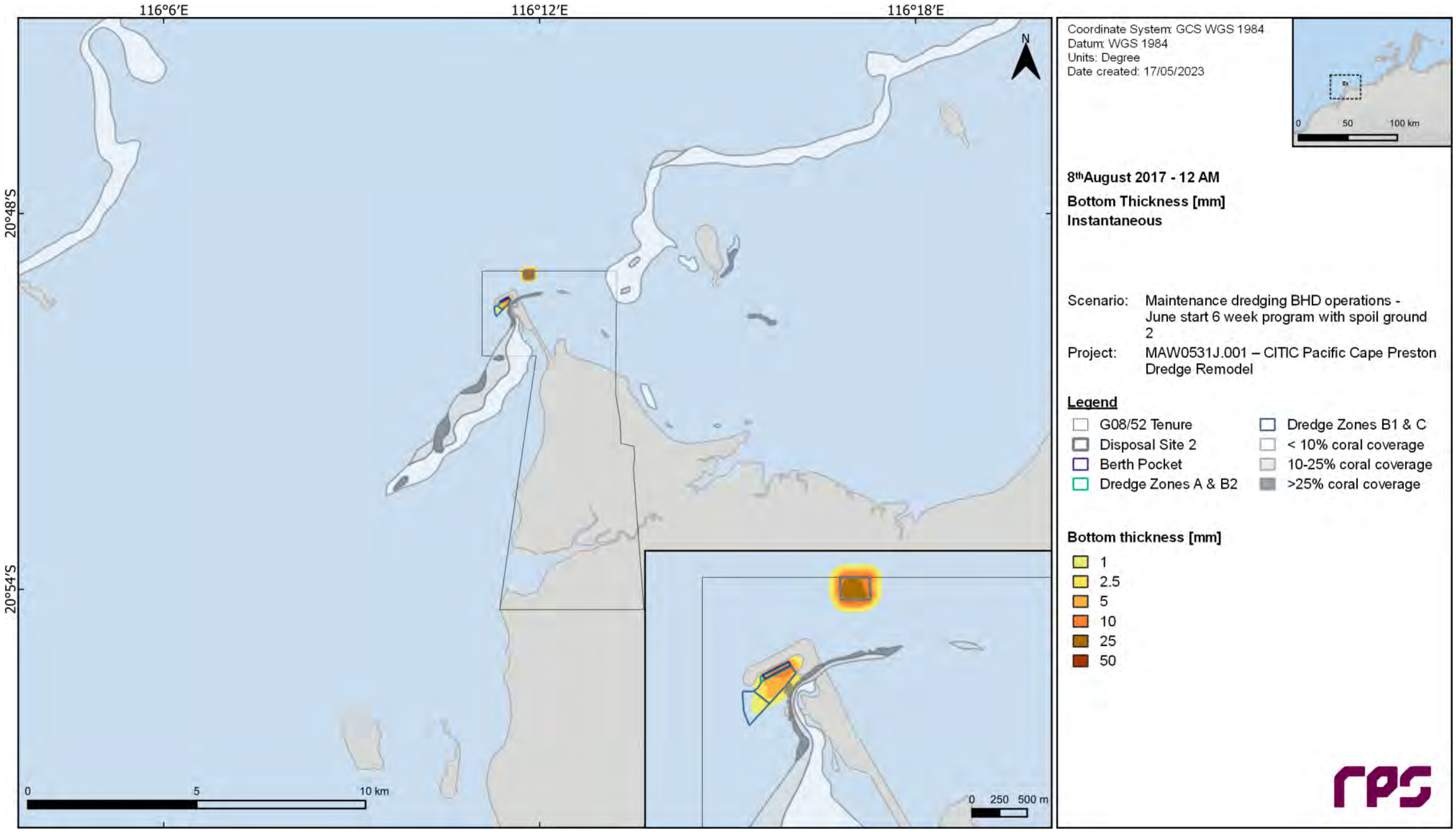

Figure 5.38 Snapshot of predicted dredge-excess bottom thickness (mm) at the end of simulation (end of Week 10; 8 August 2017) in Scenario 3.

5.1.5.4 Scenario 4: Summer Start for 2-Week Dredge Program Using Spoil Disposal Site 1

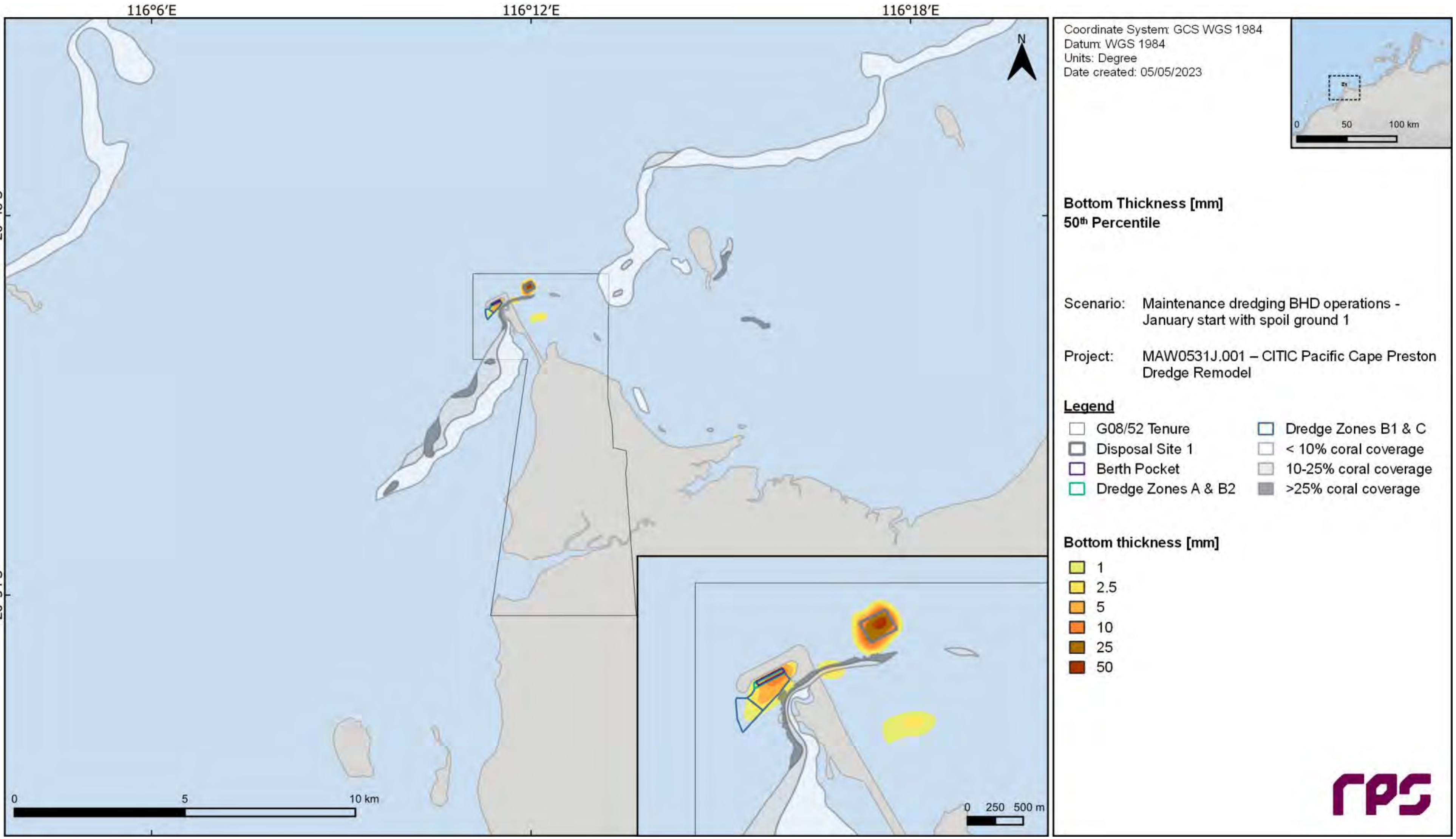

Figure 5.39 Predicted dredge-excess bottom thickness (mm) at the 50th percentile throughout the entire Scenario 4 duration (1 to 29 January 2017).

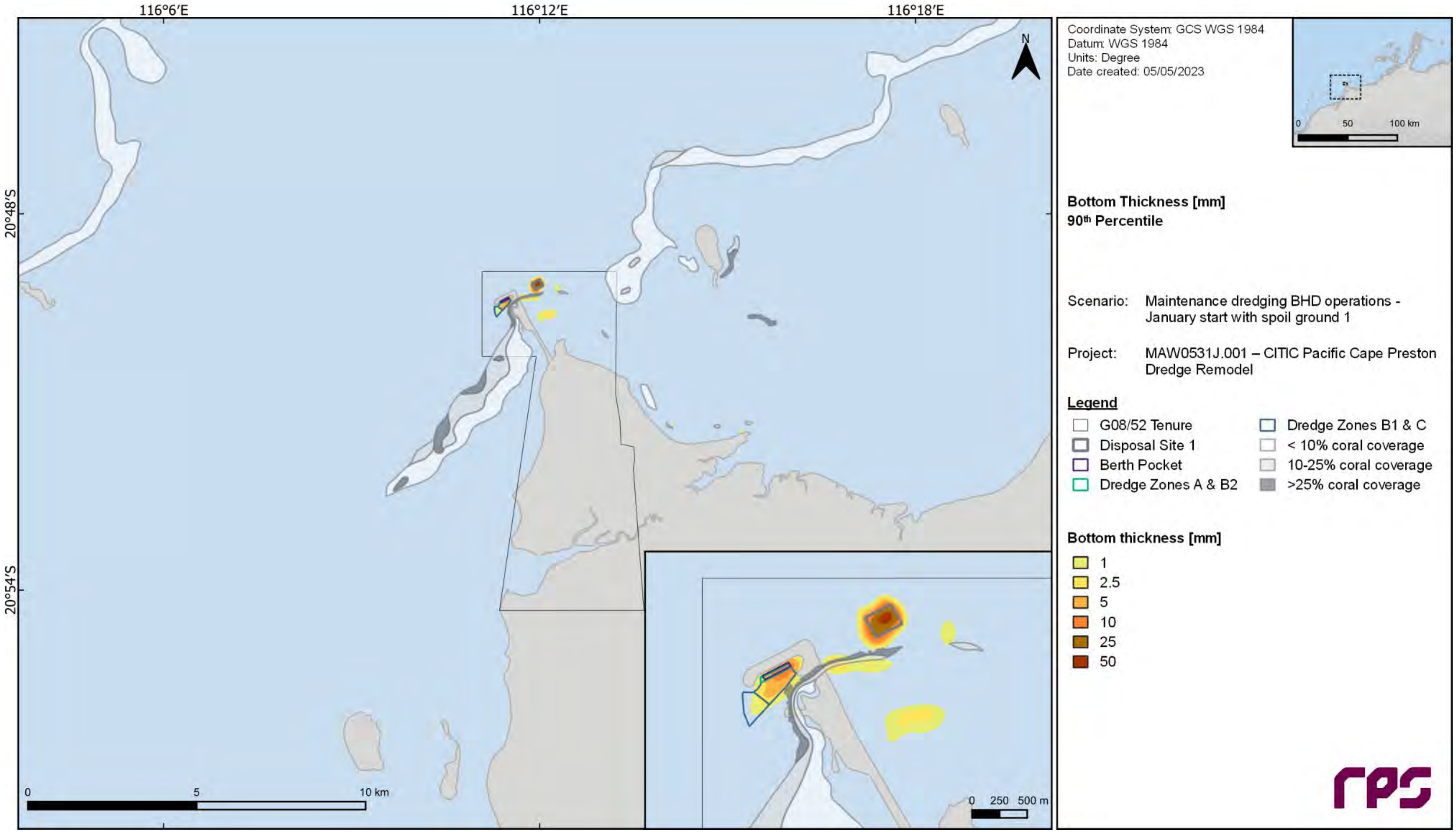

Figure 5.40 Predicted dredge-excess bottom thickness (mm) at the 90th percentile throughout the entire Scenario 4 duration (1 to 29 January 2017).

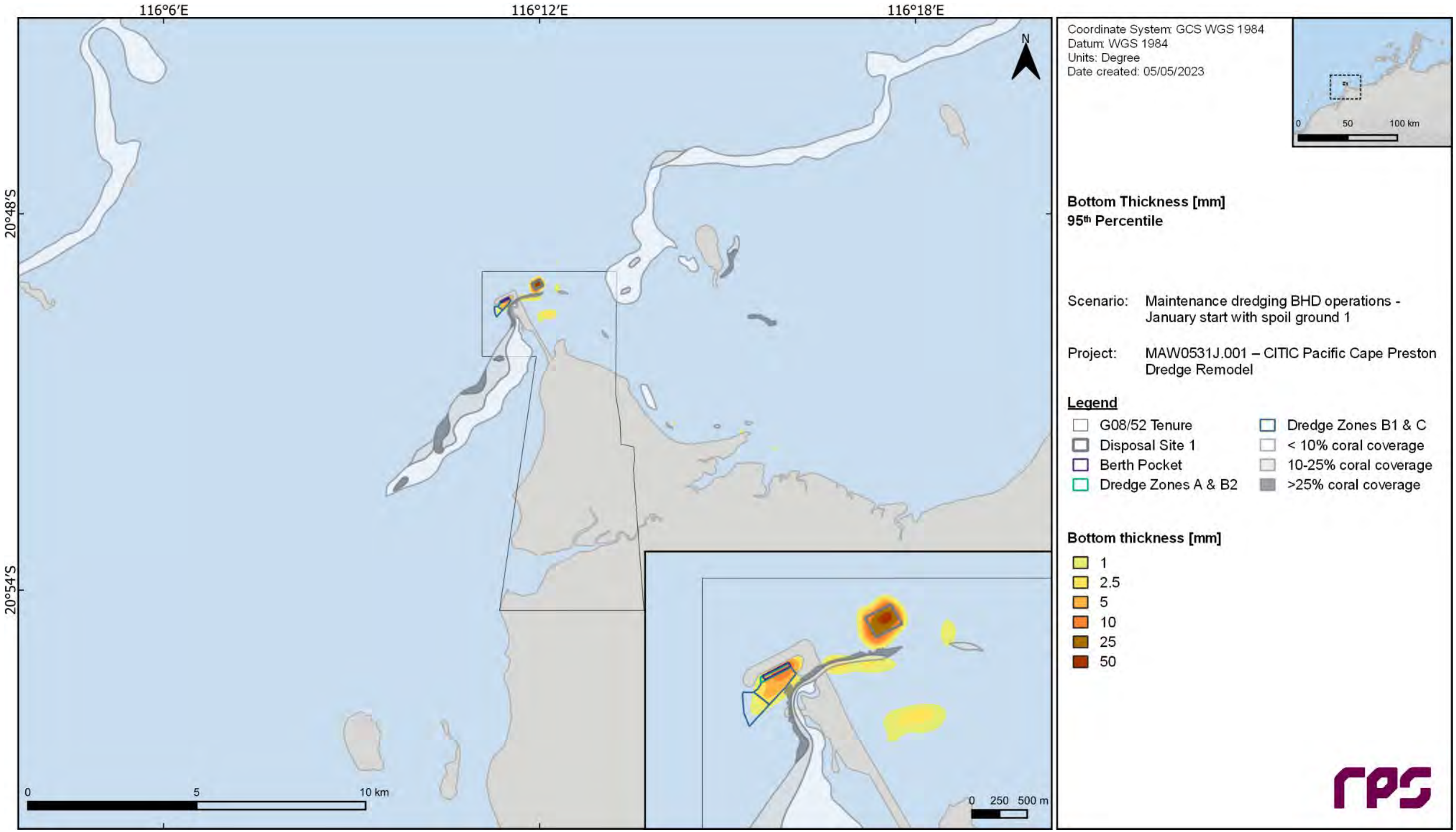

Figure 5.41 Predicted dredge-excess bottom thickness (mm) at the 95th percentile throughout the entire Scenario 4 duration (1 to 29 January 2017).

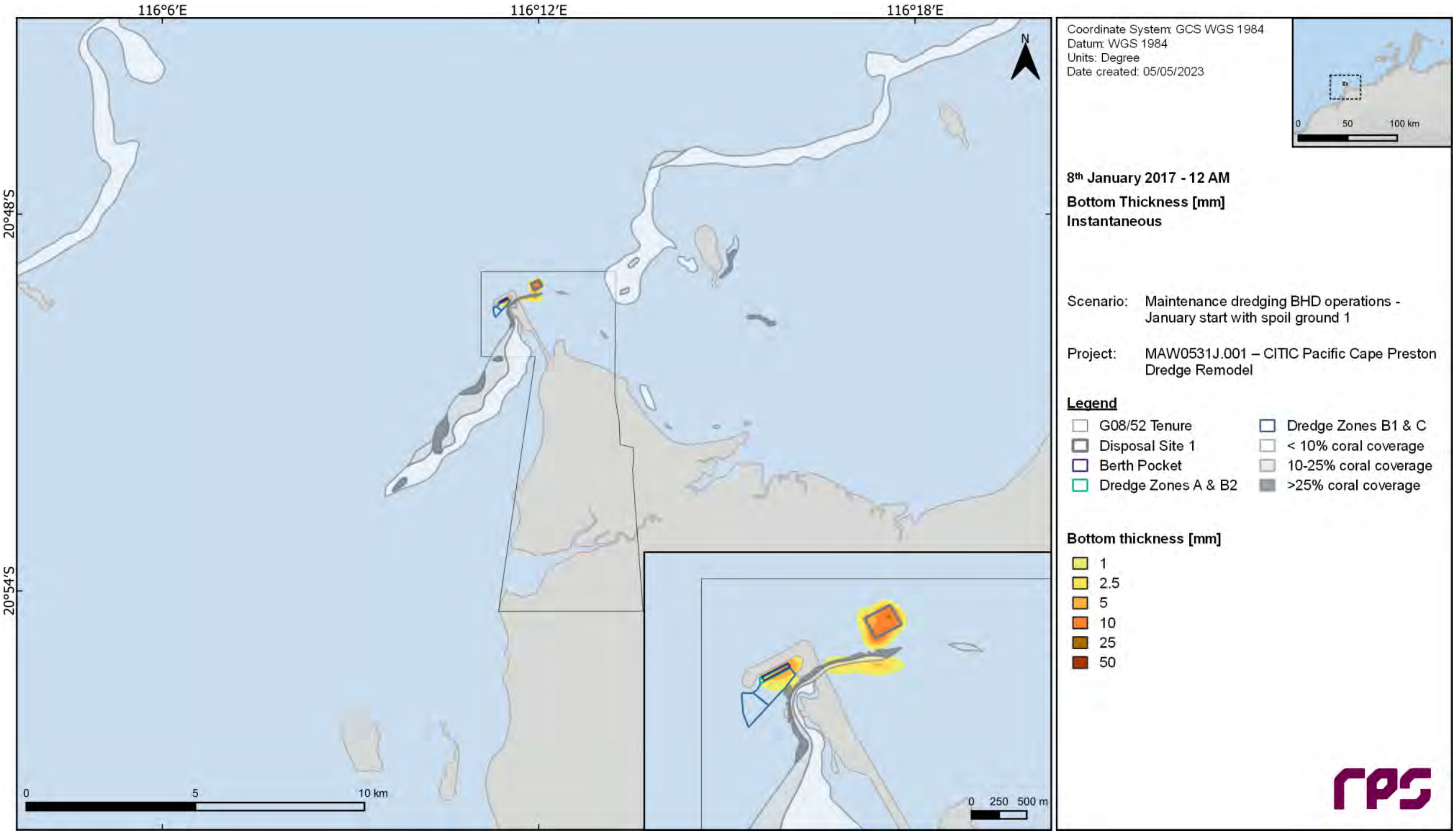

Figure 5.42 Snapshot of predicted dredge-excess bottom thickness (mm) at the end of Week 1 (8 January 2017) in Scenario 4.

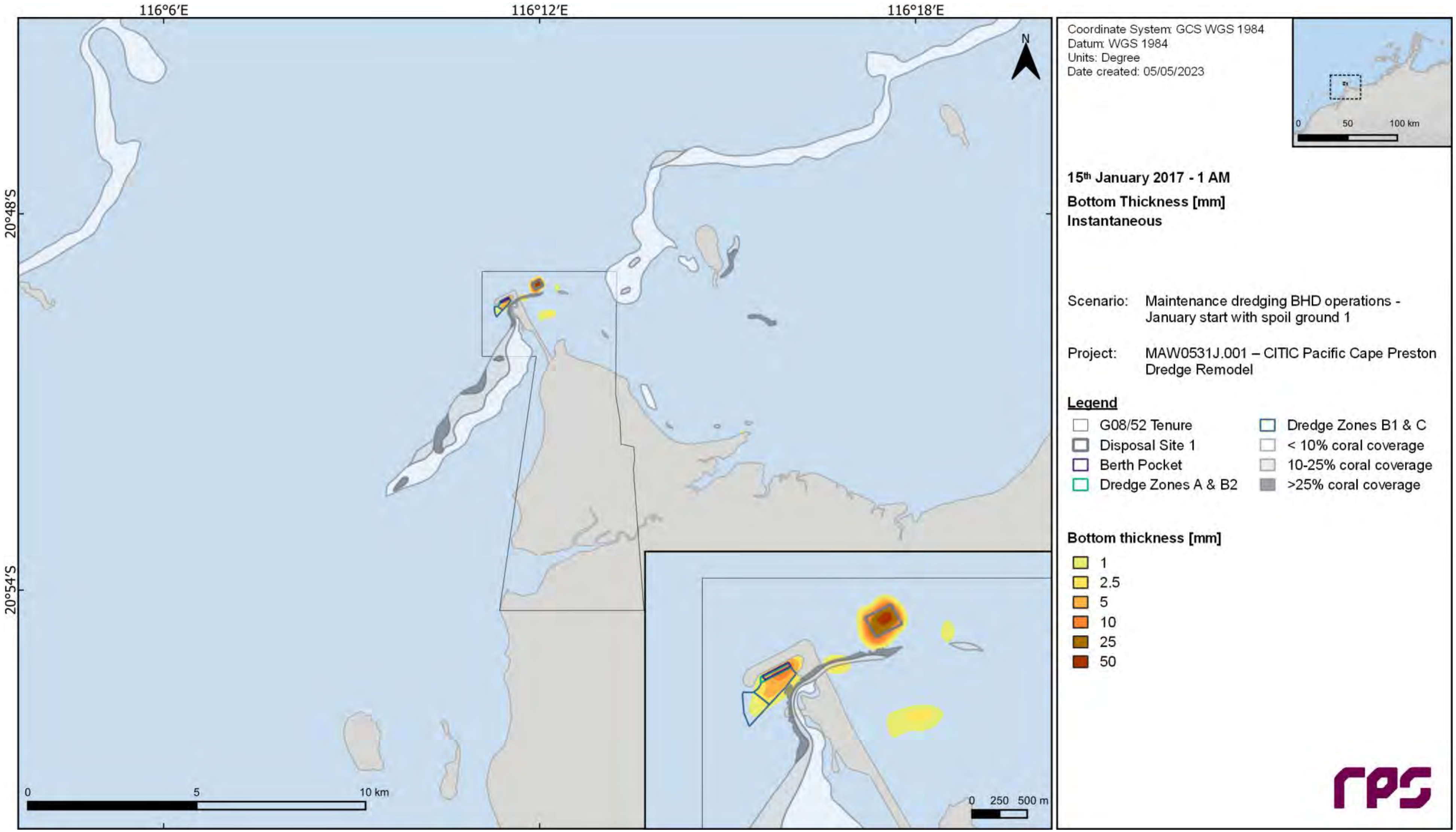

Figure 5.43 Snapshot of predicted dredge-excess bottom thickness (mm) at the end of Week 2 (15 January 2017) in Scenario 4.

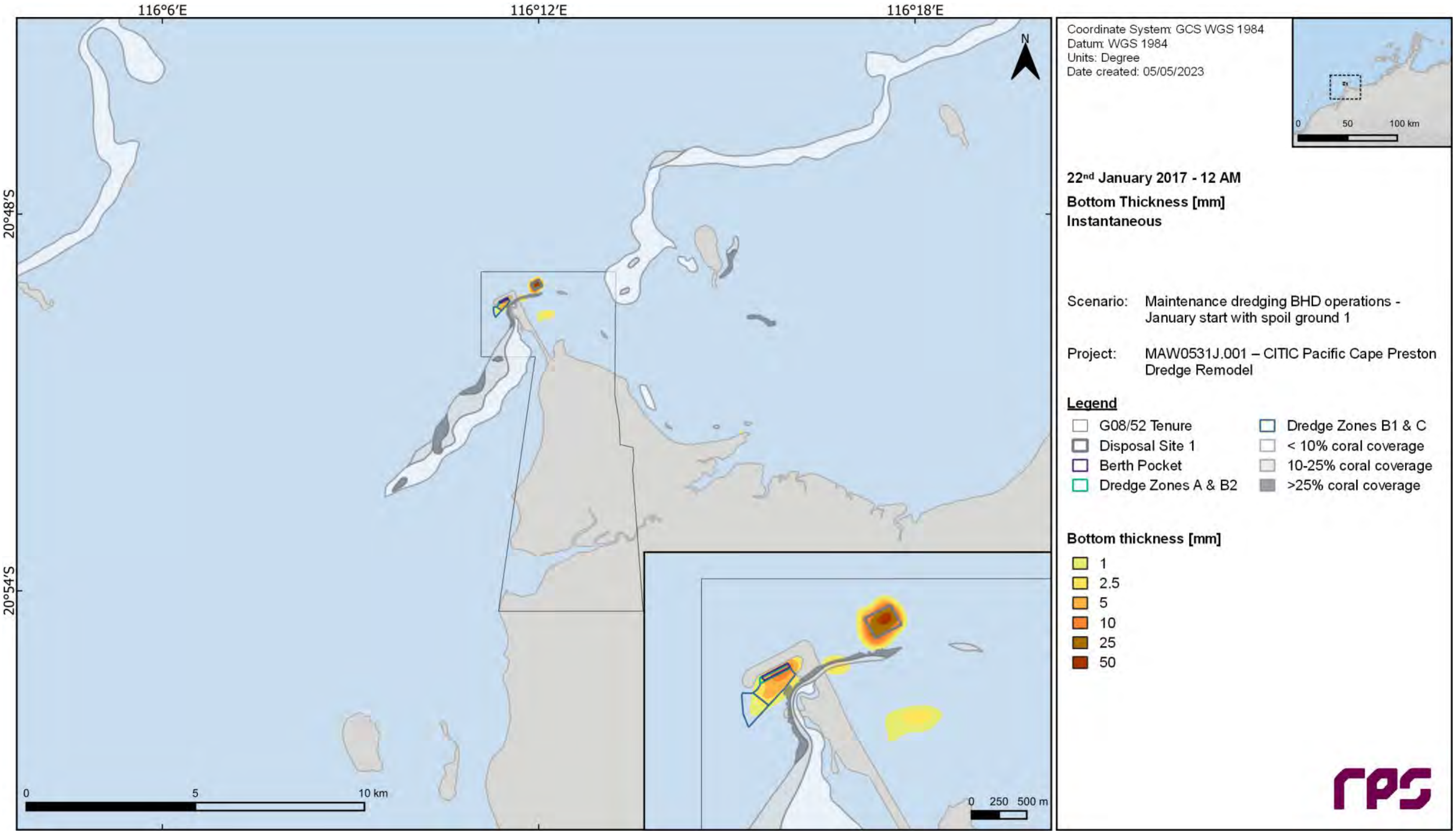

Figure 5.44 Snapshot of predicted dredge-excess bottom thickness (mm) at the end of Week 3 (22 January 2017) in Scenario 4.

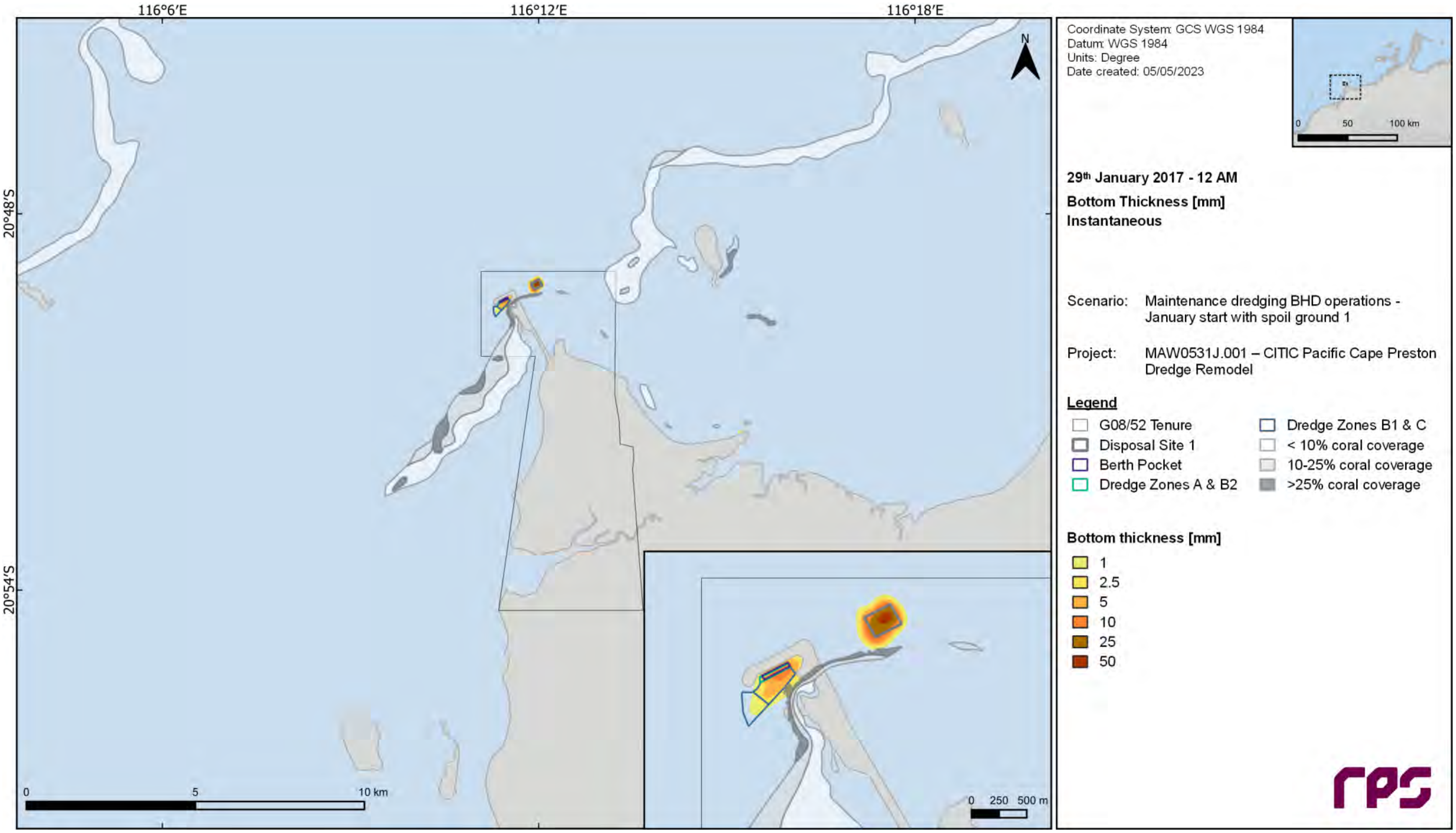

Figure 5.45 Snapshot of predicted dredge-excess bottom thickness (mm) at the end of the simulation (29 January 2017) in Scenario 4.

5.1.5.5 Scenario 5: Summer Start for 6-Week Dredge Program Using Spoil Disposal Site 2

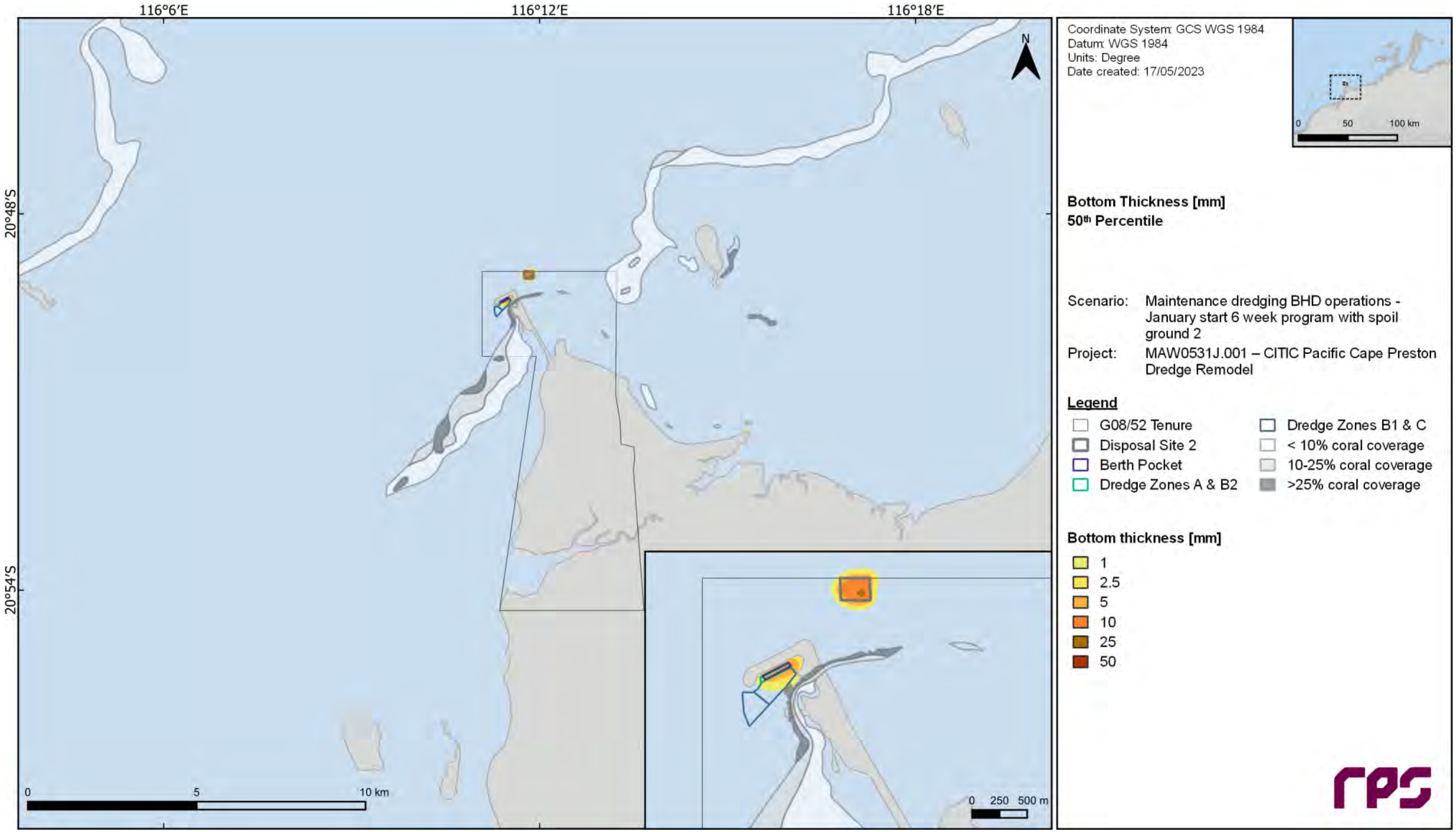

Figure 5.46 Predicted dredge-excess bottom thickness (mm) at the 50th percentile throughout the entire Scenario 5 duration (1 January to 11 March 2017).

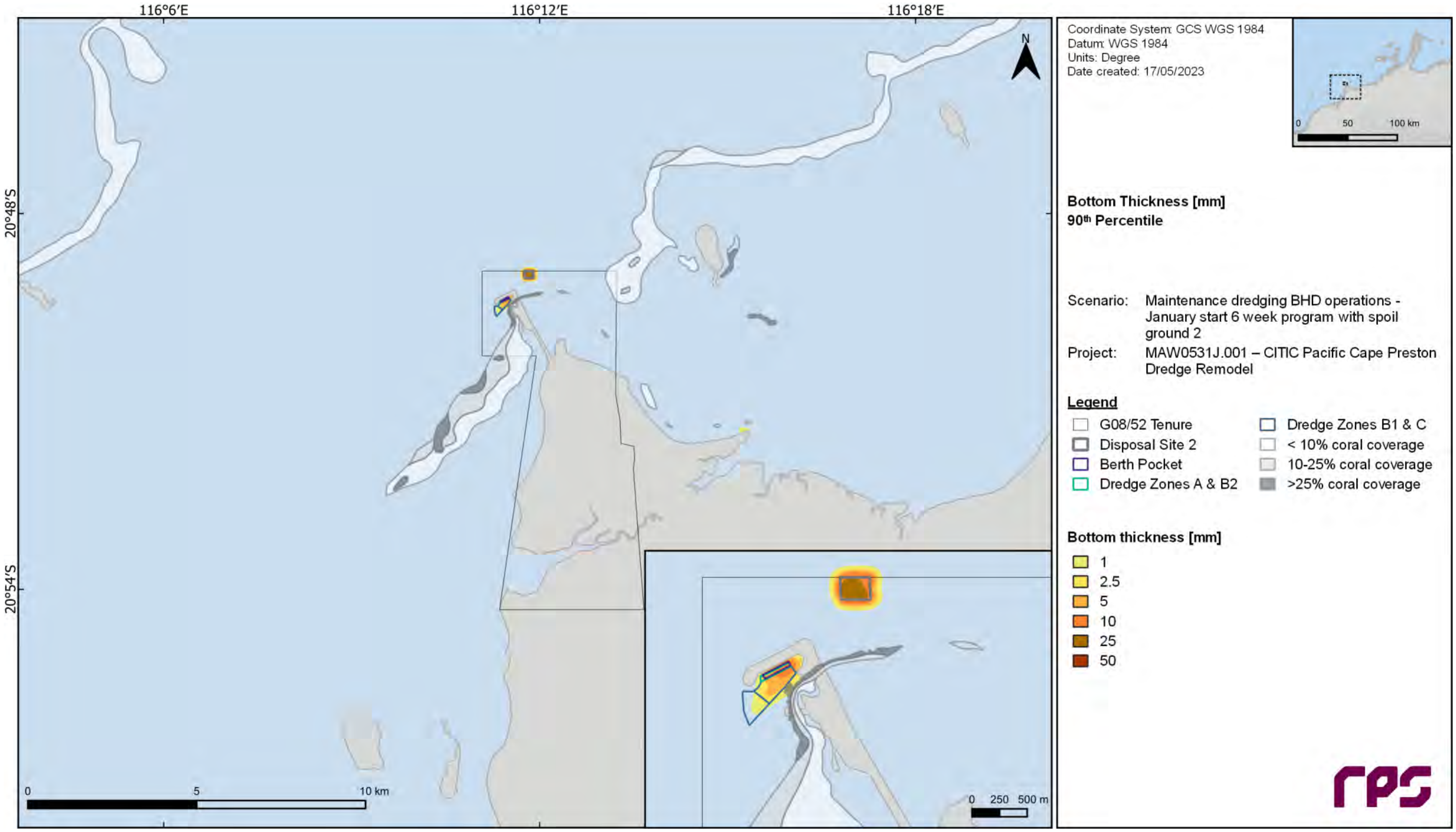

Figure 5.47 Predicted dredge-excess bottom thickness (mm) at the 90th percentile throughout the entire Scenario 5 duration (1 January to 11 March 2017).

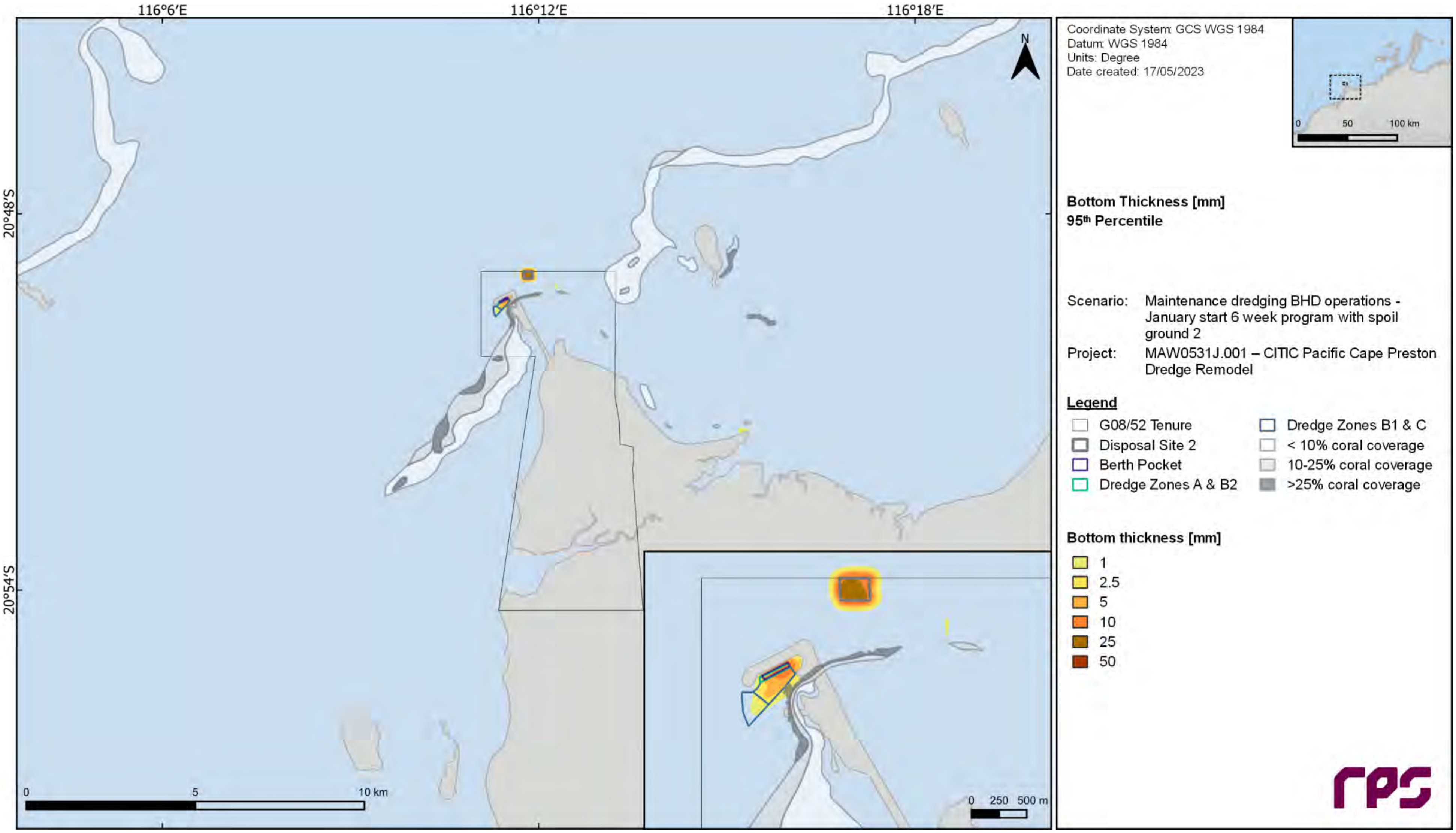

Figure 5.48 **Predicted dredge-excess bottom thickness (mm) at the 95th percentile throughout the entire Scenario 5 duration (1 January to 11 March 2017).**

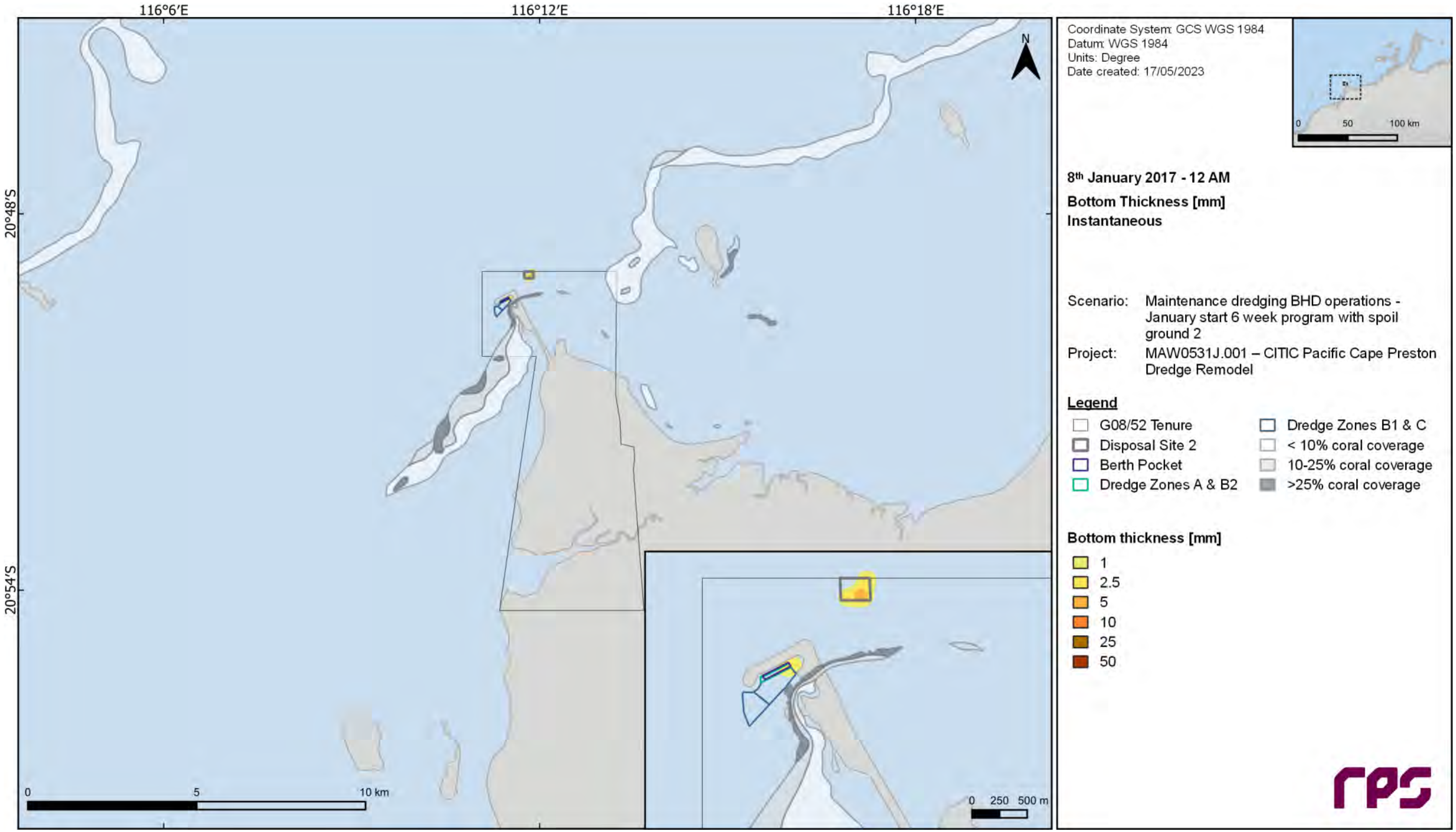

Figure 5.49 Snapshot of predicted dredge-excess bottom thickness (mm) at the end of Week 1 (8 January 2017) in Scenario 5.

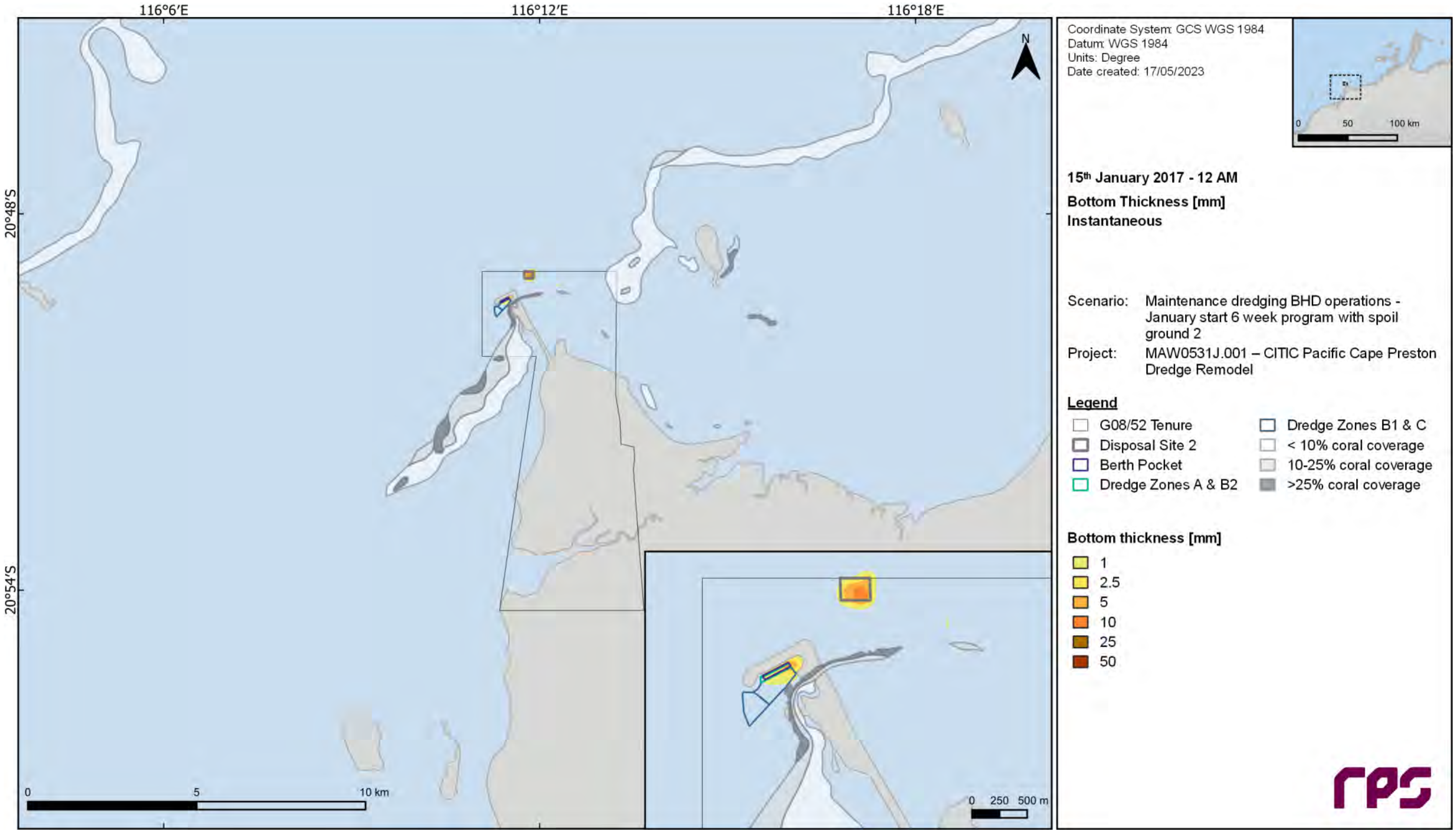

Figure 5.50 Snapshot of predicted dredge-excess bottom thickness (mm) at the end of Week 2 (15 January 2017) in Scenario 5.

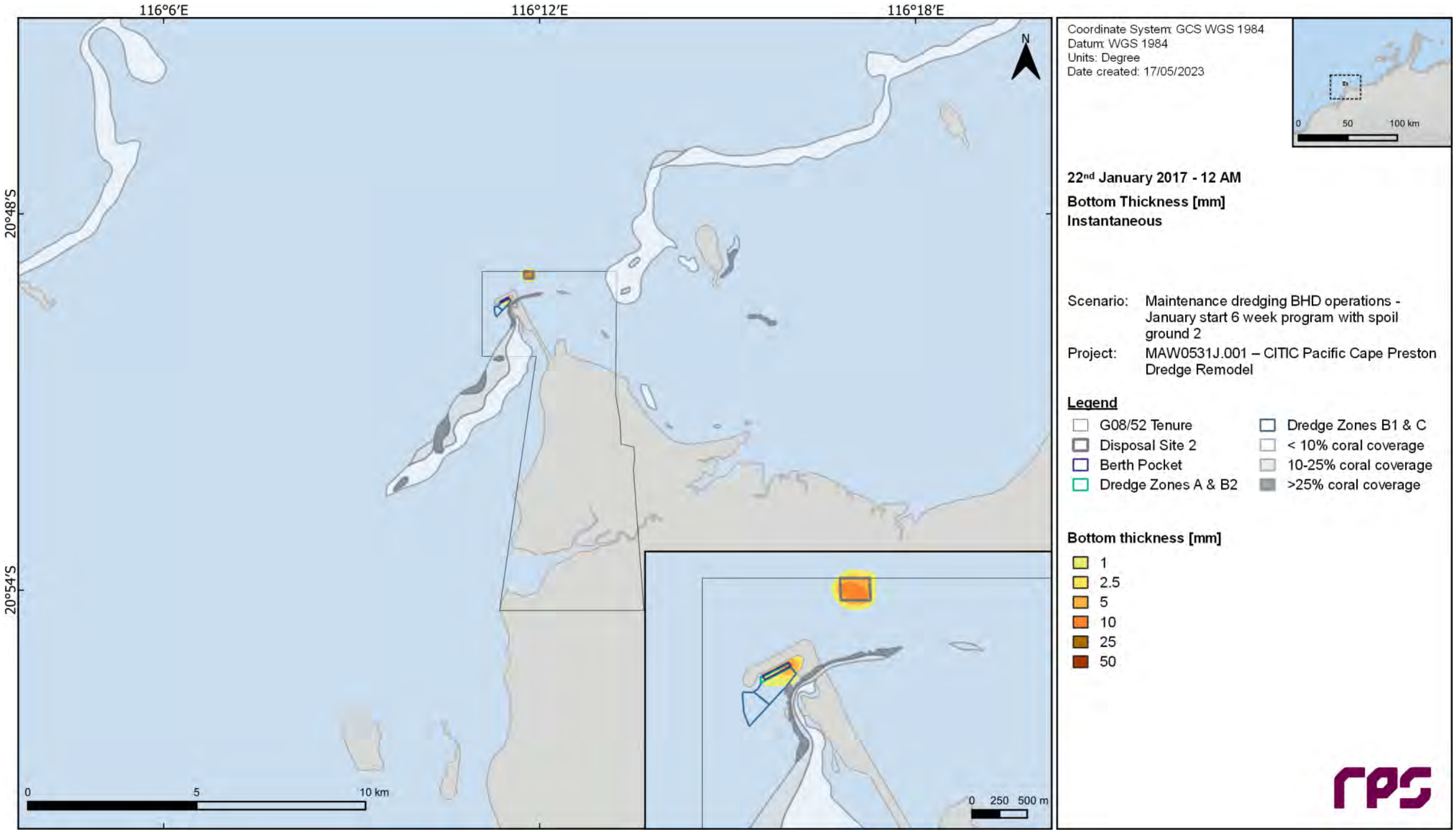

Figure 5.51 Snapshot of predicted dredge-excess bottom thickness (mm) at the end of Week 3 (22 January 2017) in Scenario 5.

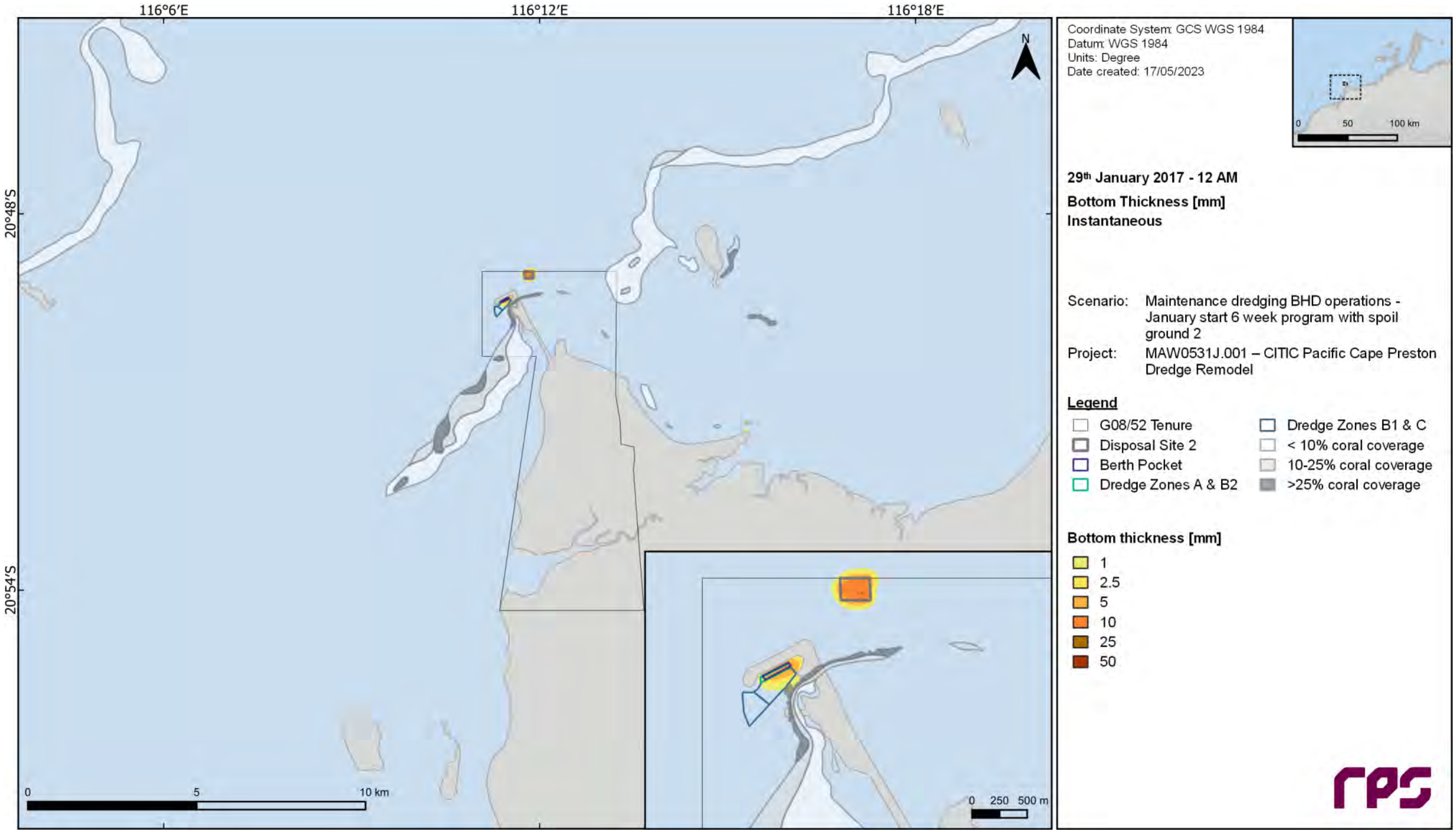

Figure 5.52 Snapshot of predicted dredge-excess bottom thickness (mm) at the end of Week 4 (29 January 2017) in Scenario 5.

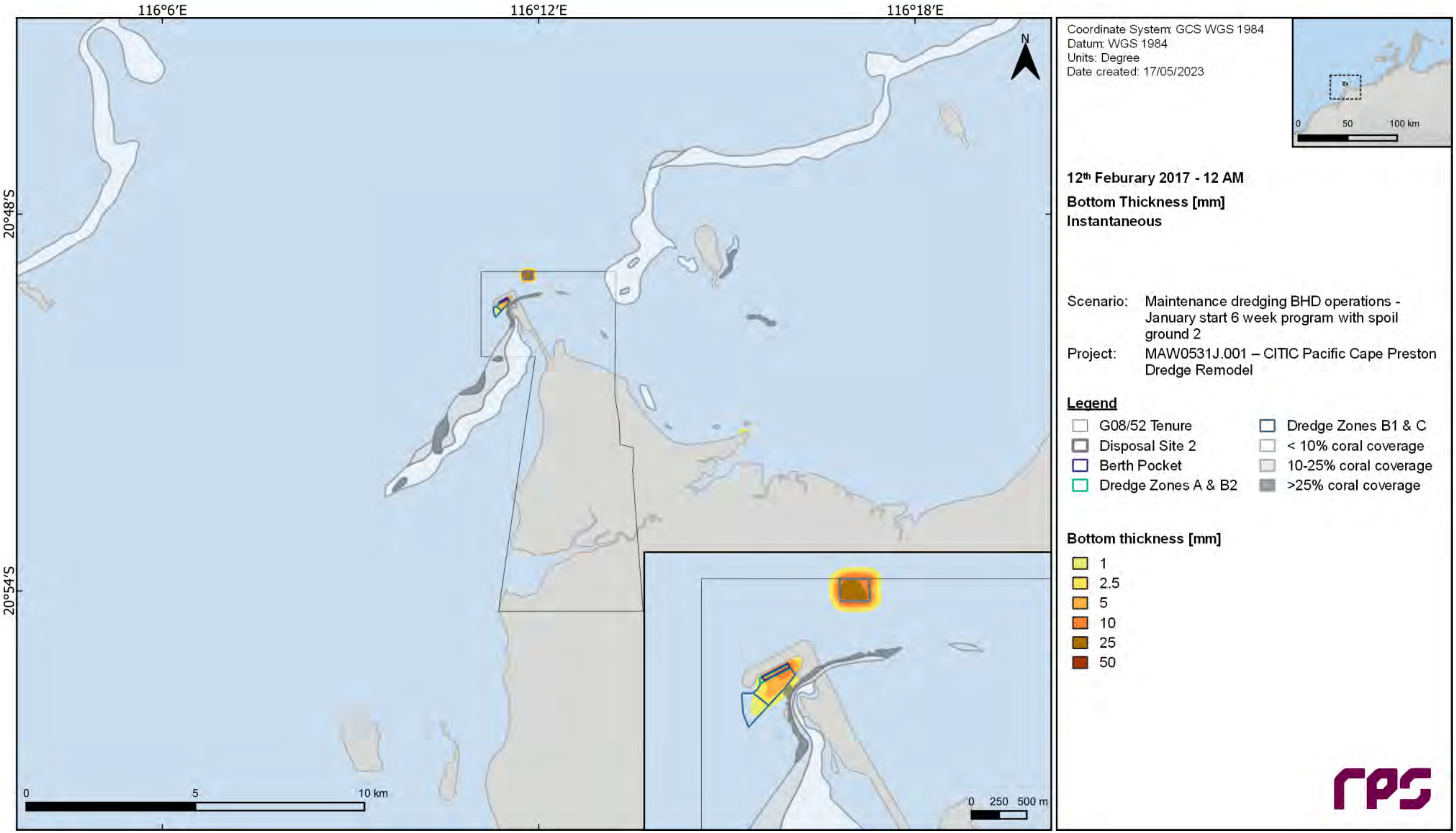

Figure 5.53 Snapshot of predicted dredge-excess bottom thickness (mm) at the end of Week 6 (12 February 2017) in Scenario 5.

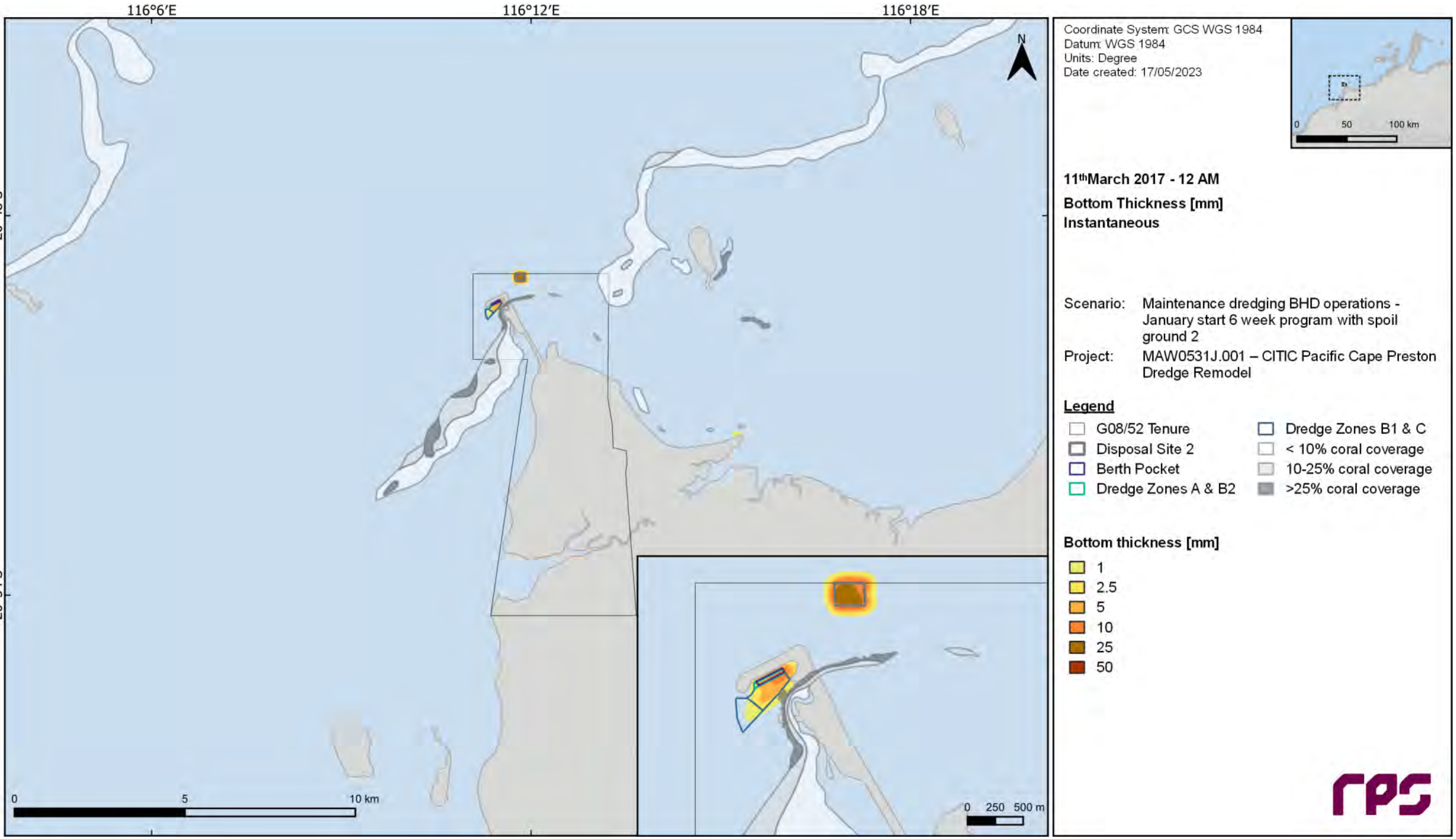

Figure 5.54 Snapshot of predicted dredge-excess bottom thickness (mm) at the end of simulation (end of Week 10; 11 March 2017) in Scenario 5.

5.2 Temporal Variability in TSSC and Sedimentation

5.2.1 Discussion

Simulations indicated that there will be significant temporal variability in the distribution of TSSC and sedimentation during the dredging and disposal operations. The vulnerability of sensitive receptors to elevated levels of TSSC and sedimentation is a function of exposure intensity and duration (Sun *et al.*, 2020), and it will also depend on whether the exposure duration comprises multiple isolated (in time) events or a consecutive period of events.

To explore the temporal exposure of sensitive receptor sites, a time series analysis at a set of sensitive locations has been conducted to supplement the spatial maps. The analysis locations were selected from among the existing coral monitoring sites and baseline turbidity monitoring sites. In addition to the monitoring sites, a set of locations was defined around each of the proposed offshore spoil disposal areas, with one final location at the Port diffuser. Figure 5.55 and Table 5.3 present the locations selected for the time series analysis. For presentation purposes the points have been split into groups as follows:

1. *CM01* to *CM05* are the coral monitoring sites to the north-east of the Port.
2. *CM06* to *CM10* are the coral monitoring sites to the south-west of the Port.
3. *TS18*, *TS20*, *TS14* and *TS13* are the baseline turbidity monitoring sites close to the Port.
4. *SG1A* to *SG1D* are the corner points of spoil ground 1 (starting at the top-left corner, moving clockwise).
5. *SG2A* to *SG2D* are the corner points of spoil ground 2 (starting at the top-left corner, moving clockwise).
6. *DIFF* is the Port diffuser location.

Table 5.3 Time series analysis locations and figure index for each scenario.

Location	Name	Longitude (°)	Latitude (°)	TSSC figures					Sedimentation figures				
				Sc1	Sc2	Sc3	Sc4	Sc5	Sc1	Sc2	Sc3	Sc4	Sc5
Coral monitoring site 1	CM01	116.25594	-20.82731	Figure 5.56	Figure 5.61	Figure 5.66	Figure 5.71	Figure 5.76	Figure 5.81	Figure 5.86	Figure 5.91	Figure 5.96	Figure 5.101
Coral monitoring site 2	CM02	116.25044	-20.81450										
Coral monitoring site 3	CM03	116.20011	-20.82117										
Coral monitoring site 4	CM04	116.19700	-20.82181										
Coral monitoring site 5	CM05	116.19525	-20.82211										
Coral monitoring site 6	CM06	116.19222	-20.82442	Figure 5.57	Figure 5.62	Figure 5.67	Figure 5.72	Figure 5.77	Figure 5.82	Figure 5.87	Figure 5.92	Figure 5.97	Figure 5.102
Coral monitoring site 7	CM07	116.19253	-20.82717										
Coral monitoring site 8	CM08	116.19289	-20.82861										
Coral monitoring site 9	CM09	116.19008	-20.83878										
Coral monitoring site 10	CM10	116.18381	-20.84694										
Turbidity monitoring site 18	TS18	116.21856	-20.81270	Figure 5.58	Figure 5.63	Figure 5.68	Figure 5.73	Figure 5.78	Figure 5.83	Figure 5.88	Figure 5.93	Figure 5.98	Figure 5.103
Turbidity monitoring site 20	TS20	116.18283	-20.84473										
Turbidity monitoring site 14	TS14	116.08312	-20.82438										
Turbidity monitoring site 13	TS13	116.25325	-20.80265										
Spoil ground 1 site A*	SG1A	116.19791	-20.81856	Figure 5.59	-	-	Figure 5.74	-	Figure 5.84	-	-	Figure 5.99	-
Spoil ground 1 site B*	SG1B	116.20001	-20.81748										
Spoil ground 1 site C*	SG1C	116.20094	-20.81906										
Spoil ground 1 site D*	SG1D	116.19883	-20.82015										
Spoil ground 2 site A*	SG2A	116.19588	-20.81534	-	Figure 5.64	Figure 5.69	-	Figure 5.79	-	Figure 5.89	Figure 5.94	-	Figure 5.104
Spoil ground 2 site B*	SG2B	116.19829	-20.81534										
Spoil ground 2 site C*	SG2C	116.19836	-20.81716										
Spoil ground 2 site D*	SG2D	116.19595	-20.81715										
Port diffuser	DIFF	116.19060	-20.82125	Figure 5.60	Figure 5.65	Figure 5.70	Figure 5.75	Figure 5.80	Figure 5.85	Figure 5.90	Figure 5.95	Figure 5.100	Figure 5.105

* Note these sites are relevant to one scenario only: SG1X for Scenarios 1 and 4, and SG2X for Scenarios 2, 3 and 5.

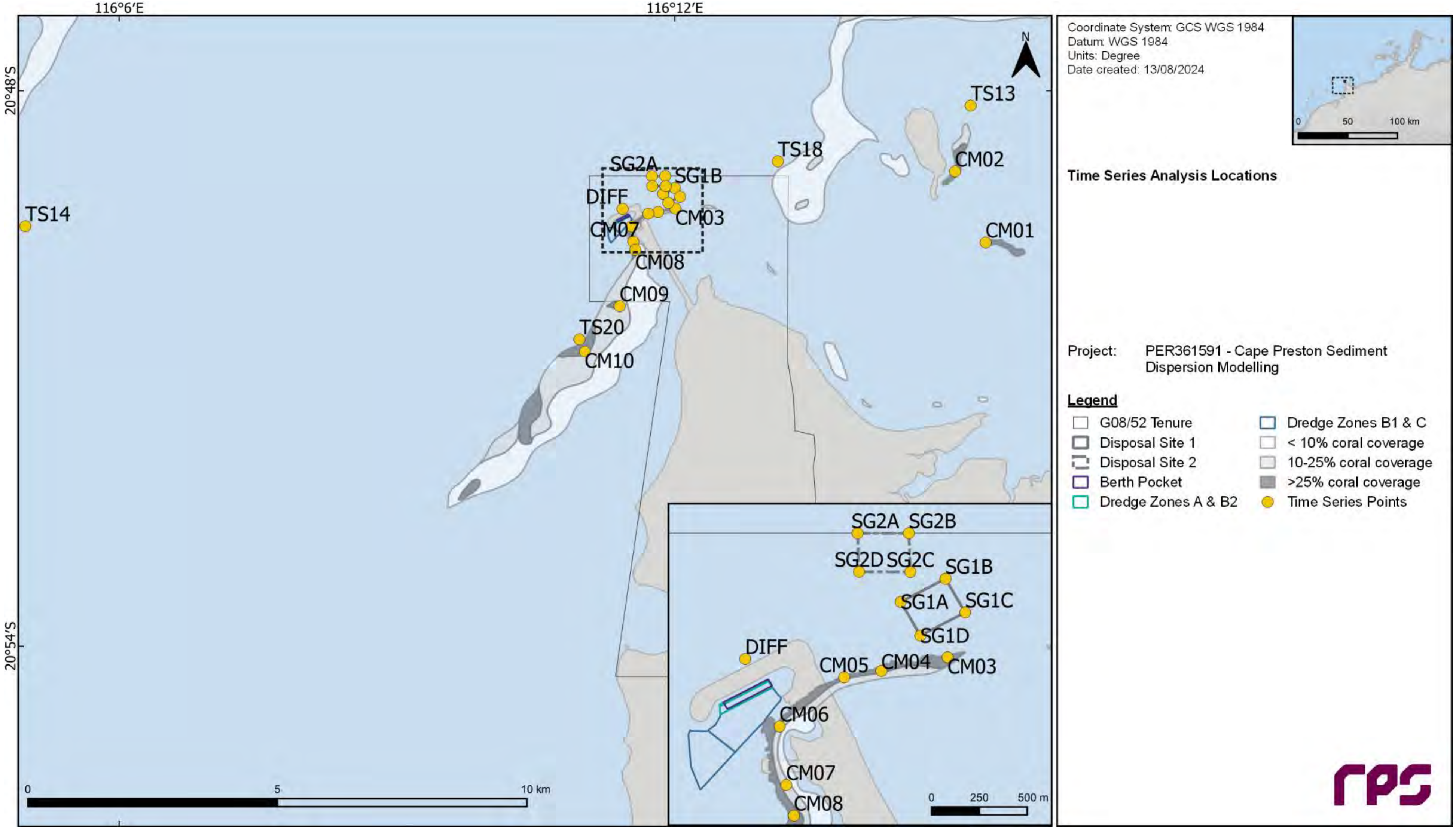

Figure 5.55 Time series analysis locations.

Time series plots showing predicted dredge-excess, depth-averaged TSSC and sedimentation for each of the selected locations are presented in Sections 5.2.2 and 5.2.3 for all scenarios (note the scale on the y-axes changes between Figures). Table 5.3 also indexes the time series figures of dredge-excess TSSC and sedimentation for each location and scenario.

Supplementary to the plots, Table 5.4 presents the predicted 80th percentile, 95th percentile, 98th percentile and maximum dredge-excess, depth-averaged TSSC for each of the selected locations in each scenario. The percentile values for TSSC are presented because in some of the plots, to maintain a scale that clearly shows the general patterns of temporal variation at all sites, the y-axis limit has purposefully been selected to cut off the peaks. Lower percentiles (median and below) have not been presented because, at all sites analysed, the dredge-excess, depth-averaged TSSC median values were close to 0 mg/L.

In all modelled scenarios the temporal variation in dredge-excess TSSC at all analysis sites to the south-west and north-east of the Port and at the spoil ground sites reflects the spatial patchiness of the plumes and the oscillations of the dominant tidal flows in the area, with rapidly changing (over hourly scales) sharp peaks and troughs. The time series reveal that exposure to elevated TSSC is typically transient and periodic at all sites, and TSSC is not consistently elevated throughout the dredging and disposal period.

Data at the coral monitoring sites to the north of the Port (*CM01* to *CM05*) shows that plumes rarely reach these sites during winter conditions (Scenarios 1 to 3) due to the dominant southward drift direction in the region. However, during the summer simulations (Scenario 3 and 4) plumes reach these sites due to the prevailing northerly drift directions.

At the spoil ground sites (*SG1A* to *SG1D* for Scenarios 1 and 4, and *SG2A* to *SG2D* for Scenarios 2, 3 and 5), the temporal variability in predicted TSSC also reflects tidal oscillations and dominant drift currents, with the sites on the southern side showing higher overall TSSC values during winter. However, superimposed on these patterns is additional variability due to the sporadic nature of the disposal sources which are variable in time and space. The timings and intensities of the individual peaks vary due to the relative proximity of each site to individual disposal events. Although the maximum TSSC varies significantly between sites, at the 95th and 98th percentile levels the values at the sites within the disposal areas are similar in Scenarios 1, 2, 3 and 5 (less than 20 mg/L). Scenario 4 has higher 80th, 95th and 98th percentile values at the spoil disposal sites than the other scenarios, attributable to the summer conditions which have a less dominant drift trajectory, resulting in slower dispersion of the plume. However, the percentile values remain significantly lower than the maximums. Data at these sites reveals that elevated TSSC levels (of the order of 100-1,000 mg/L) occur immediately after disposal events but are rapidly dispersed and do not persist for long periods of time (scales of hours).

As indicated by the bottom thickness spatial maps, the time series analysis of sedimentation shows that the deposition rates at distance from the dredging and disposal areas are low, forming only very thin layers of material. At all sites other than those around the disposal area, and *CM04* to *CM06* which are relatively close to the dredging and disposal areas, the predicted thicknesses remain less than 0.2 mm. The low rates of deposition are due to the magnitude of the tidal and drift currents in the area and the shallow exposed bathymetry: material that is suspended is dispersed rapidly and widely, with material deposited at slack tides being typically resuspended on the next tide.

At the spoil ground sites (*SG1A* to *SG1D* for Scenarios 1 and 4, and *SG2A* to *SG2D* for Scenarios 2, 3 and 5), there are variations in thickness based on their relative proximity to where disposals have been simulated. Some slight reductions in predicted bottom thickness can be seen during the run-on periods, but as the deposited material typically comprises coarser sediments the sedimentation levels are relatively stable during ambient conditions.

Table 5.4 Percentiles (80th, 95th and 98th) and maximum predicted dredge-excess, depth-averaged TSSC (mg/L) for each time series analysis location throughout the dredging program and run-on period for Scenarios 1 to 5.

Name	Scenario 1				Scenario 2				Scenario 3				Scenario 4				Scenario 5			
	80th	95th	98th	Max	80th	95th	98th	Max	80th	95th	98th	Max	80th	95th	98th	Max	80th	95th	98th	Max
CM01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	1.1	0.0	0.0	0.0	1.5
CM02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
CM03	0.0	0.0	0.0	4.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	1.1	12.4	20.2	79.2	0.0	1.4	3.2	97.5
CM04	0.0	0.2	2.4	18.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	3.9	2.1	7.9	13.4	204.0	0.0	1.2	3.0	29.6
CM05	0.0	0.4	2.2	7.7	0.0	0.0	0.0	1.7	0.0	0.0	0.4	5.4	3.2	11.9	22.5	144.6	0.0	1.9	4.4	26.2
CM06	0.9	2.8	4.2	6.3	0.9	2.8	4.2	6.3	0.1	0.6	1.1	4.0	1.3	2.9	3.9	10.1	0.3	0.8	1.4	48.2
CM07	0.0	0.2	0.3	4.4	0.0	0.2	0.2	1.0	0.0	0.1	0.4	11.8	0.0	0.3	0.4	2.2	0.0	0.0	0.2	1.3
CM08	0.0	0.3	0.8	6.1	0.0	0.1	0.3	1.5	0.0	0.1	0.7	6.0	0.0	0.4	0.8	8.1	0.0	0.1	0.3	6.6
CM09	0.2	1.8	4.8	17.7	0.1	0.9	1.9	5.6	0.0	0.8	2.0	11.0	0.1	1.9	3.8	12.3	0.0	0.8	1.9	7.9
CM10	0.1	1.8	4.4	9.8	0.2	2.9	5.4	16.1	0.0	1.6	3.9	24.5	0.0	1.0	2.5	19.9	0.0	0.6	1.8	6.7
TS18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.4	0.0	0.1	0.6	2.7	0.0	0.0	0.1	2.4
TS20	0.1	2.8	5.8	13.1	0.4	4.6	9.5	30.5	0.0	1.7	4.1	21.1	0.0	1.6	3.3	12.1	0.0	1.3	3.2	15.5
TS14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TS13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1
SG1A	0.4	8.3	19.1	85.2	-	-	-	-	-	-	-	-	3.4	19.1	45.2	156.4	0.1	1.7	4.5	38.7
SG1B	0.0	0.1	0.6	8.8	-	-	-	-	-	-	-	-	0.5	2.4	5.0	73.6	0.0	1.1	3.2	67.3
SG1C	0.0	0.0	0.1	13.6	-	-	-	-	-	-	-	-	1.3	14.5	38.5	307.7	0.1	2.0	4.3	68.2
SG1D	0.0	1.4	4.0	882.3	-	-	-	-	-	-	-	-	4.6	36.0	68.0	1020.8	0.0	1.9	4.5	21.7
SG2A	-	-	-	-	0.1	4.6	11.3	94.7	0.0	0.9	3.9	279.5	-	-	-	-	-	-	-	-
SG2B	-	-	-	-	0.0	0.2	0.6	87.7	0.0	0.1	0.6	20.2	-	-	-	-	-	-	-	-
SG2C	-	-	-	-	0.0	0.0	0.0	1.1	0.0	0.1	0.7	21.9	-	-	-	-	-	-	-	-
SG2D	-	-	-	-	0.1	3.4	7.5	97.4	0.0	3.1	10.2	339.3	-	-	-	-	-	-	-	-
DIFF	0.1	0.6	1.2	1.7	0.1	0.5	1.1	2.1	0.0	0.0	0.0	0.0	0.5	2.2	3.6	18.0	0.0	0.4	0.9	4.6

5.2.2 TSSC – Time Series Figures

5.2.2.1 Scenario 1: Winter Start for 2-Week Dredge Program Using Spoil Disposal Site 1

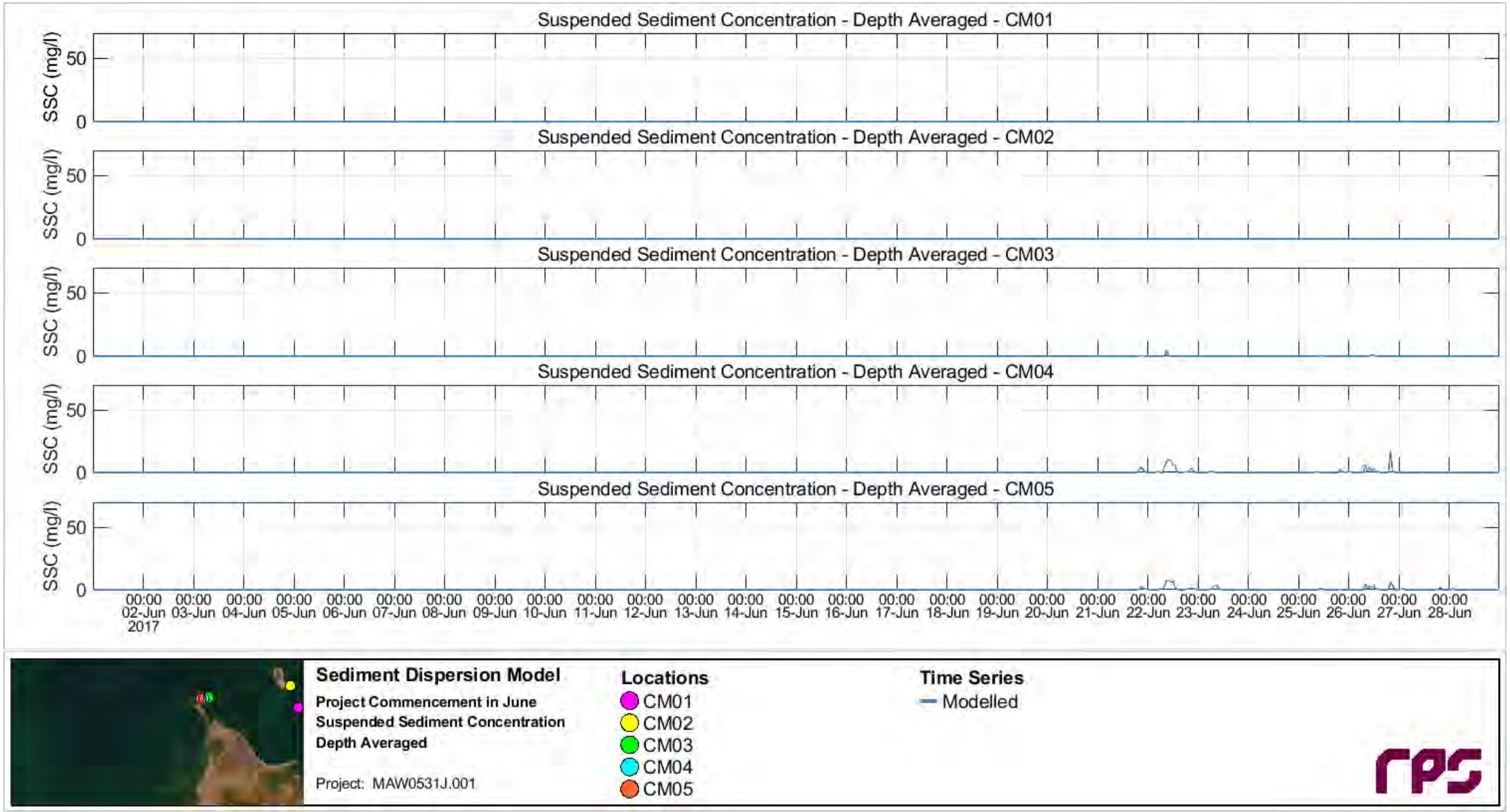

Figure 5.56 Time series of predicted dredge-excess depth-averaged TSSC at the *CM01* to *CM05* sites throughout the entire Scenario 1 duration (1 to 29 June 2017).

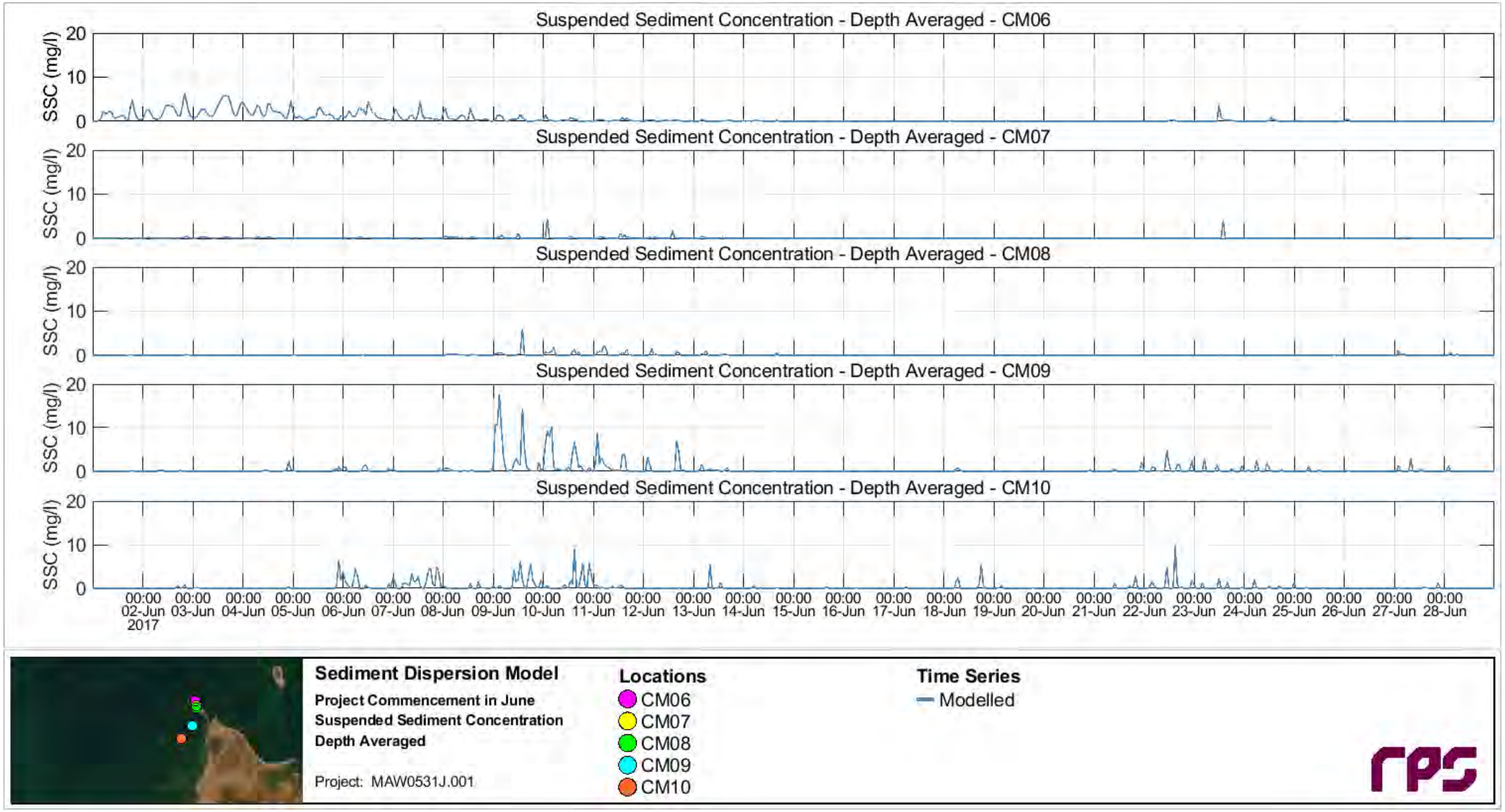

Figure 5.57 Time series of predicted dredge-excess depth-averaged TSSC at the *CM06* to *CM10* sites throughout the entire Scenario 1 duration (1 to 29 June 2017).

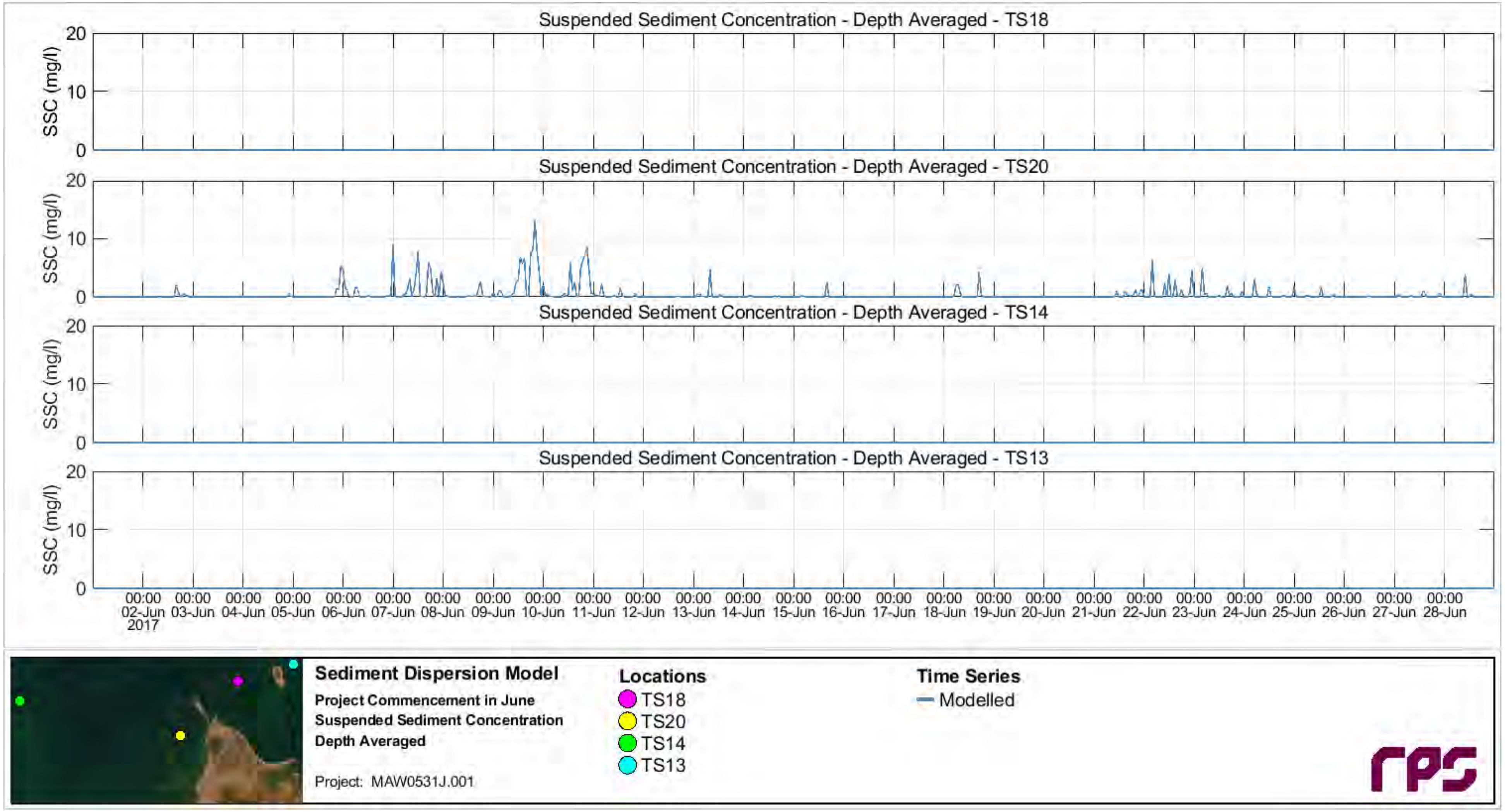

Figure 5.58 Time series of predicted dredge-excess depth-averaged TSSC at the *TS18*, *TS20*, *TS14* and *TS13* sites throughout the entire Scenario 1 duration (1 to 29 June 2017).

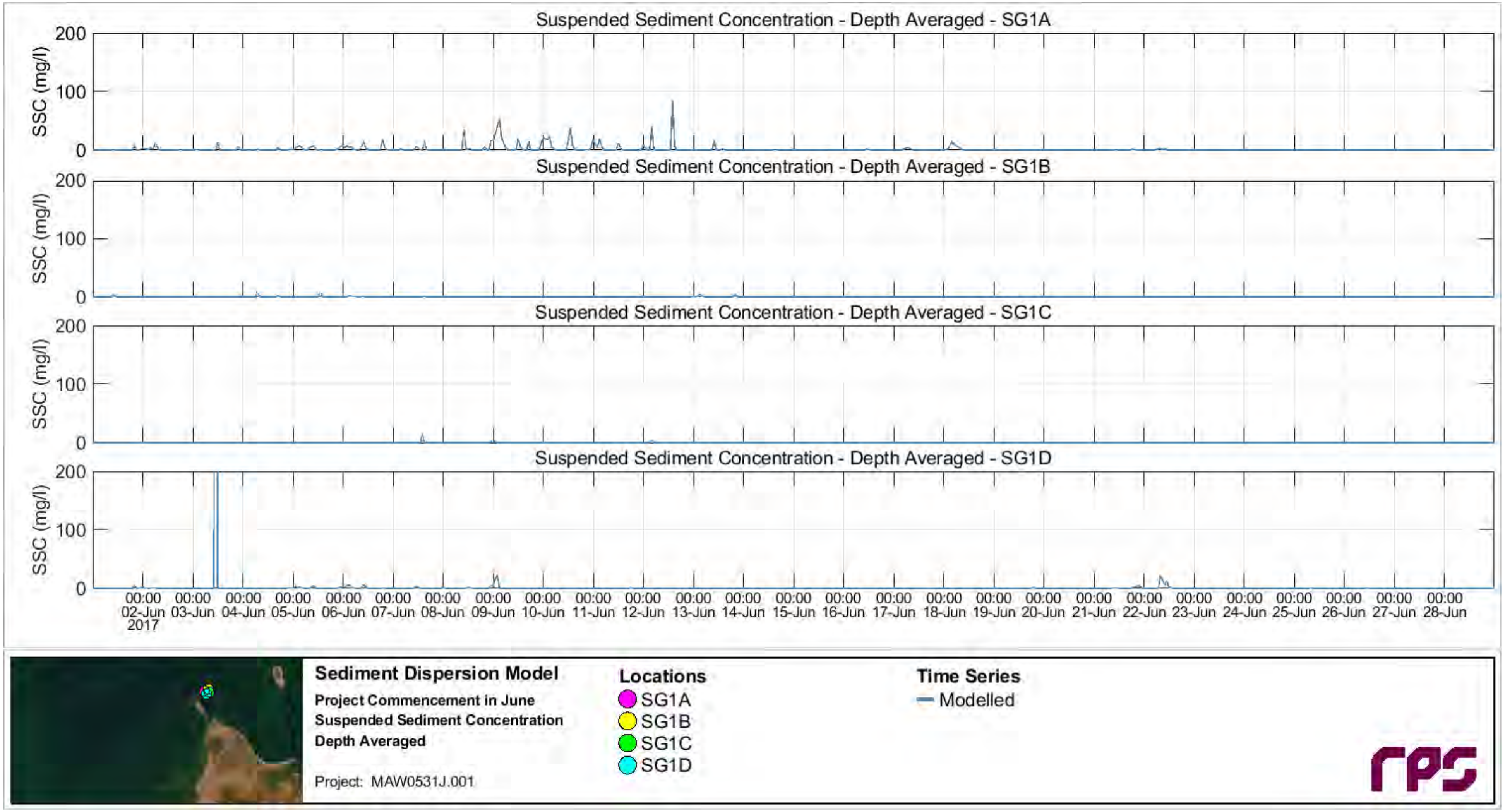

Figure 5.59 Time series of predicted dredge-excess depth-averaged TSSC at the *SG1A* to *SG1D* sites throughout the entire Scenario 1 duration (1 to 29 June 2017).

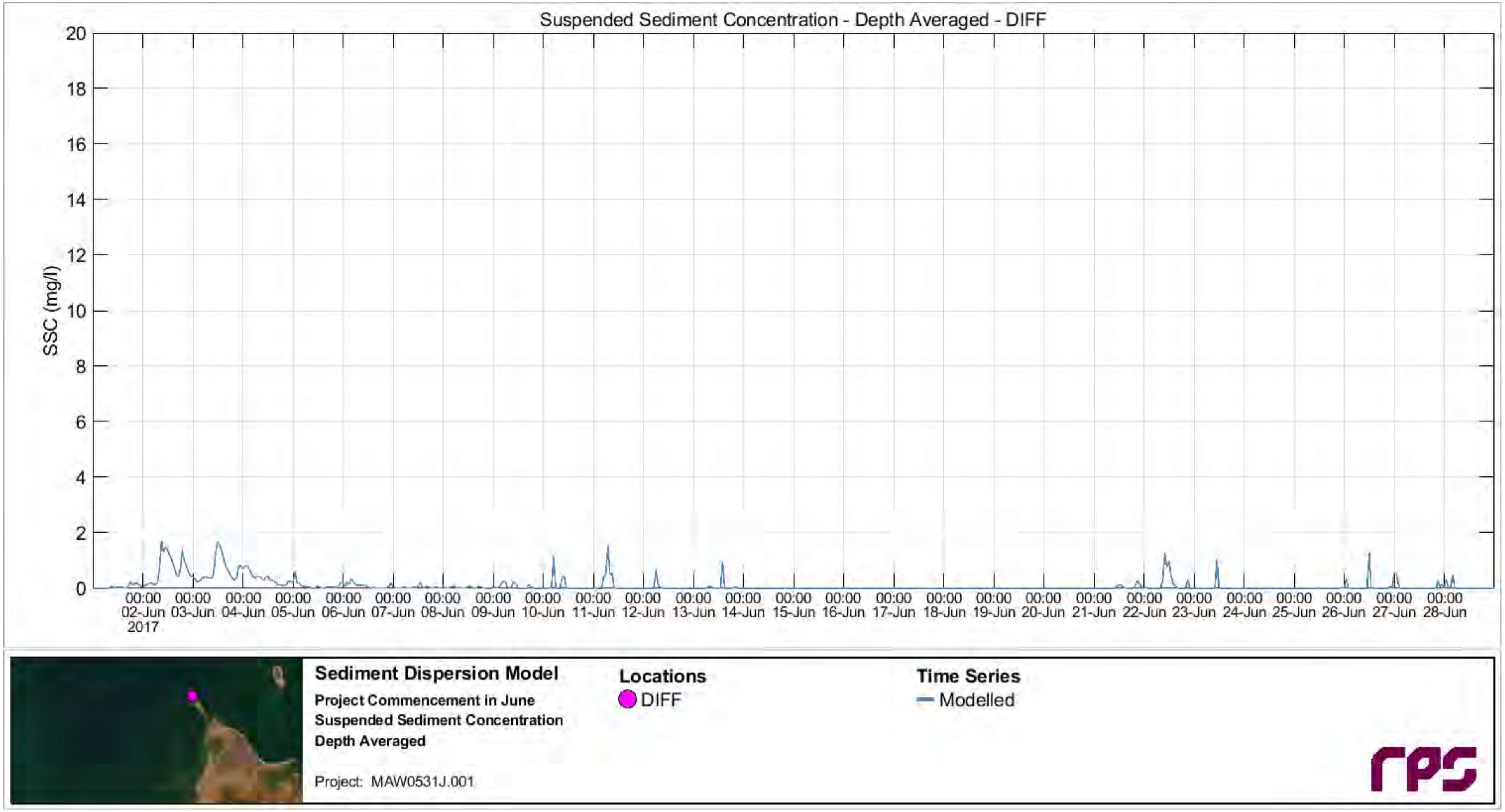

Figure 5.60 Time series of predicted dredge-excess depth-averaged TSSC at the *DIFF* site throughout the entire Scenario 1 duration (1 to 29 June 2017).

5.2.2.2 Scenario 2: Winter Start for 2-Week Dredge Program Using Spoil Disposal Site 2

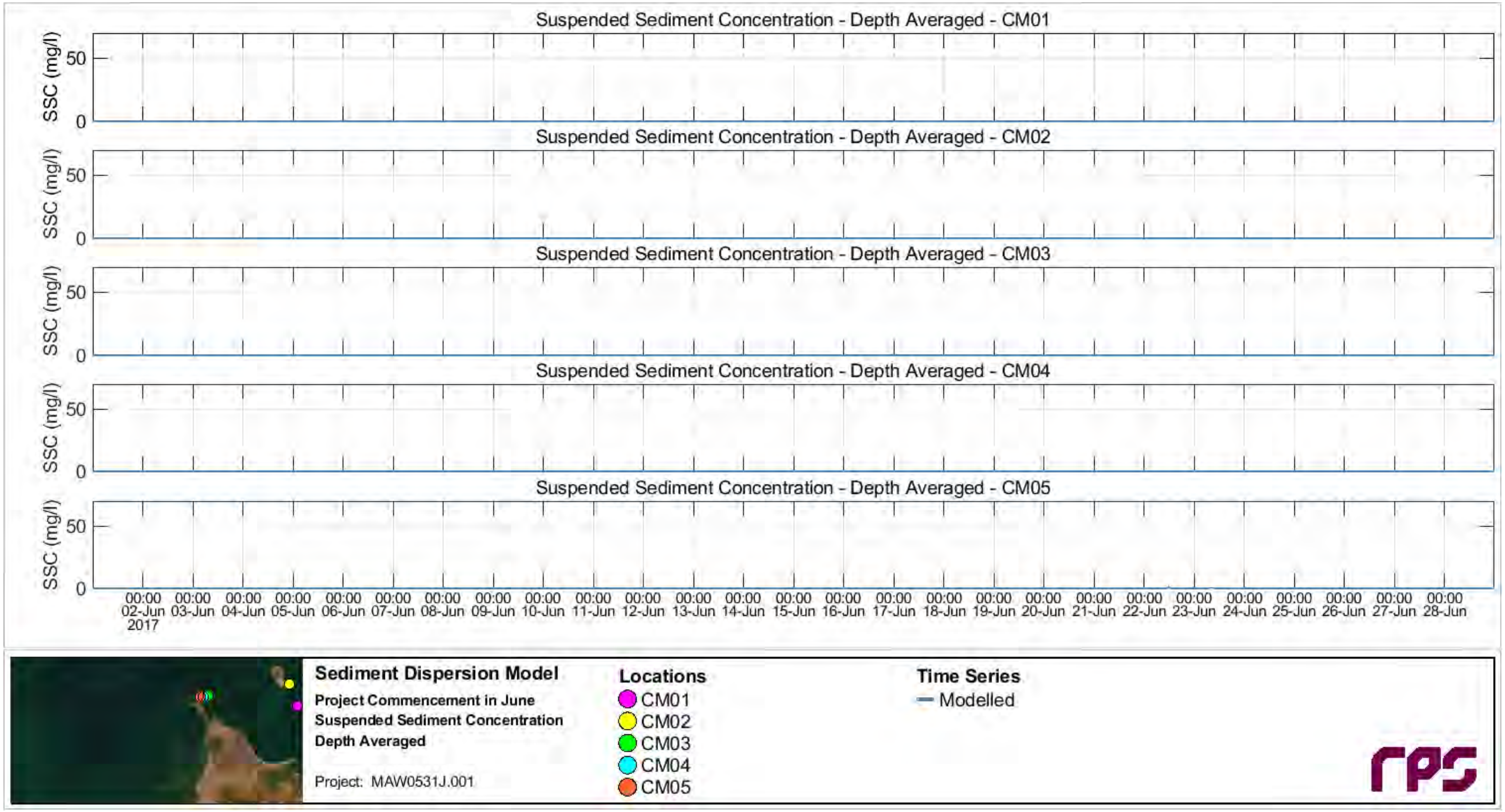

Figure 5.61 Time series of predicted dredge-excess depth-averaged TSSC at the *CM01* to *CM05* sites throughout the entire Scenario 2 duration (1 to 29 June 2017).

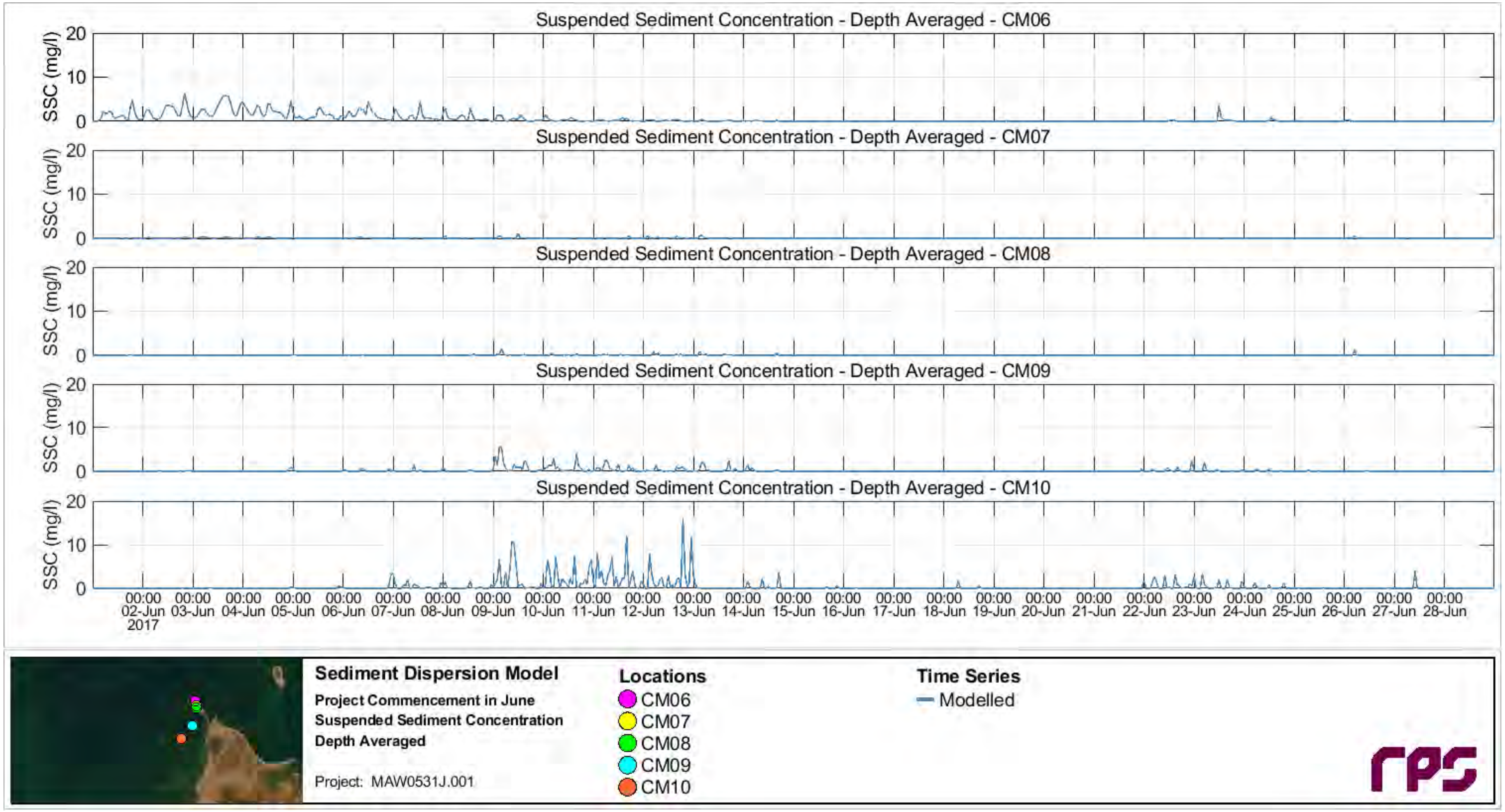

Figure 5.62 Time series of predicted dredge-excess depth-averaged TSSC at the *CM06* to *CM10* sites throughout the entire Scenario 2 duration (1 to 29 June 2017).

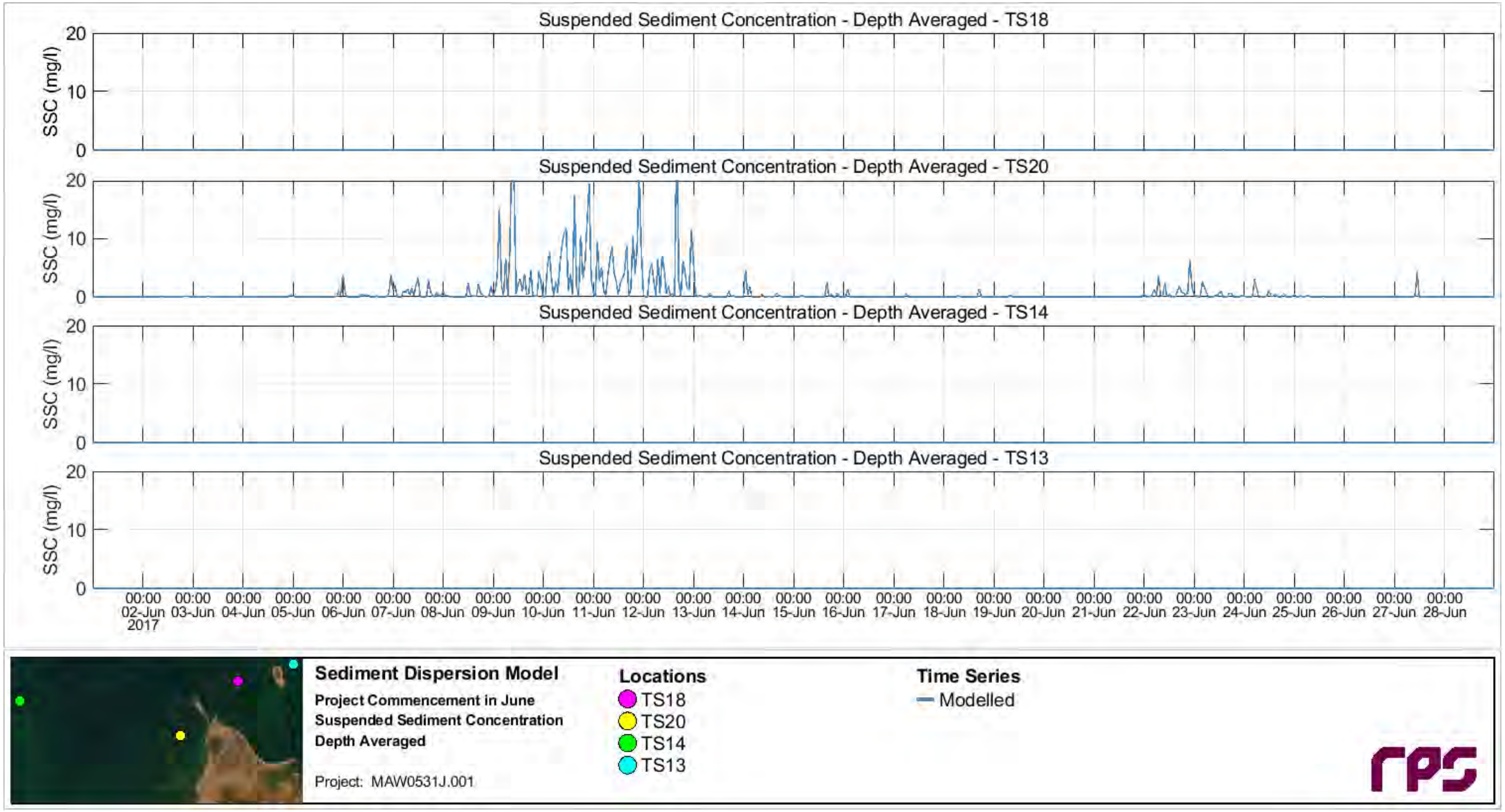

Figure 5.63 **Time series of predicted dredge-excess depth-averaged TSSC at the *TS18*, *TS20*, *TS14* and *TS13* sites throughout the entire Scenario 2 duration (1 to 29 June 2017).**

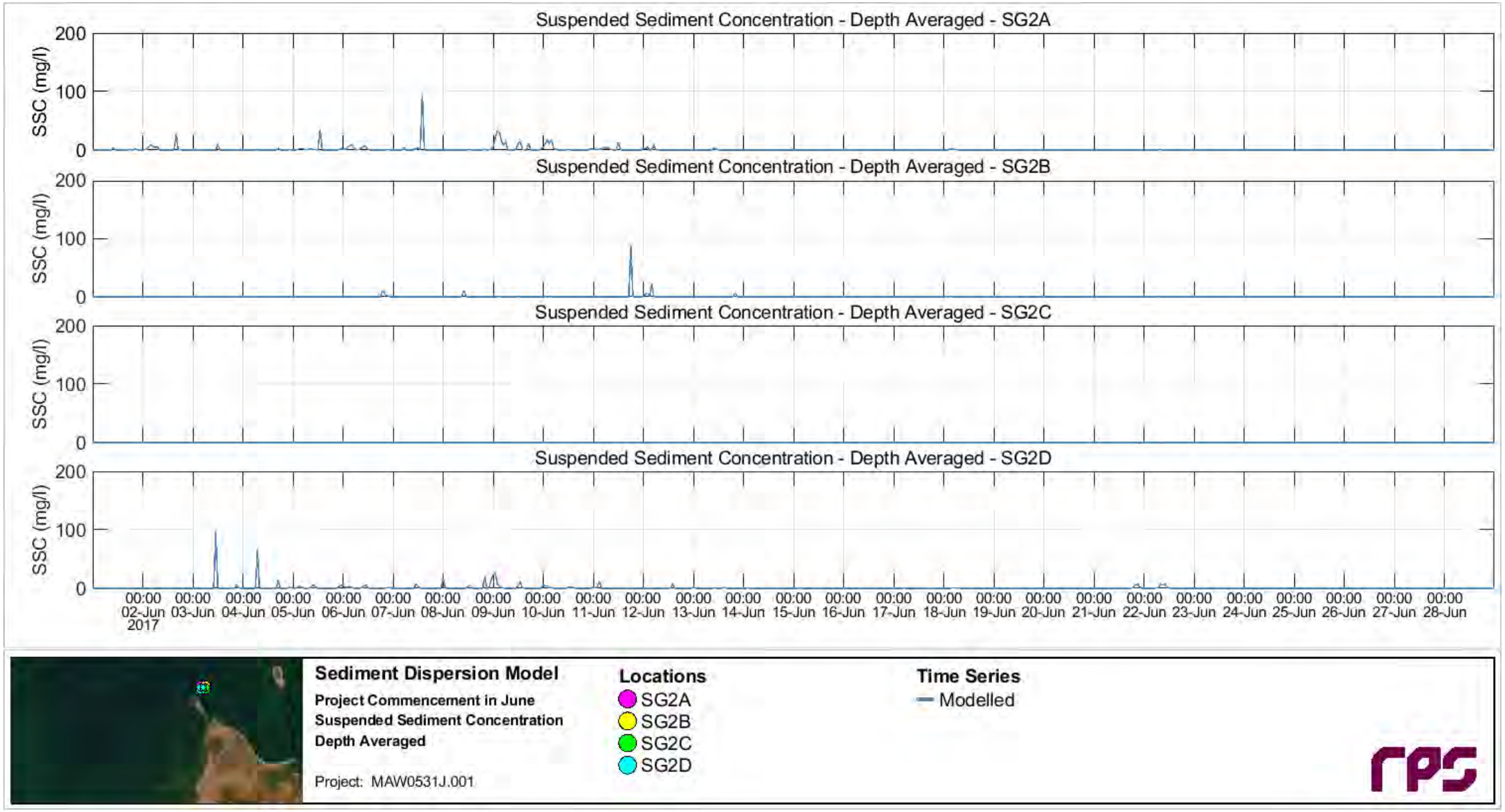

Figure 5.64 Time series of predicted dredge-excess depth-averaged TSSC at the *SG2A* to *SG2D* sites throughout the entire Scenario 2 duration (1 to 29 June 2017).

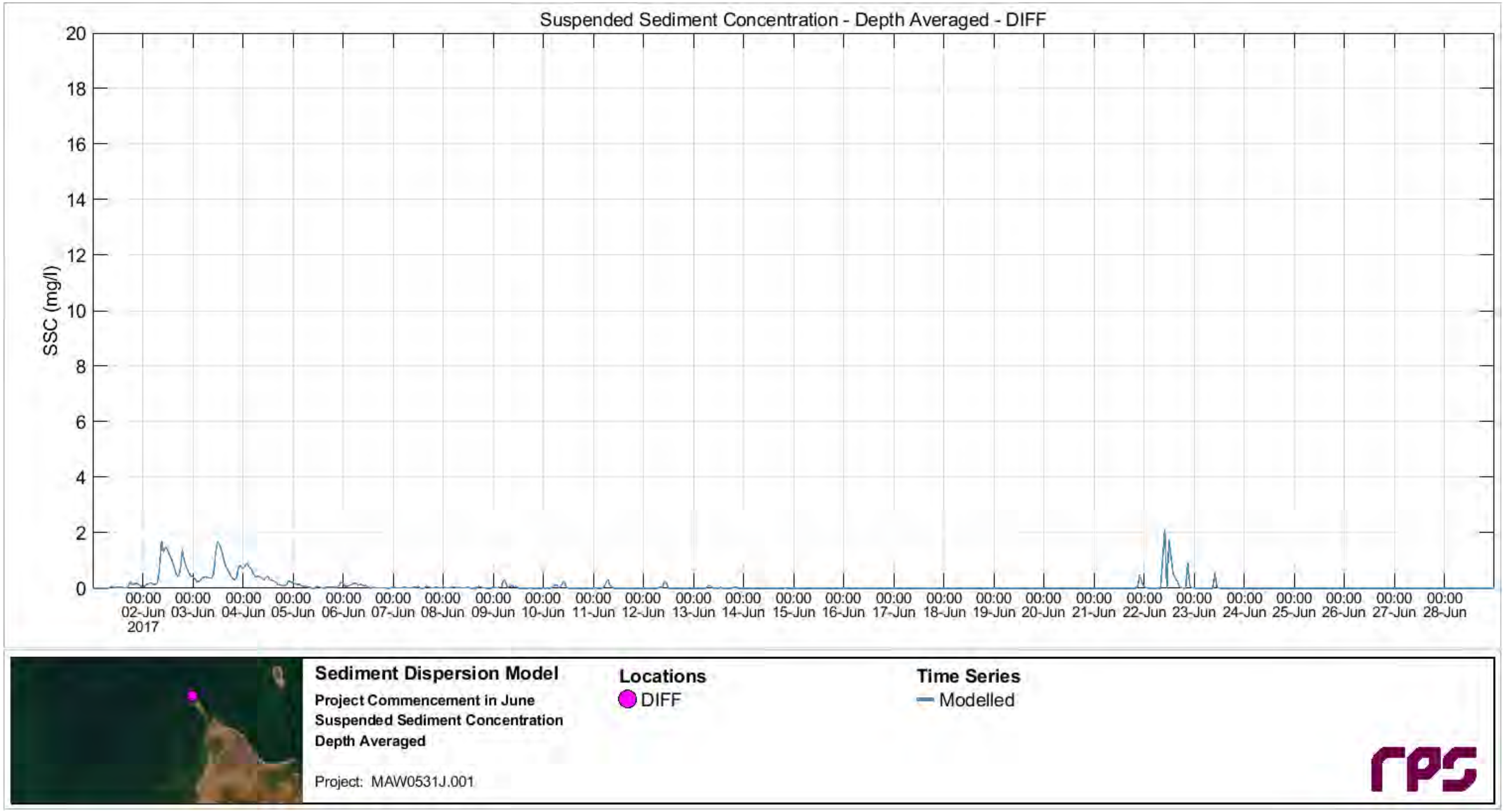

Figure 5.65 Time series of predicted dredge-excess depth-averaged TSSC at the *DIFF* site throughout the entire Scenario 2 duration (1 to 29 June 2017).

5.2.2.3 Scenario 3: Winter Start for 6-Week Dredge Program Using Spoil Disposal Site 2

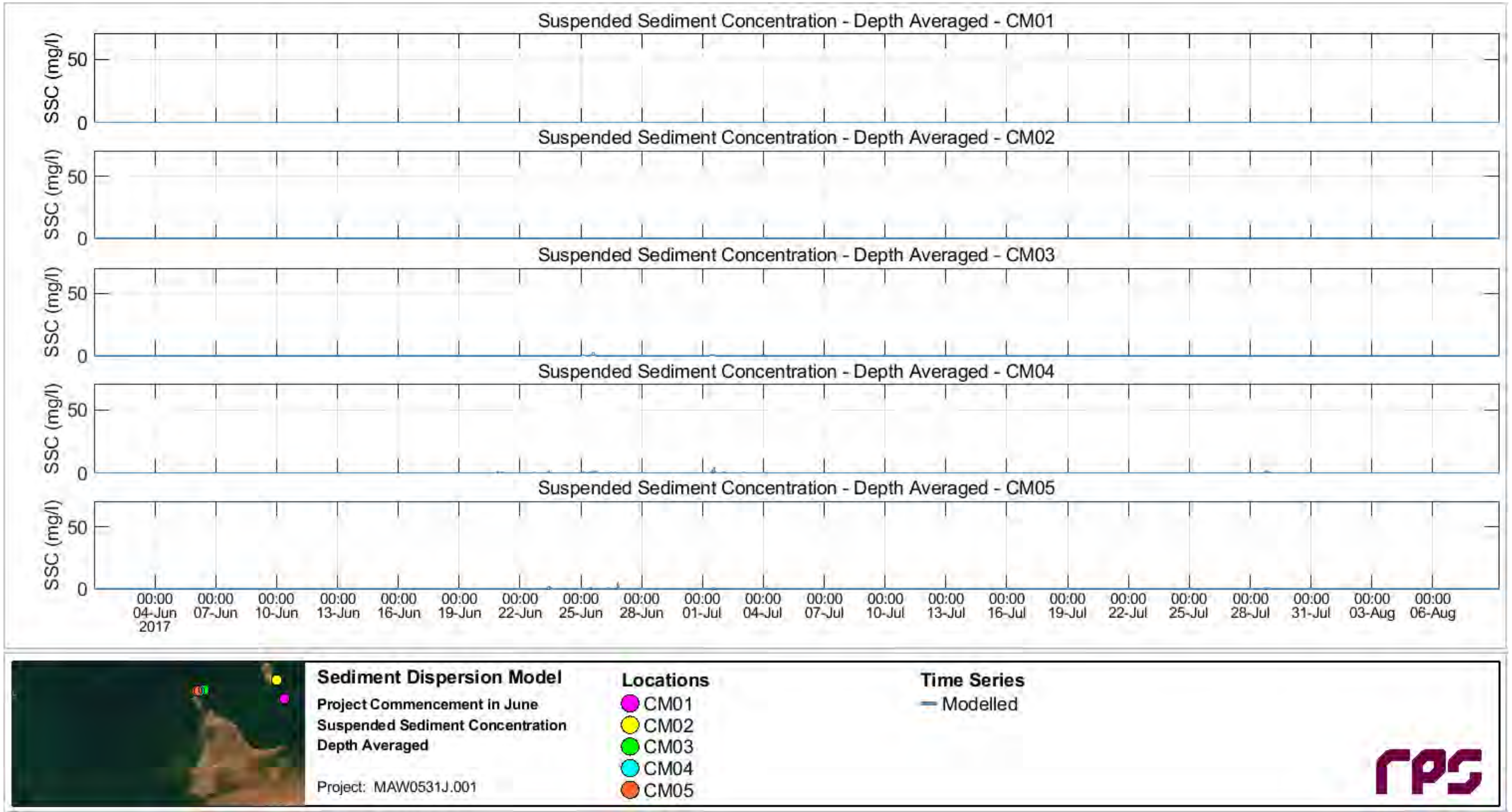

Figure 5.66 Time series of predicted dredge-excess depth-averaged TSSC at the *CM01* to *CM05* sites throughout the entire Scenario 3 duration (1 June to 9 August 2017).

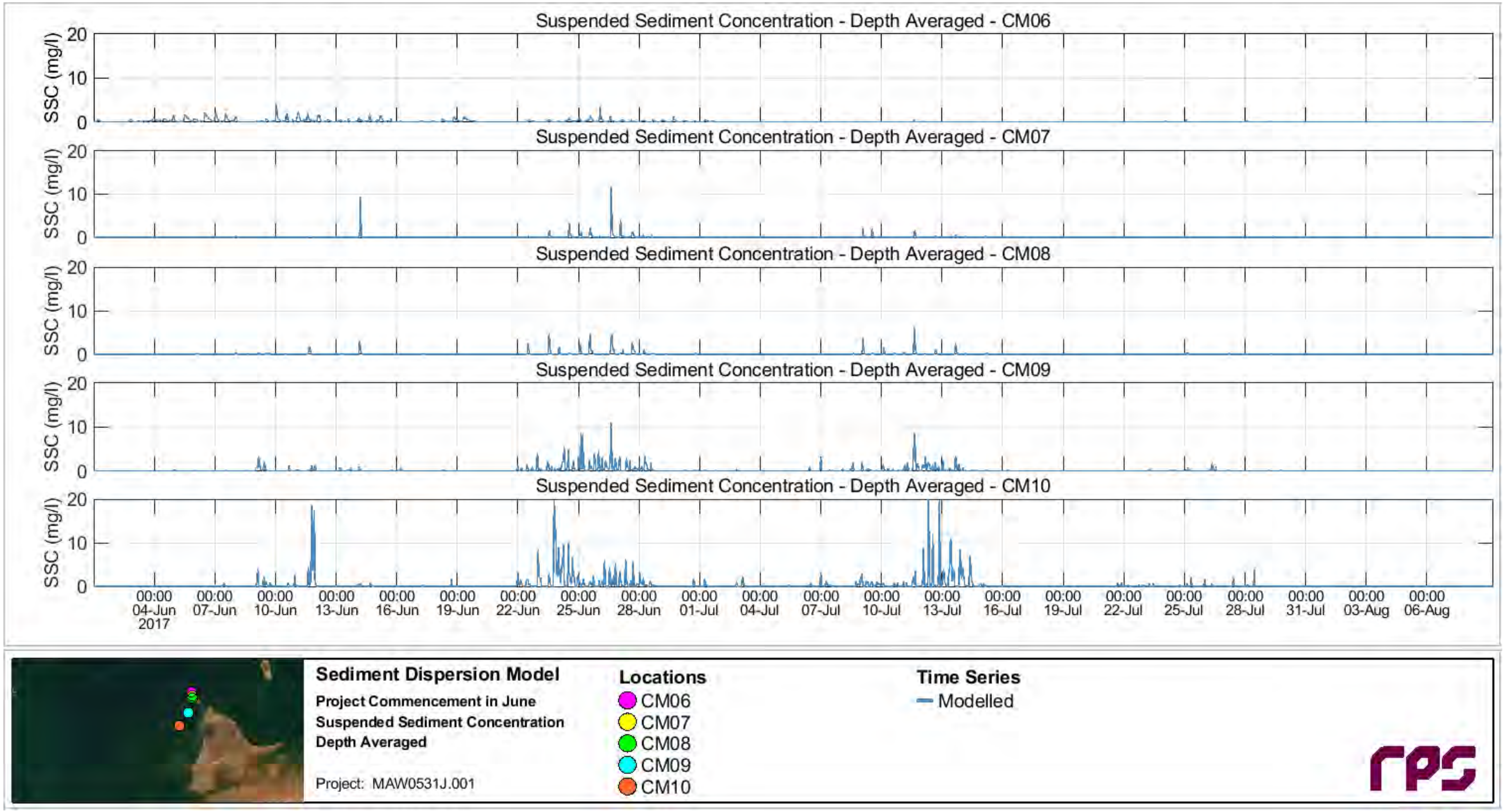

Figure 5.67 **Time series of predicted dredge-excess depth-averaged TSSC at the *CM06* to *CM10* sites throughout the entire Scenario 3 duration (1 June to 9 August 2017).**

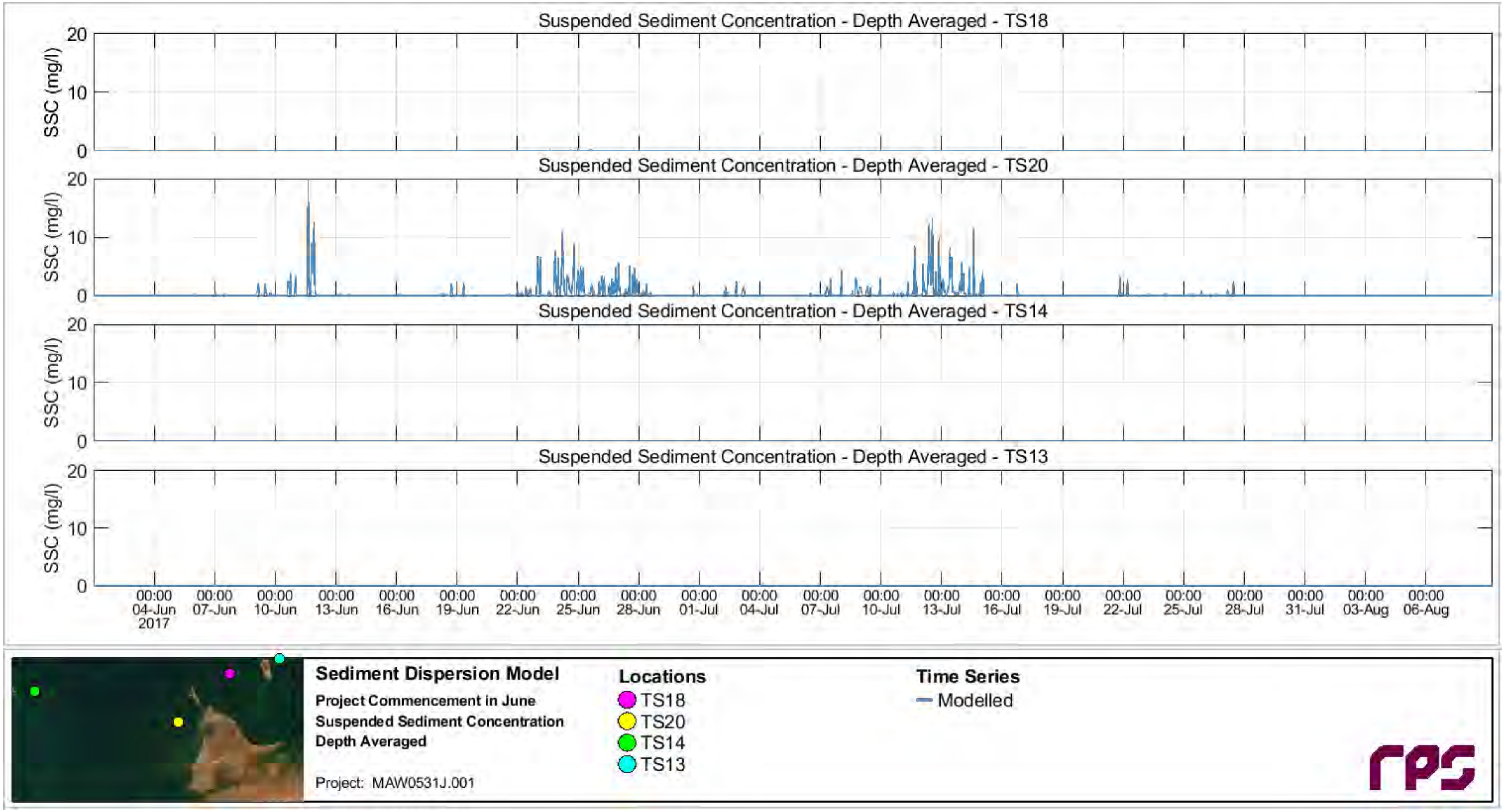

Figure 5.68 **Time series of predicted dredge-excess depth-averaged TSSC at the *TS18*, *TS20*, *TS14* and *TS13* sites throughout the entire Scenario 3 duration (1 June to 9 August 2017).**

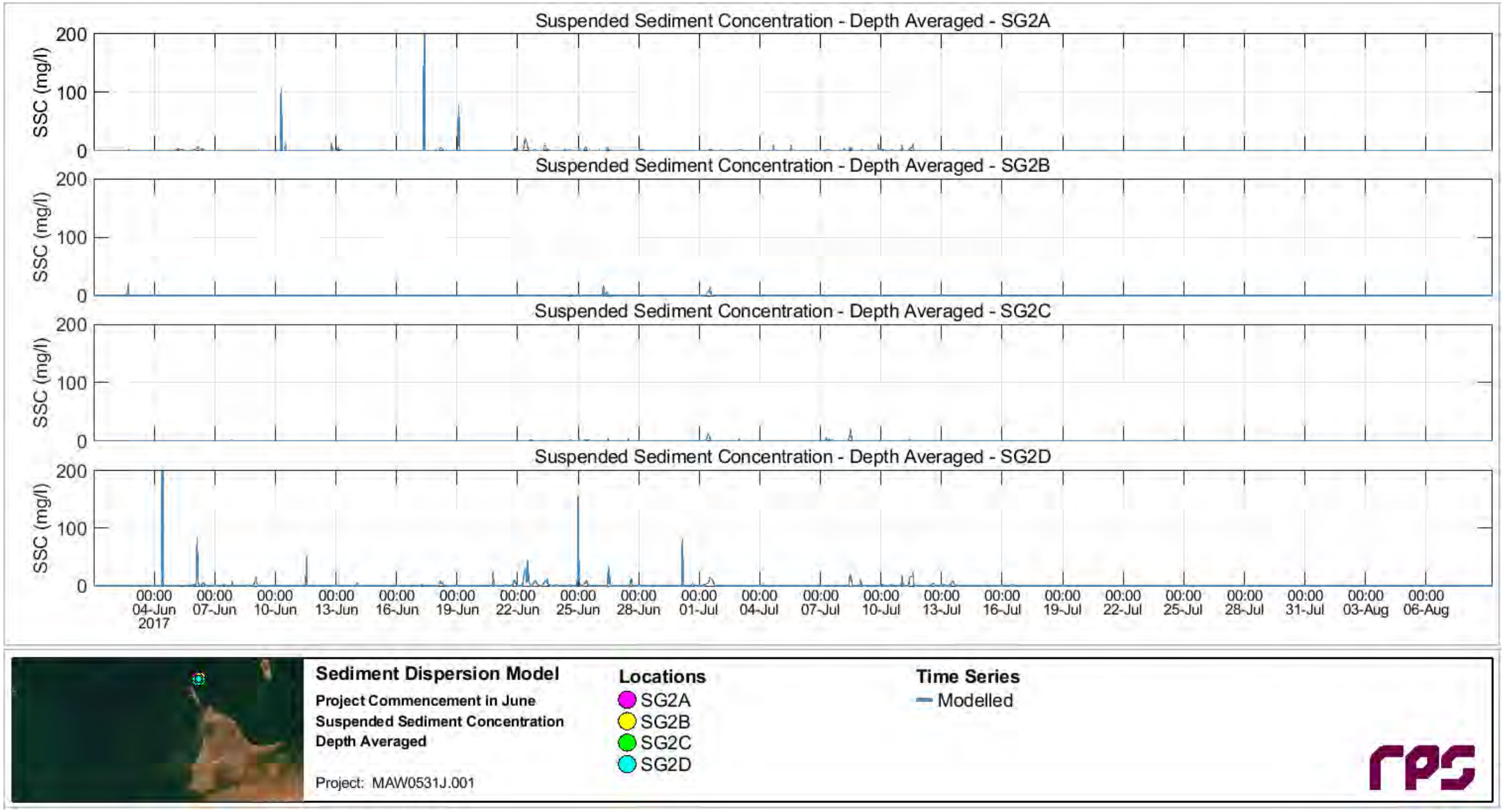

Figure 5.69 Time series of predicted dredge-excess depth-averaged TSSC at the *SG2A* to *SG2D* sites throughout the entire Scenario 3 duration (1 June to 9 August 2017).

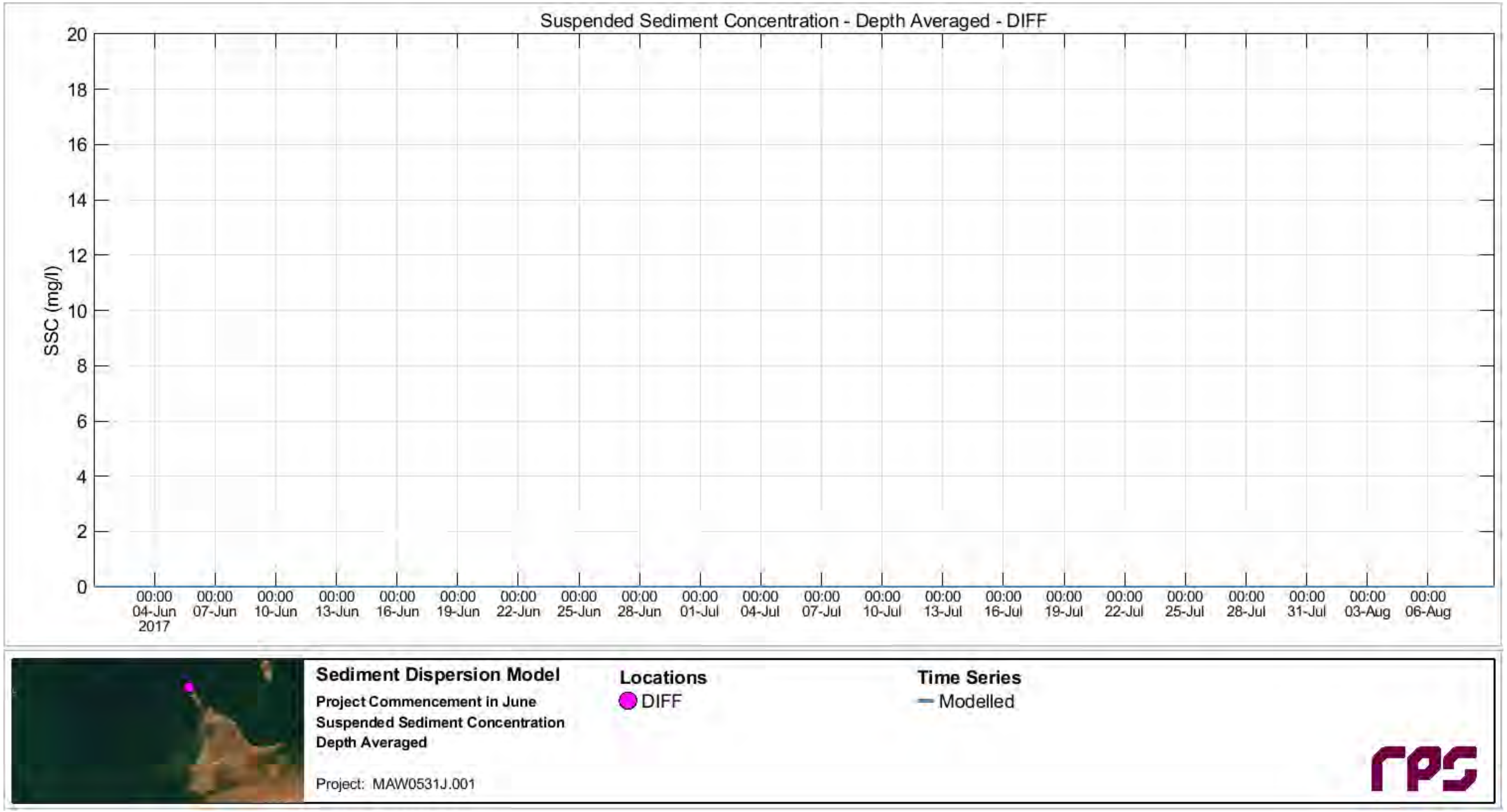

Figure 5.70 Time series of predicted dredge-excess depth-averaged TSSC at the *DIFF* site throughout the entire Scenario 3 duration (1 June to 9 August 2017).

5.2.2.4 Scenario 4: Summer Start for 2-Week Dredge Program Using Spoil Disposal Site 1

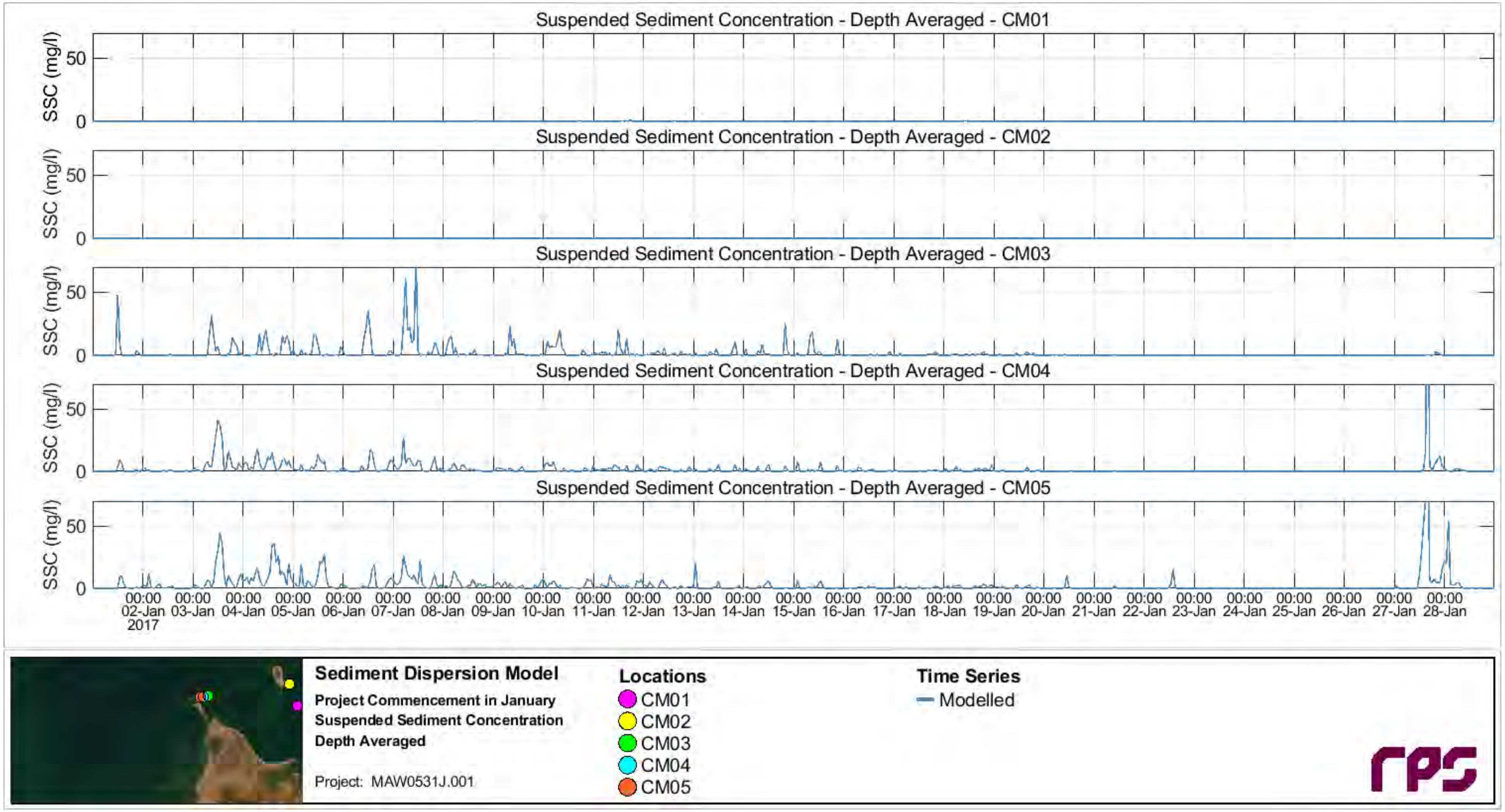

Figure 5.71 Time series of predicted dredge-excess depth-averaged TSSC at the *CM01* to *CM05* sites throughout the entire Scenario 4 duration (1 to 29 January 2017).

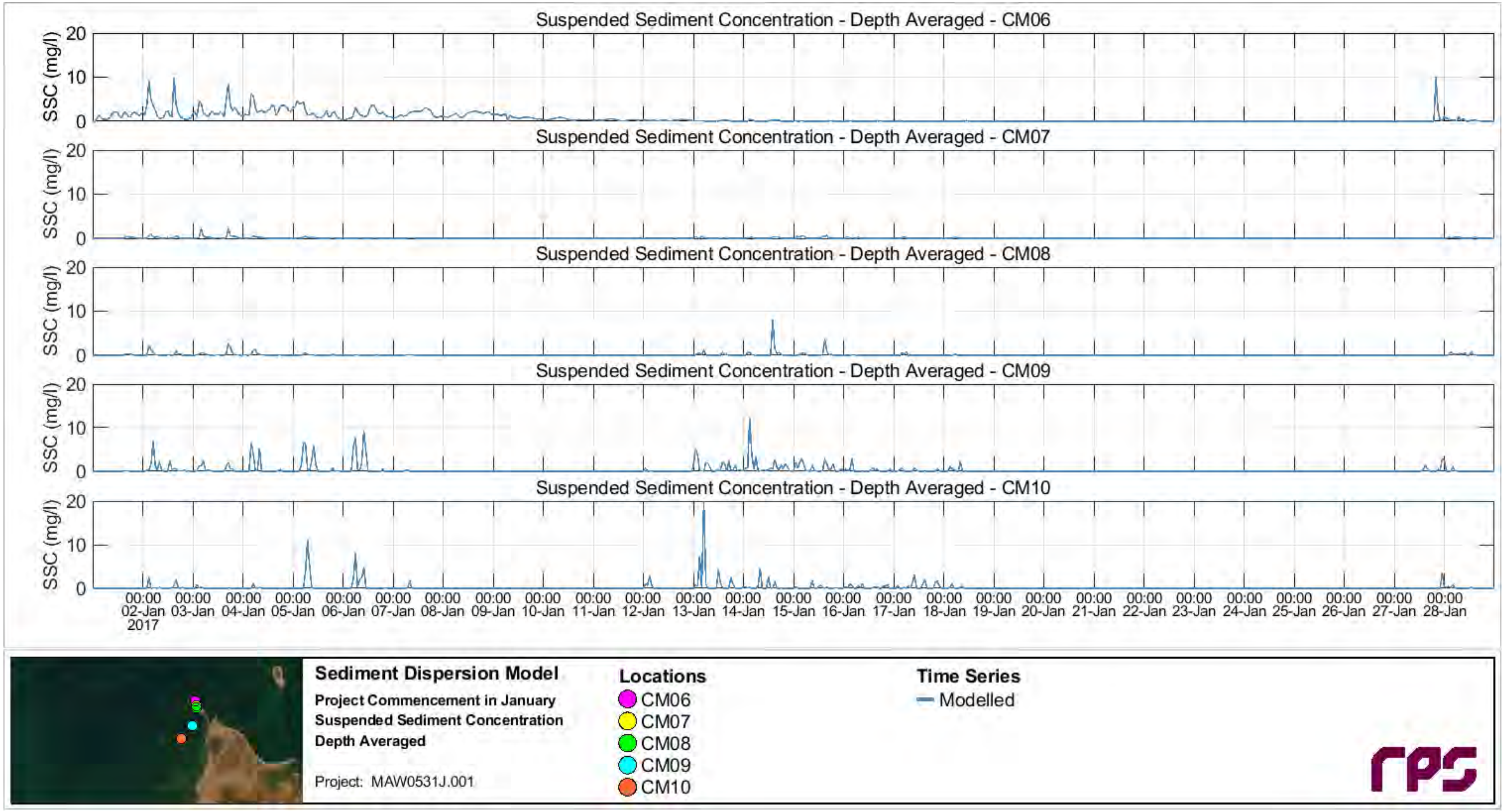

Figure 5.72 Time series of predicted dredge-excess depth-averaged TSSC at the *CM06* to *CM10* sites throughout the entire Scenario 4 duration (1 to 29 January 2017).

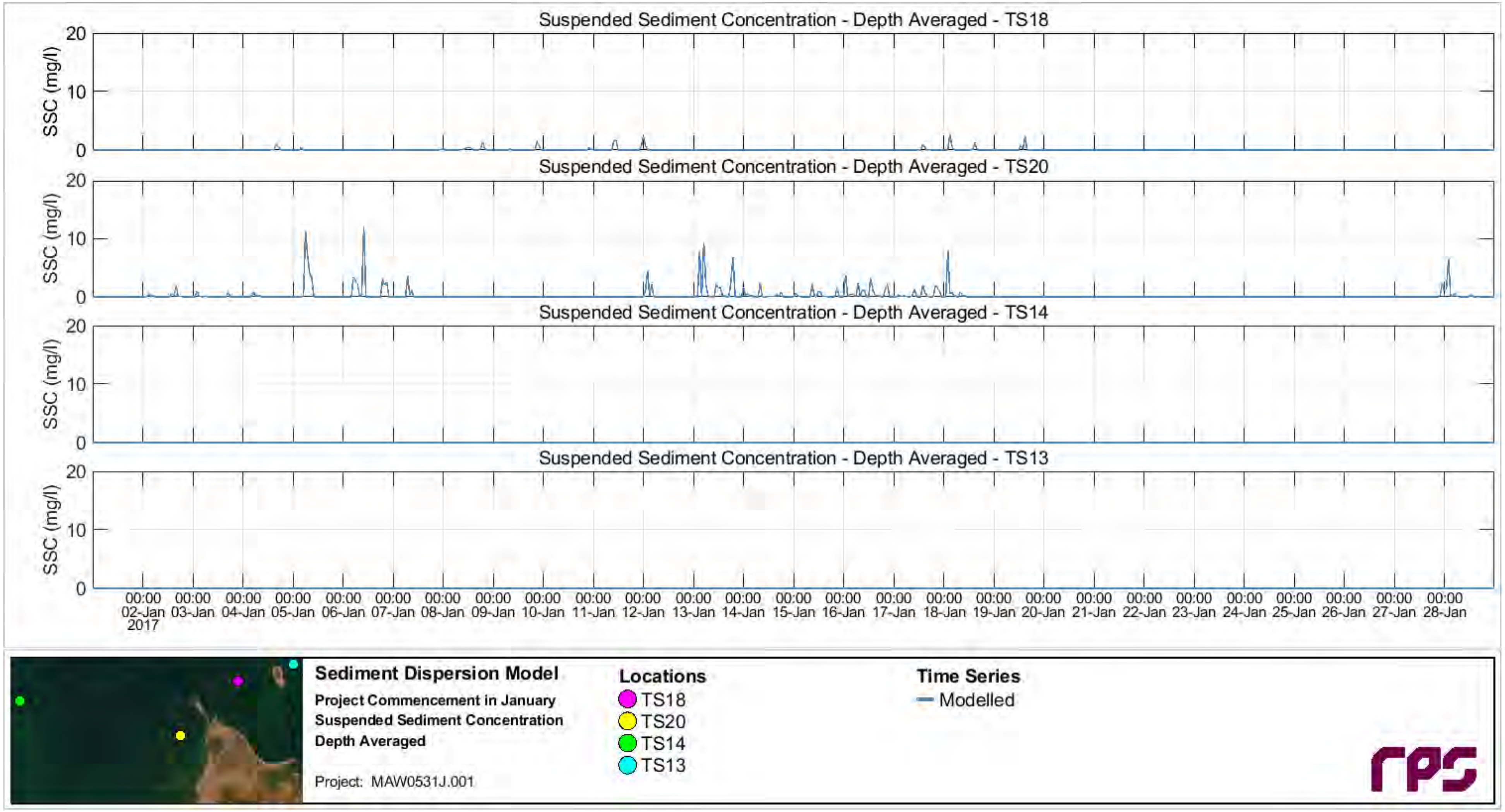

Figure 5.73 Time series of predicted dredge-excess depth-averaged TSSC at the *TS18, TS20, TS14* and *TS13* sites throughout the entire Scenario 4 duration (1 to 29 January 2017).

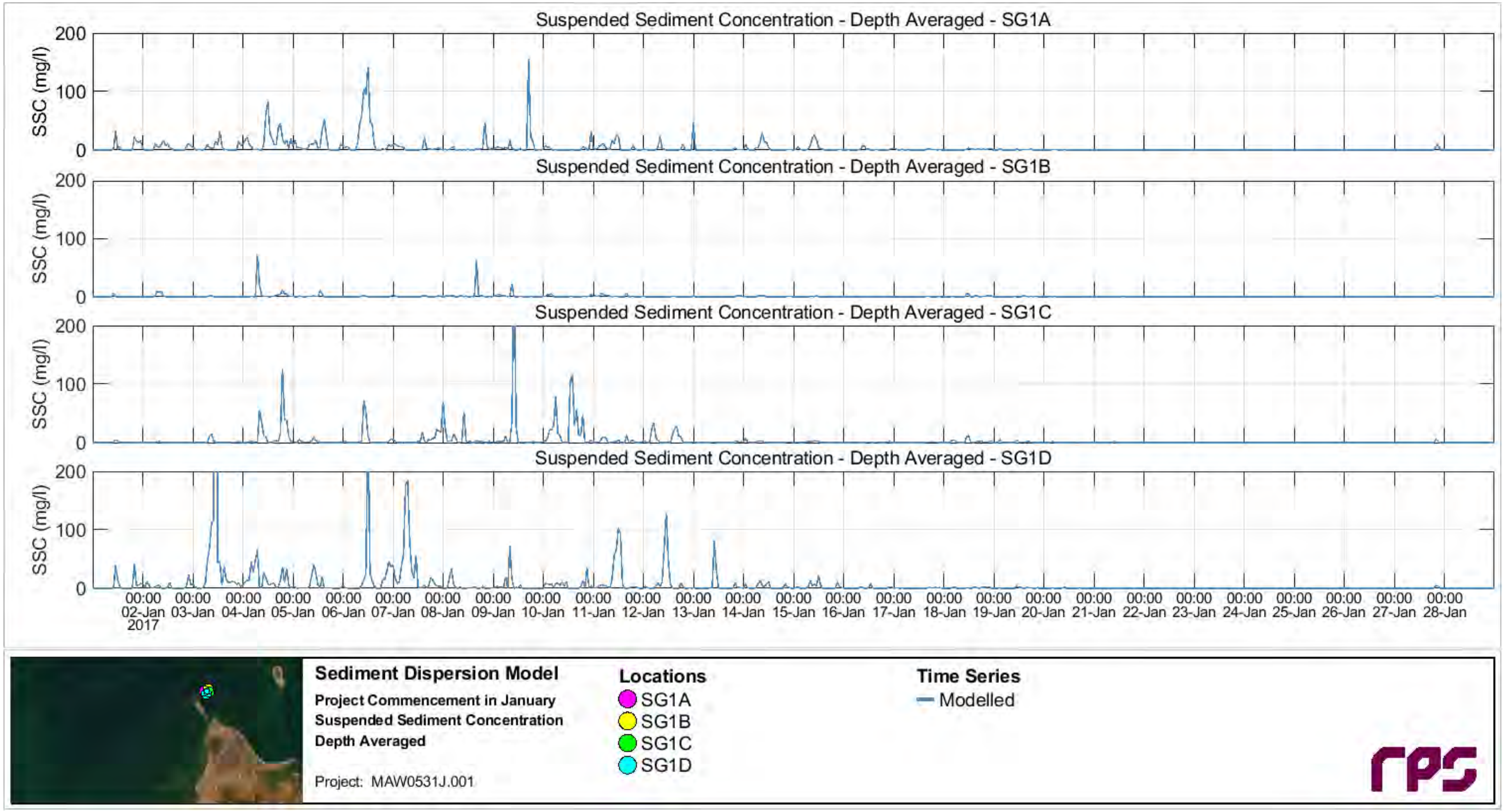

Figure 5.74 Time series of predicted dredge-excess depth-averaged TSSC at the *SG1A* to *SG1D* sites throughout the entire Scenario 4 duration (1 to 29 January 2017).

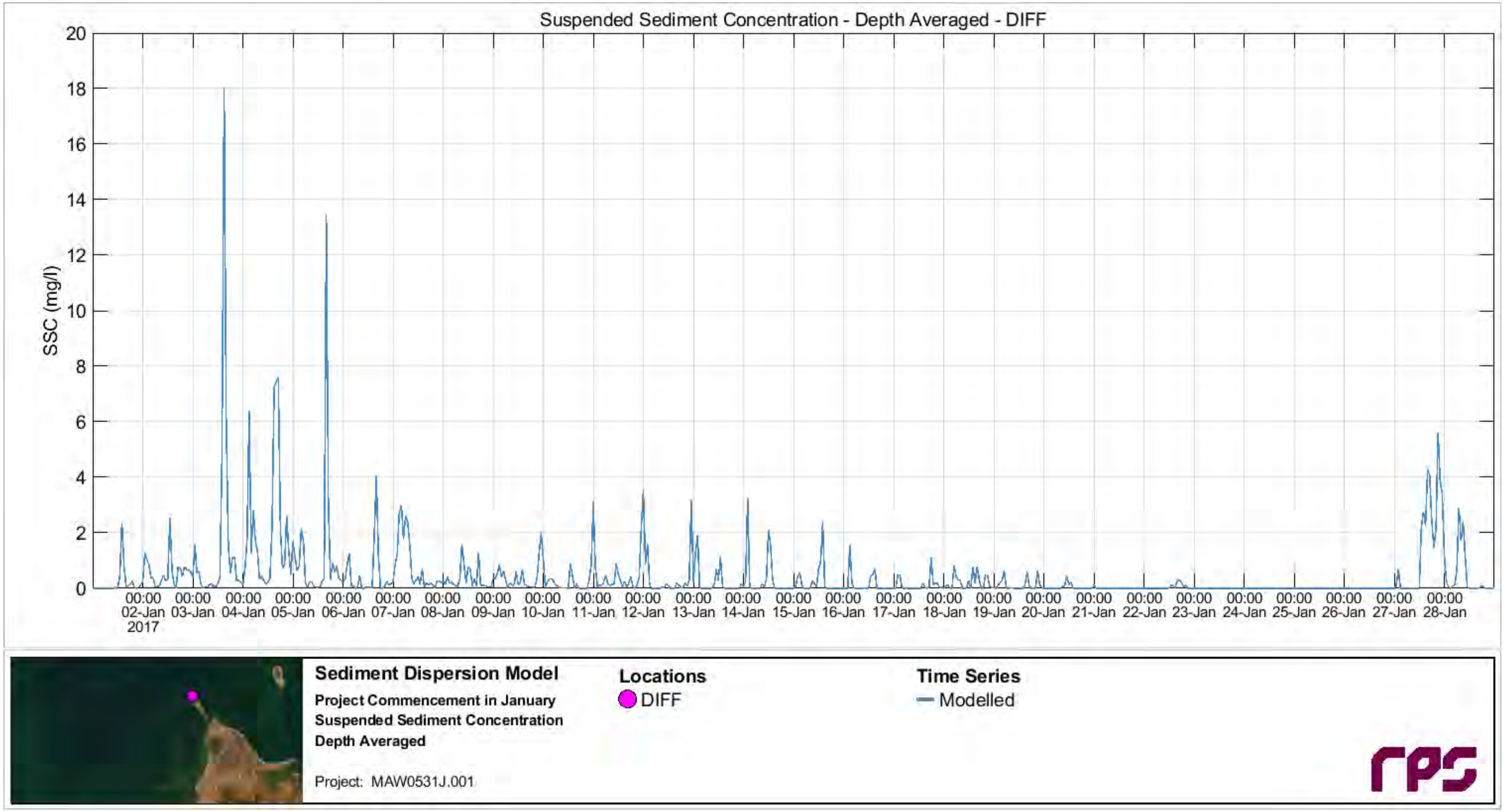

Figure 5.75 Time series of predicted dredge-excess depth-averaged TSSC at the *DIFF* site throughout the entire Scenario 4 duration (1 to 29 January 2017).

5.2.2.5 Scenario 5: Summer Start for 6-Week Dredge Program Using Spoil Disposal Site 2

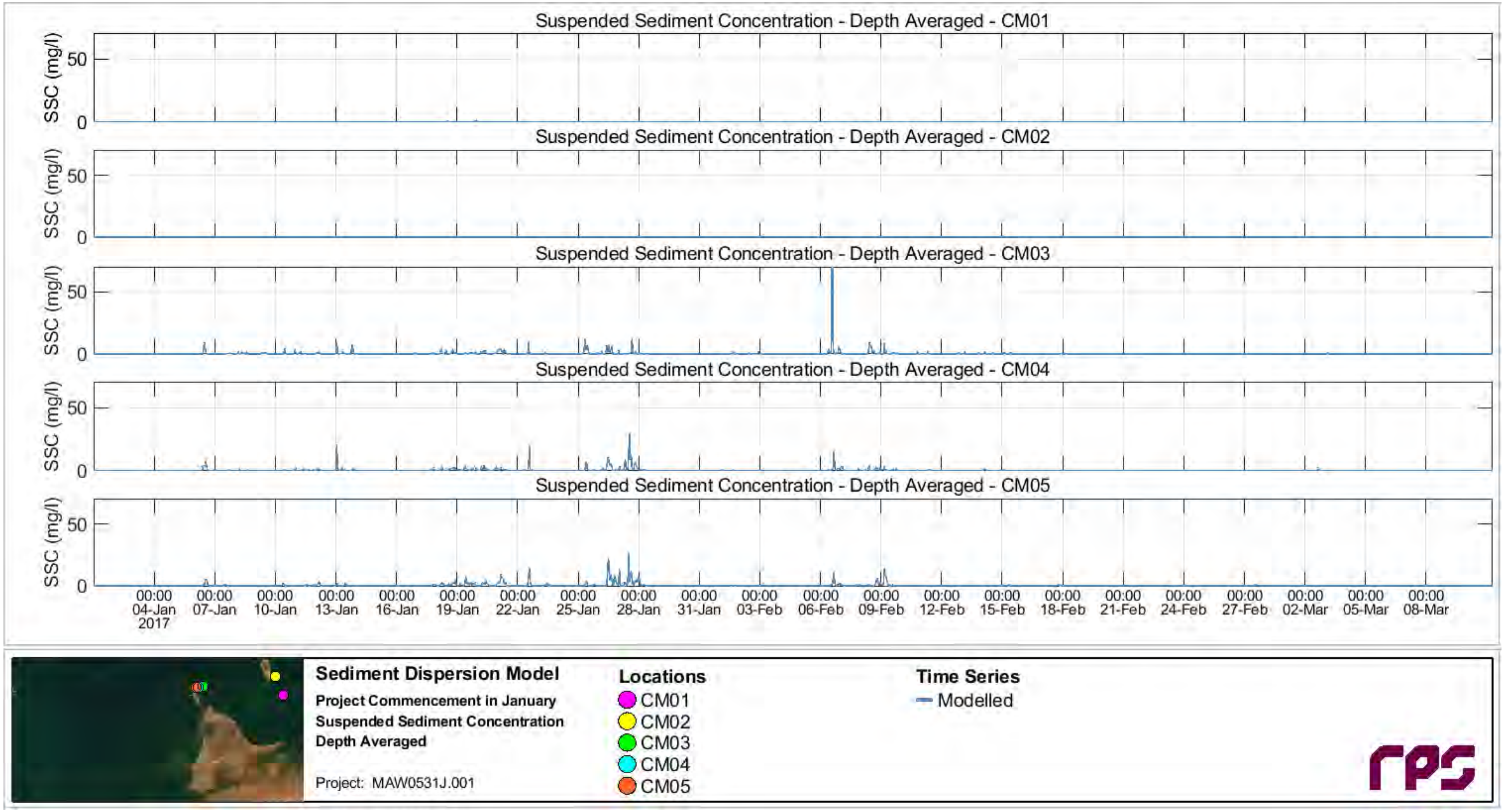

Figure 5.76 Time series of predicted dredge-excess depth-averaged TSSC at the *CM01* to *CM05* sites throughout the entire Scenario 5 duration (1 January to 11 March 2017).

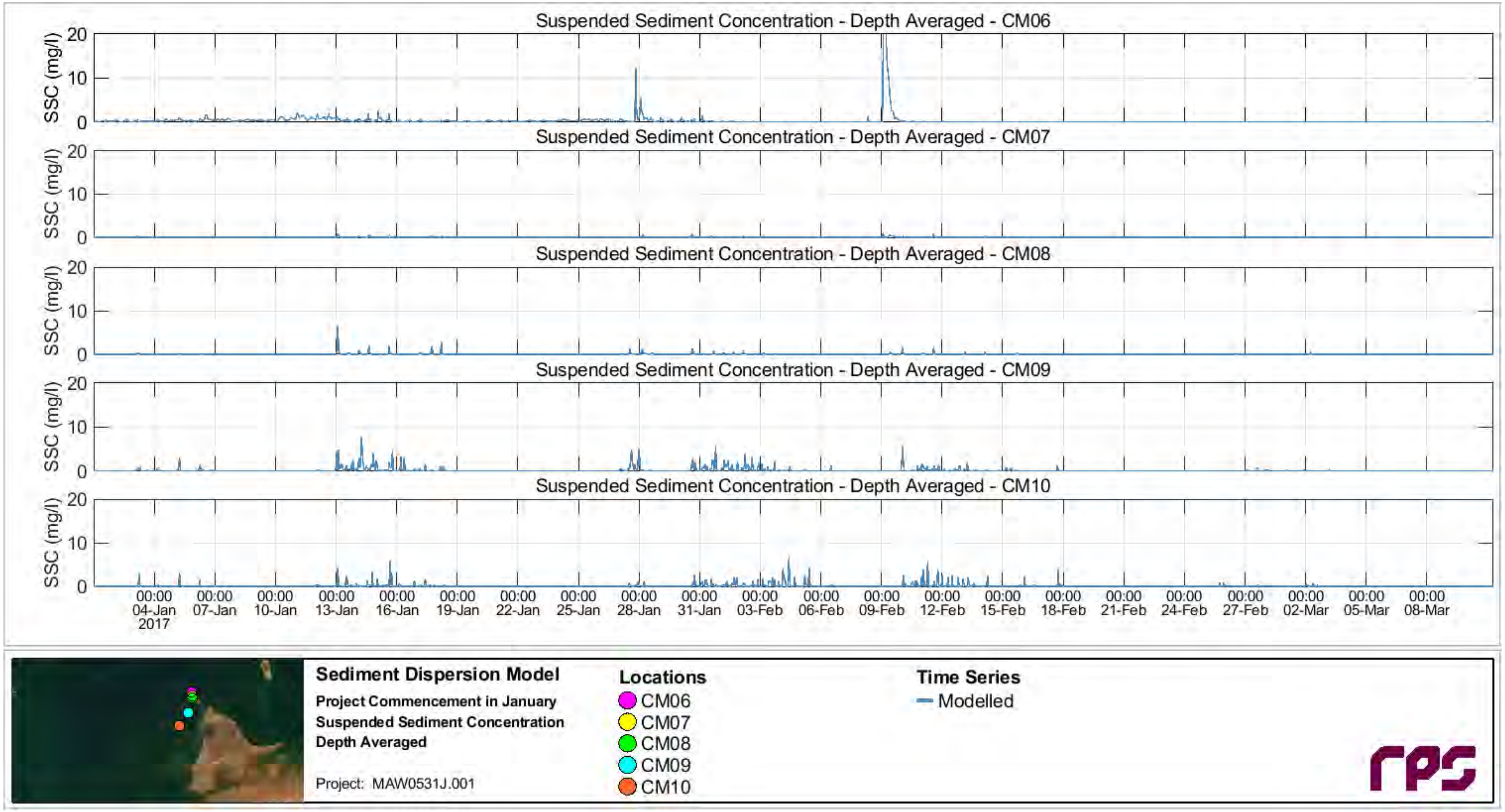

Figure 5.77 Time series of predicted dredge-excess depth-averaged TSSC at the *CM06* to *CM10* sites throughout the entire Scenario 5 duration (1 January to 11 March 2017).

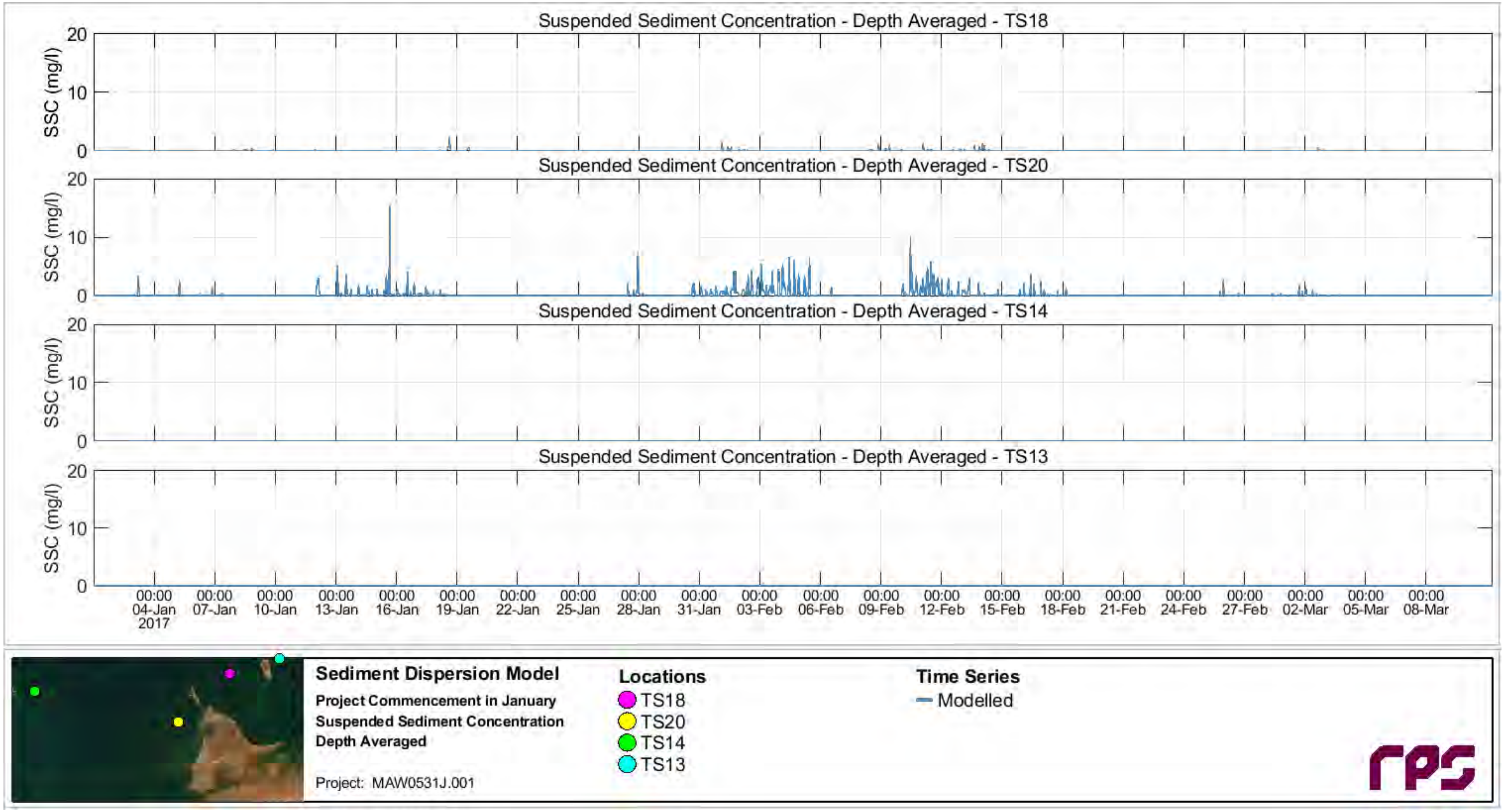

Figure 5.78 Time series of predicted dredge-excess depth-averaged TSSC at the *TS18, TS20, TS14* and *TS13* sites throughout the entire Scenario 5 duration (1 January to 11 March 2017).

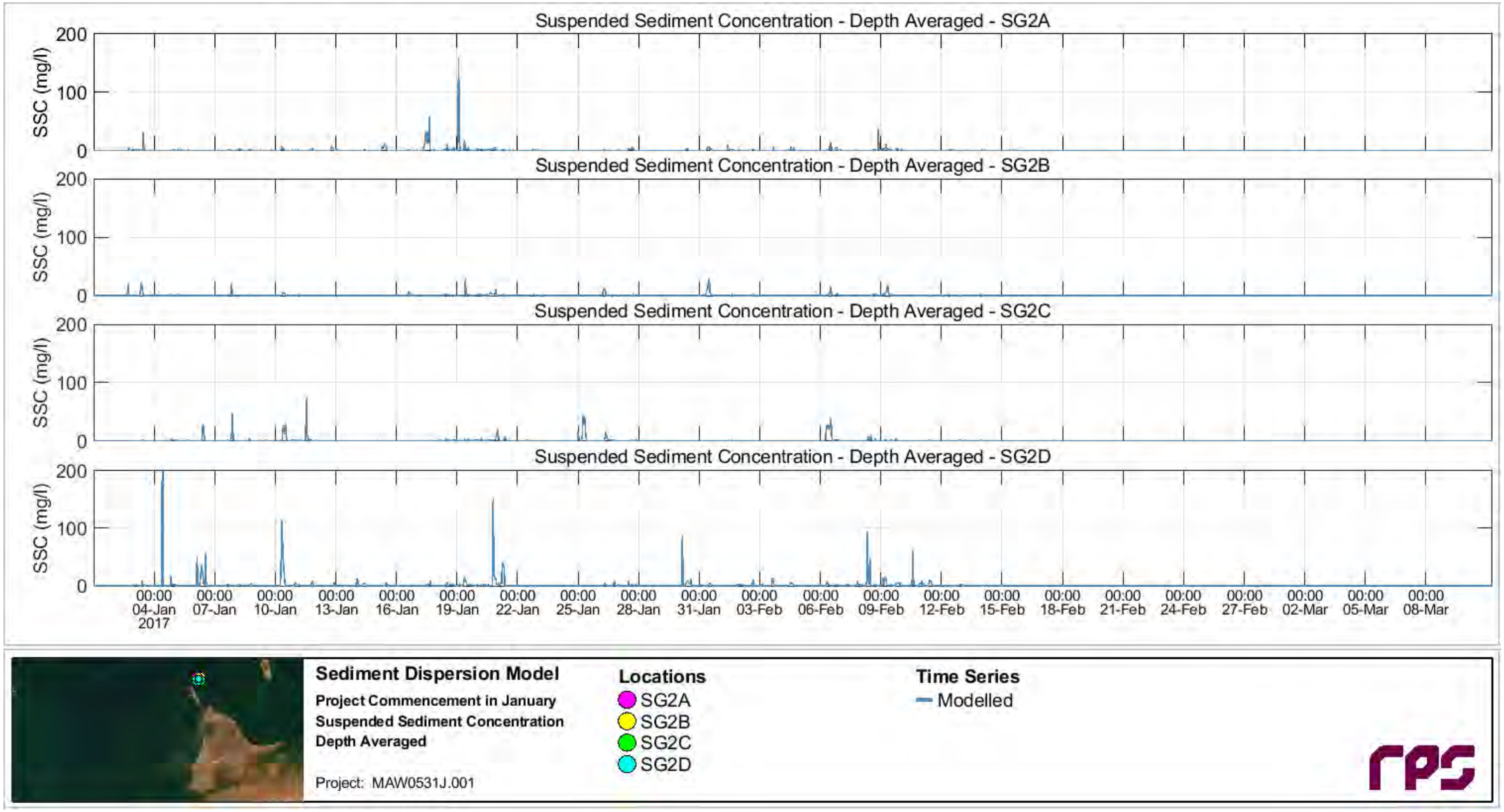

Figure 5.79 **Time series of predicted dredge-excess depth-averaged TSSC at the *SG2A* to *SG2D* sites throughout the entire Scenario 5 duration (1 January to 11 March 2017).**

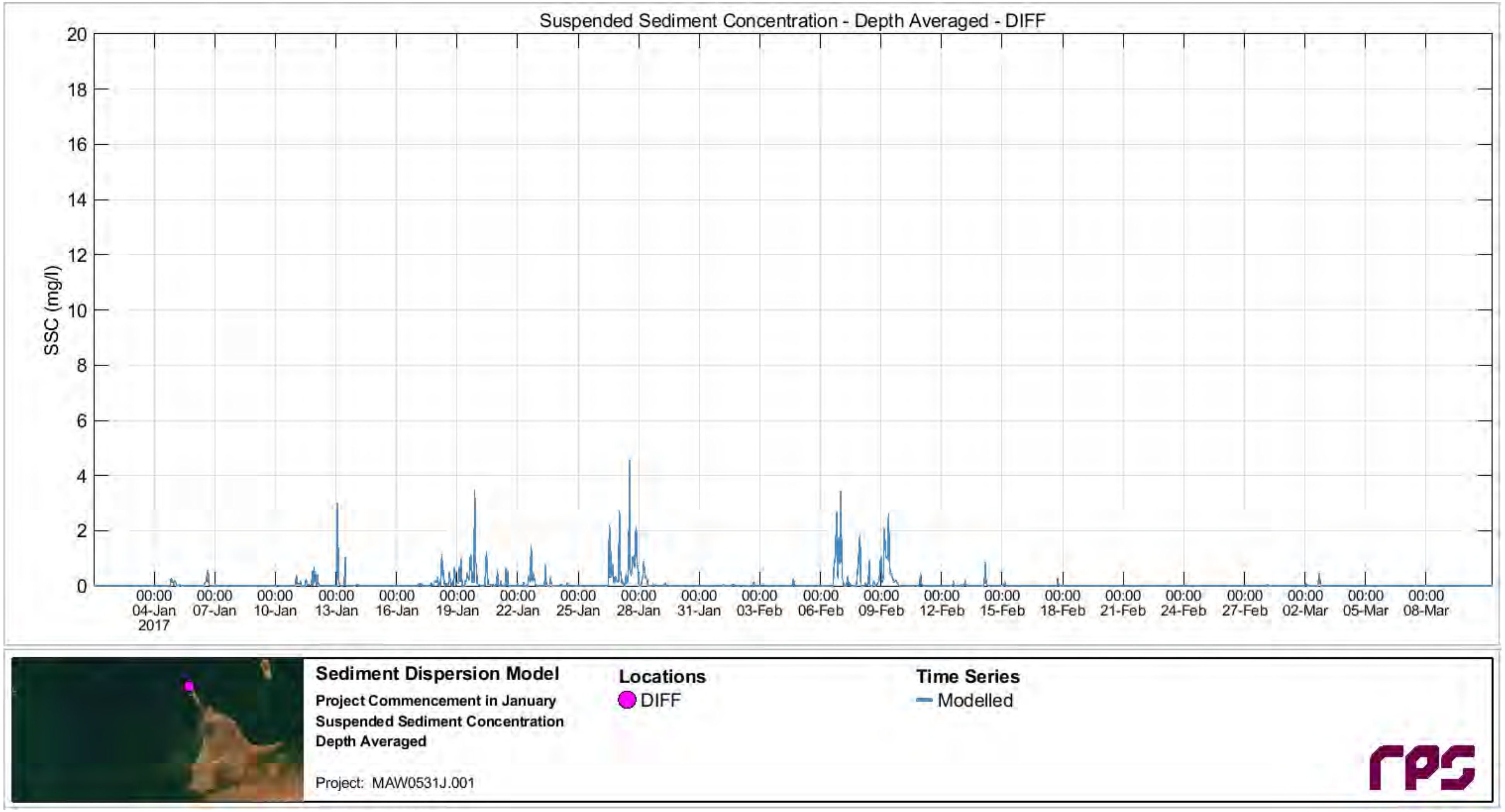

Figure 5.80 Time series of predicted dredge-excess depth-averaged TSSC at the *DIFF* site throughout the entire Scenario 5 duration (1 January to 11 March 2017).

5.2.3 Sedimentation – Time Series Figures

5.2.3.1 Scenario 1: Winter Start for 2-Week Dredge Program Using Spoil Disposal Site 1

Figure 5.81 Time series of predicted dredge-excess bottom thickness at the *CM01* to *CM05* sites throughout the entire Scenario 1 duration (1 to 29 June 2017).

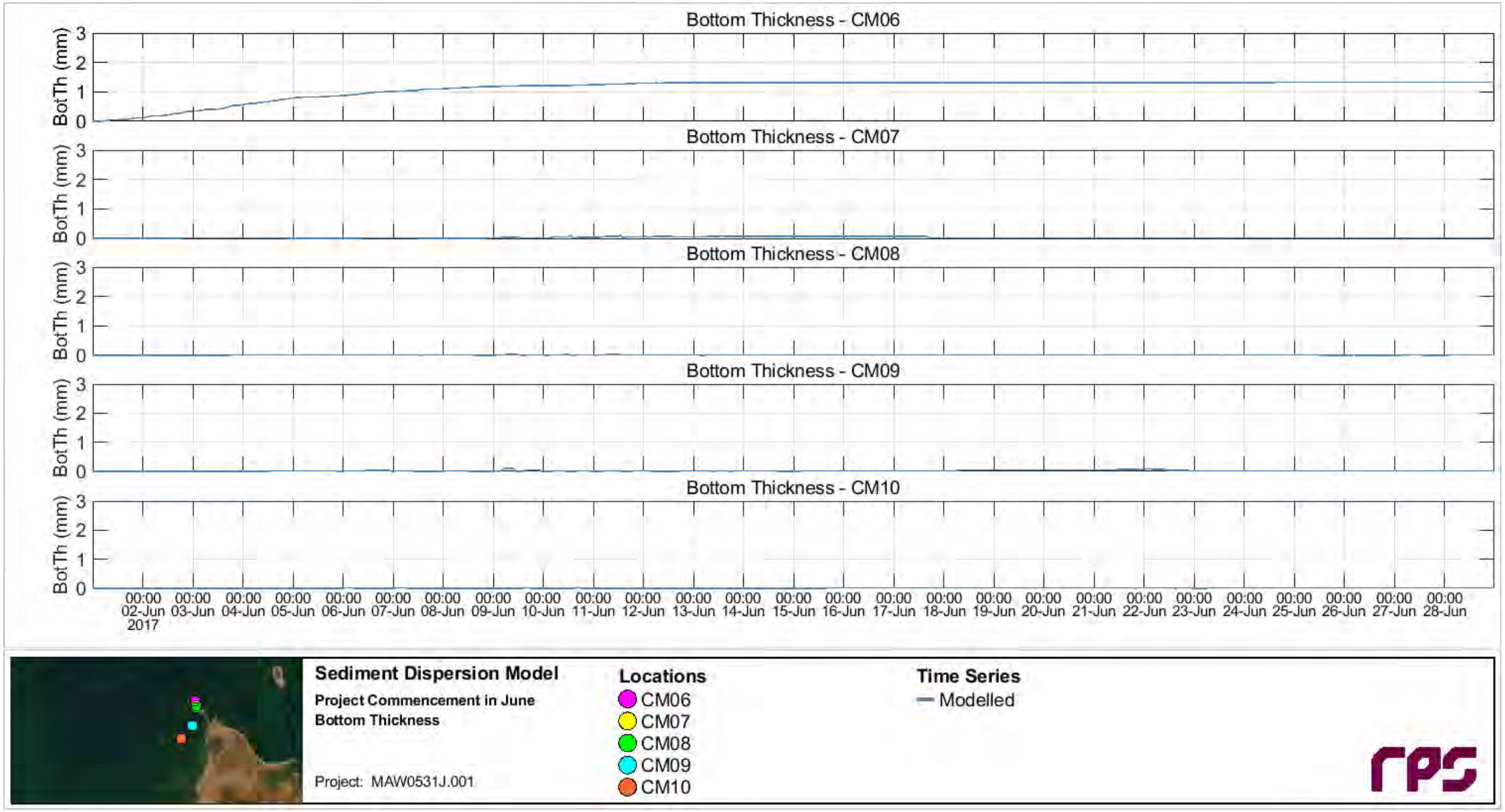

Figure 5.82 Time series of predicted dredge-excess bottom thickness at the *CM06* to *CM10* sites throughout the entire Scenario 1 duration (1 to 29 June 2017).

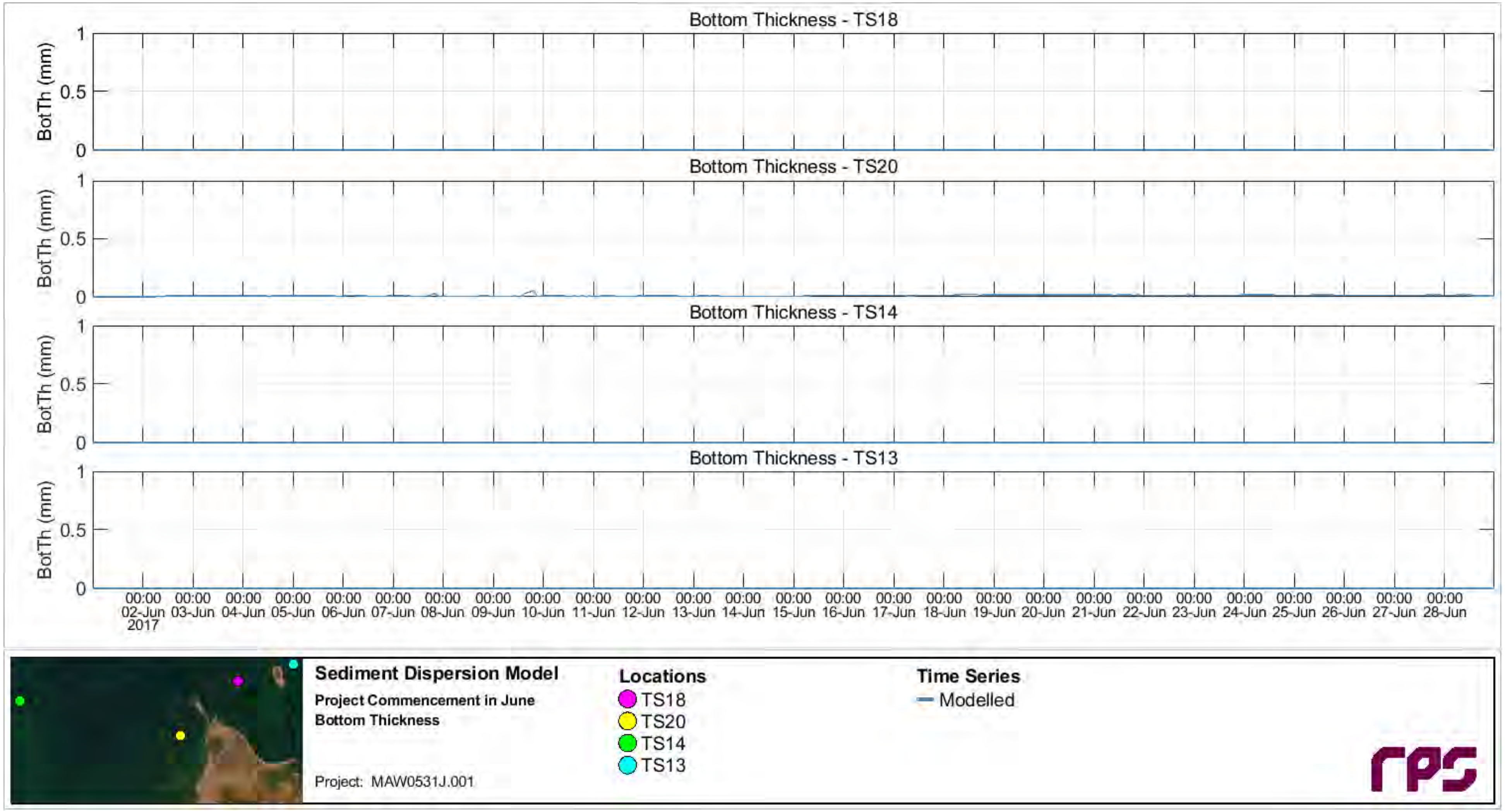

Figure 5.83 Time series of predicted dredge-excess bottom thickness at the *TS18*, *TS20*, *TS14* and *TS13* sites throughout the entire Scenario 1 duration (1 to 29 June 2017).

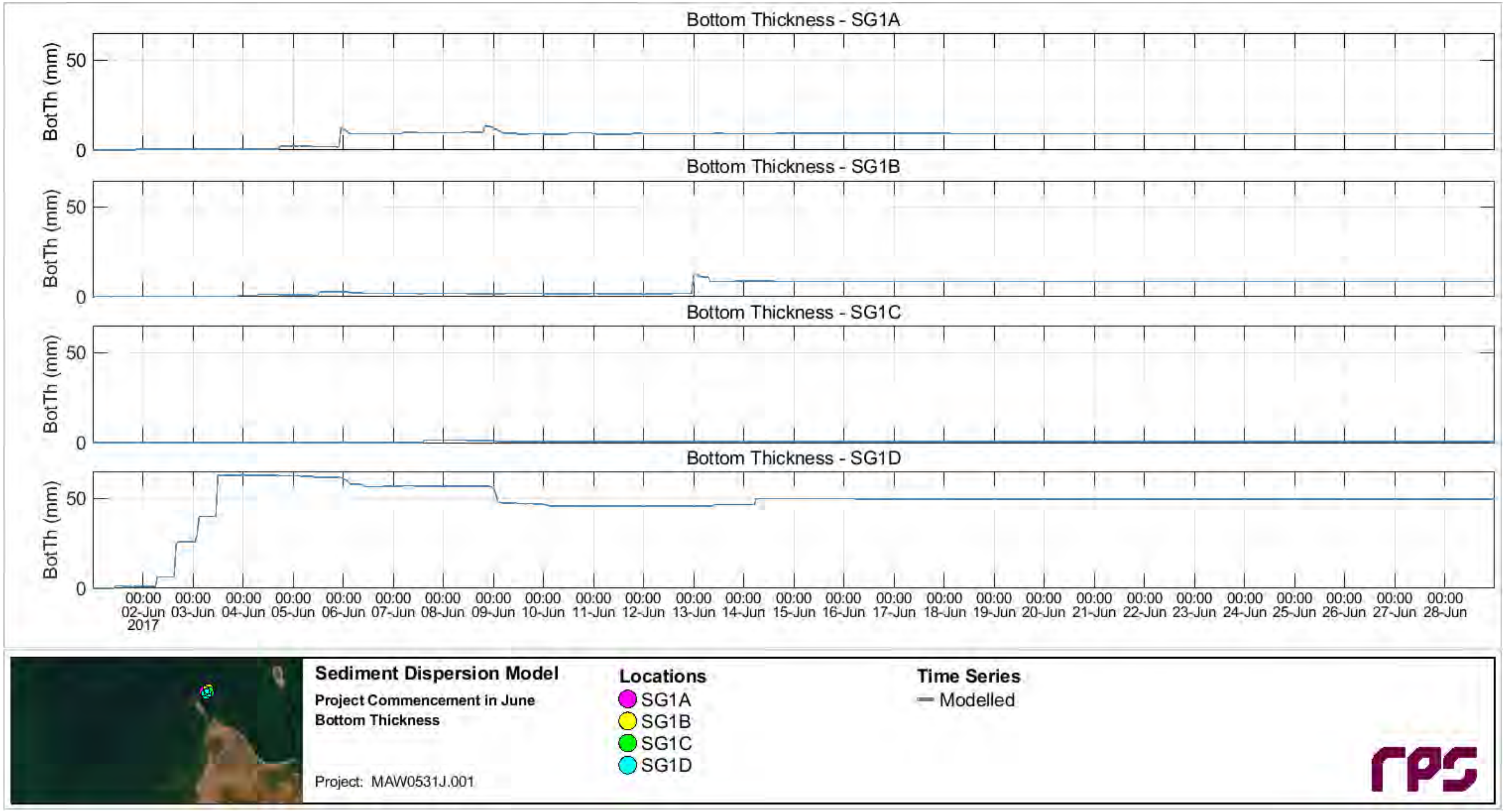

Figure 5.84 Time series of predicted dredge-excess bottom thickness at the *SG1A* to *SG1D* sites throughout the entire Scenario 1 duration (1 to 29 June 2017).

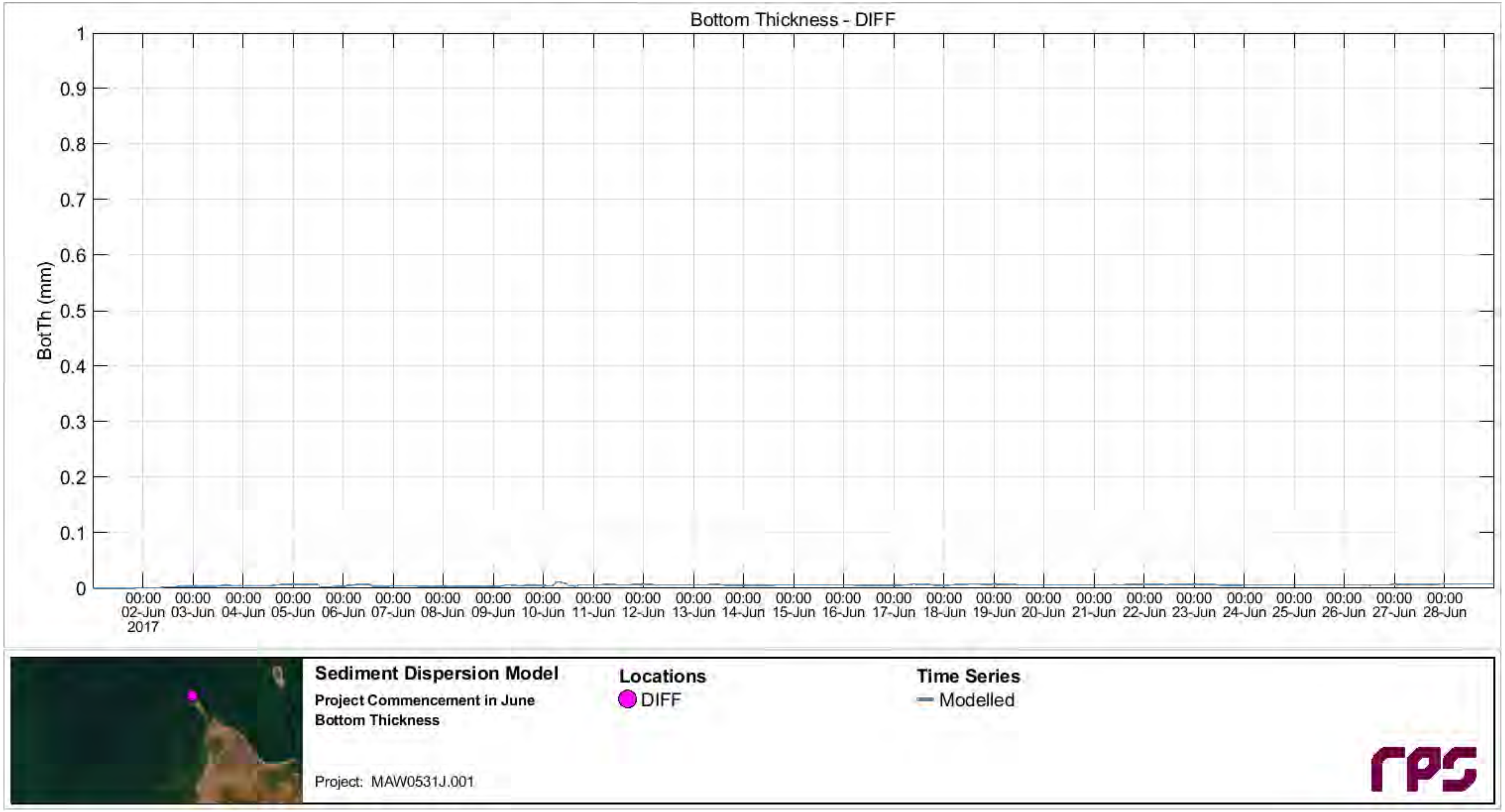

Figure 5.85 **Time series of predicted dredge-excess bottom thickness at the *DIFF* site throughout the entire Scenario 1 duration (1 to 29 June 2017).**

5.2.3.2 Scenario 2: Winter Start for 2-Week Dredge Program Using Spoil Disposal Site 2

Figure 5.86 Time series of predicted dredge-excess bottom thickness at the *CM01* to *CM05* sites throughout the entire Scenario 2 duration (1 to 29 June 2017).

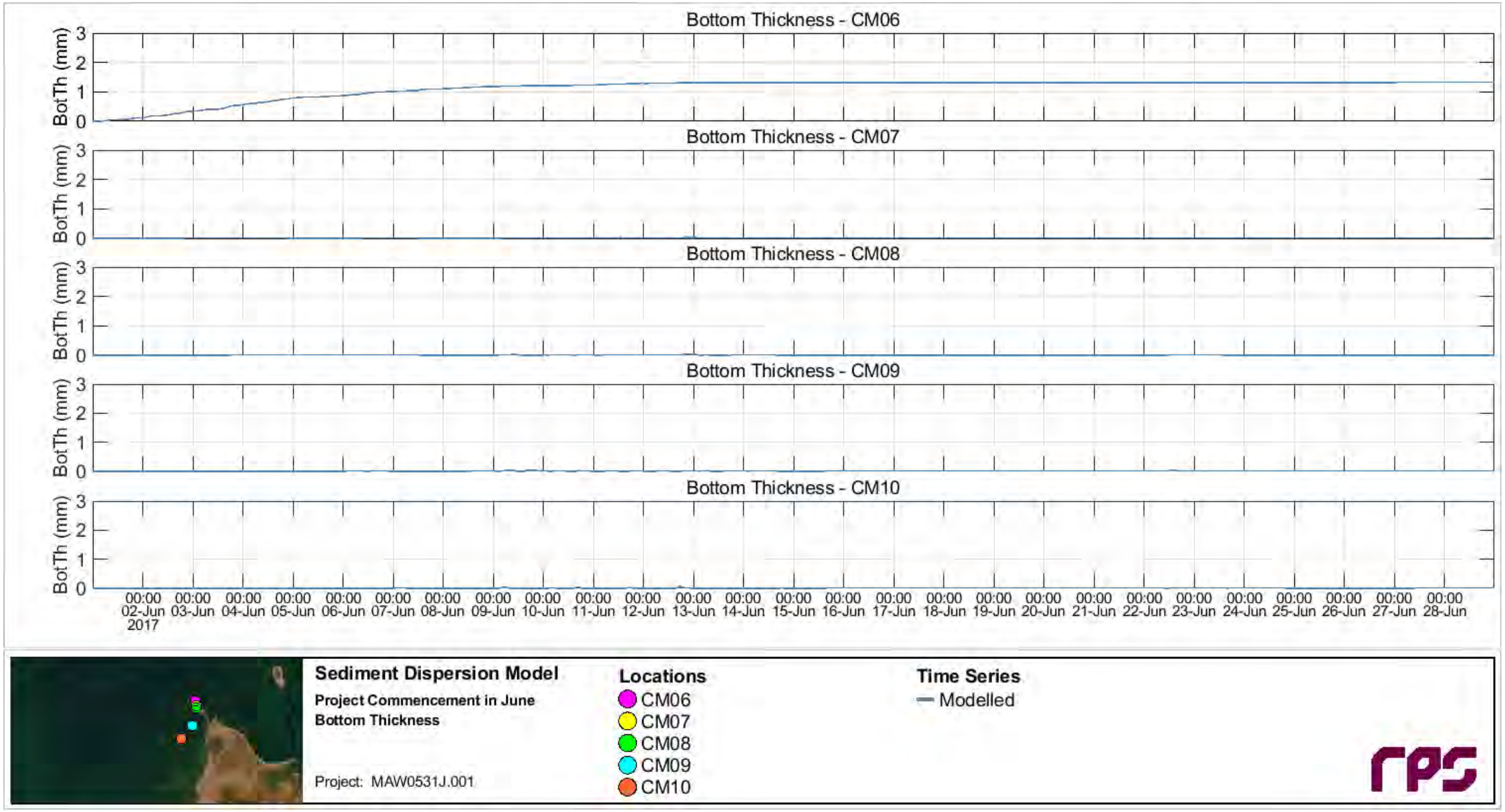

Figure 5.87 Time series of predicted dredge-excess bottom thickness at the *CM06* to *CM10* sites throughout the entire Scenario 2 duration (1 to 29 June 2017).

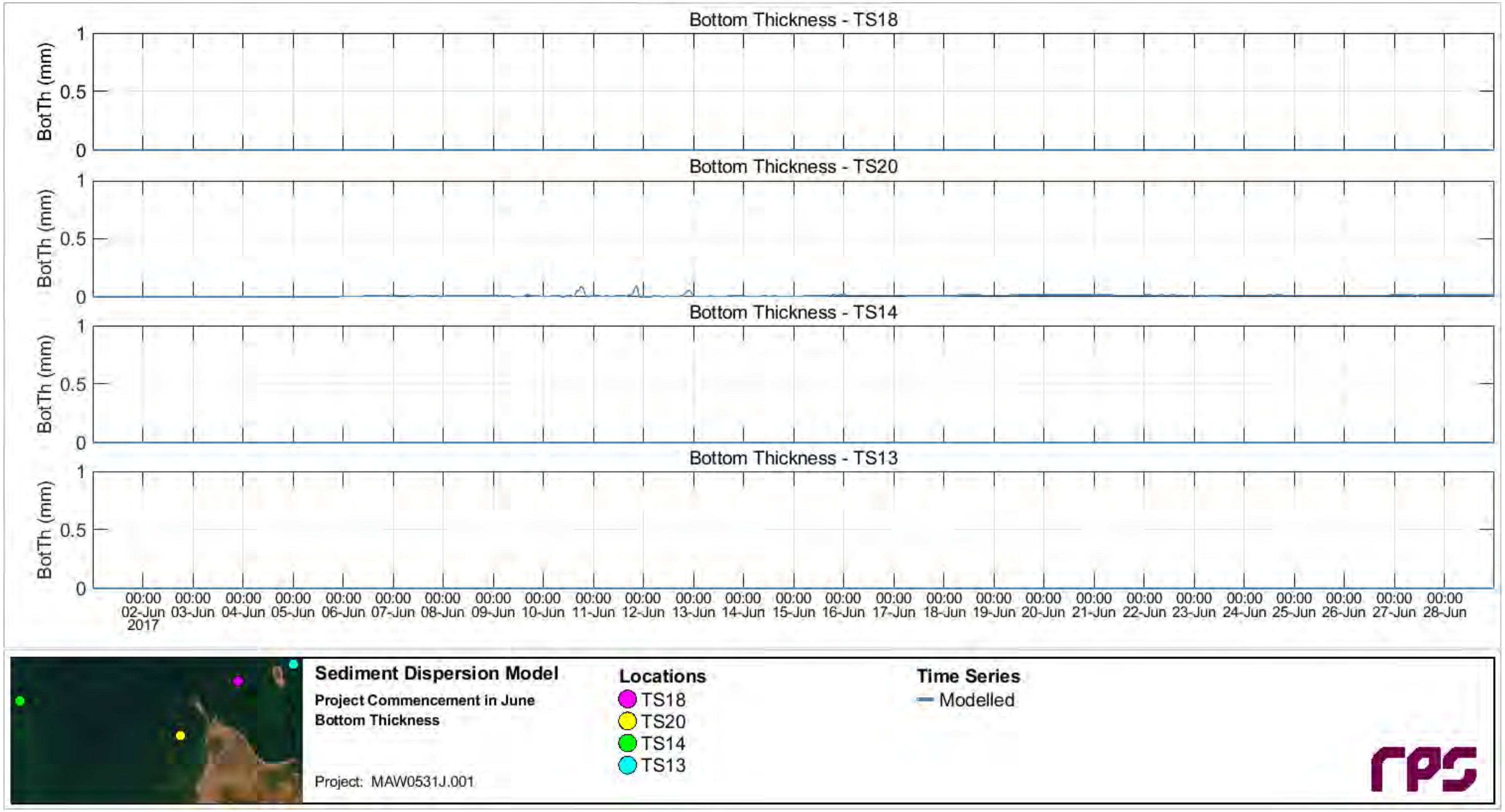

Figure 5.88 Time series of predicted dredge-excess bottom thickness at the *TS18*, *TS20*, *TS14* and *TS13* sites throughout the entire Scenario 2 duration (1 to 29 June 2017).

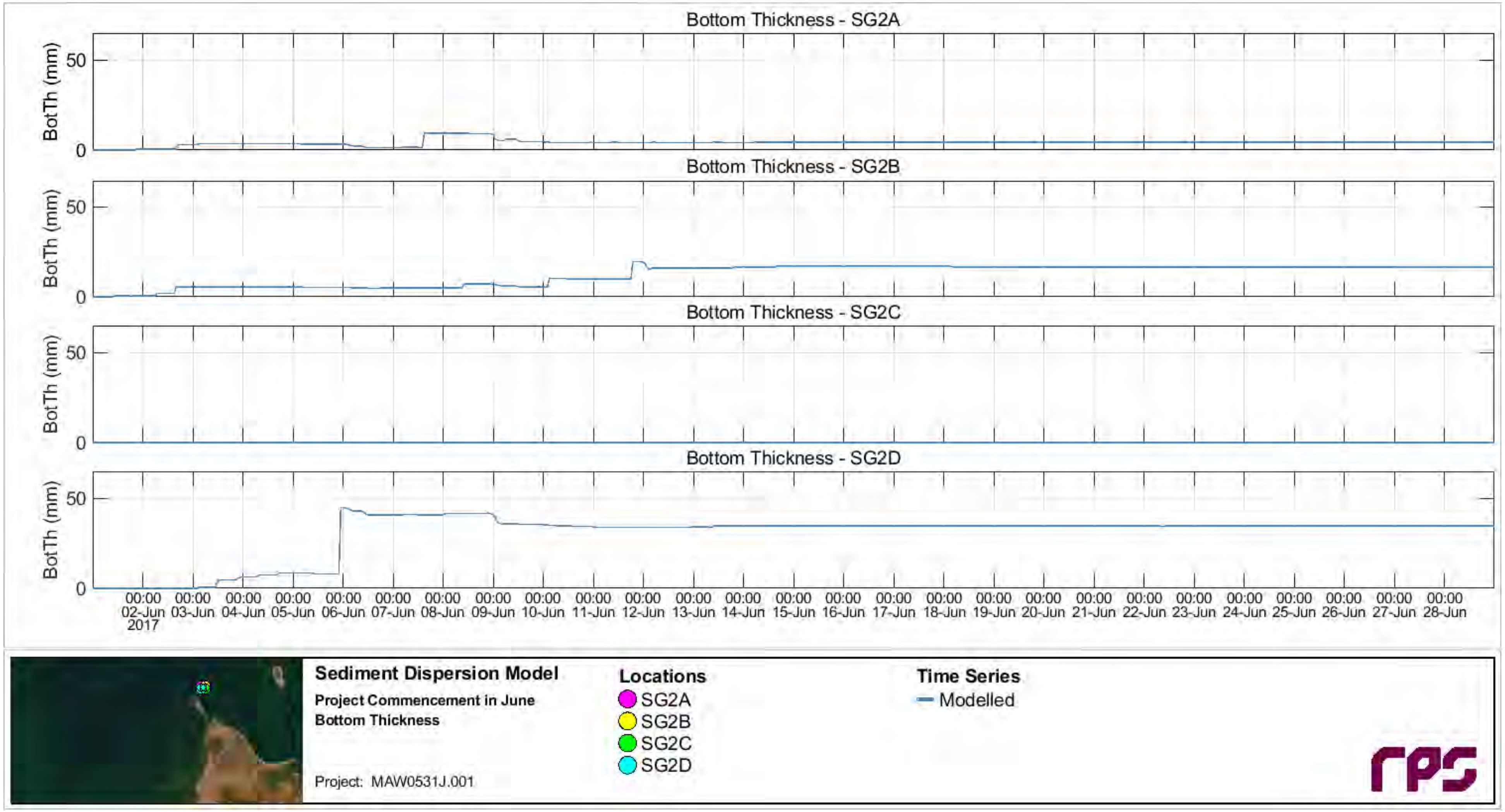

Figure 5.89 Time series of predicted dredge-excess bottom thickness at the *SG2A* to *SG2D* sites throughout the entire Scenario 2 duration (1 to 29 June 2017).

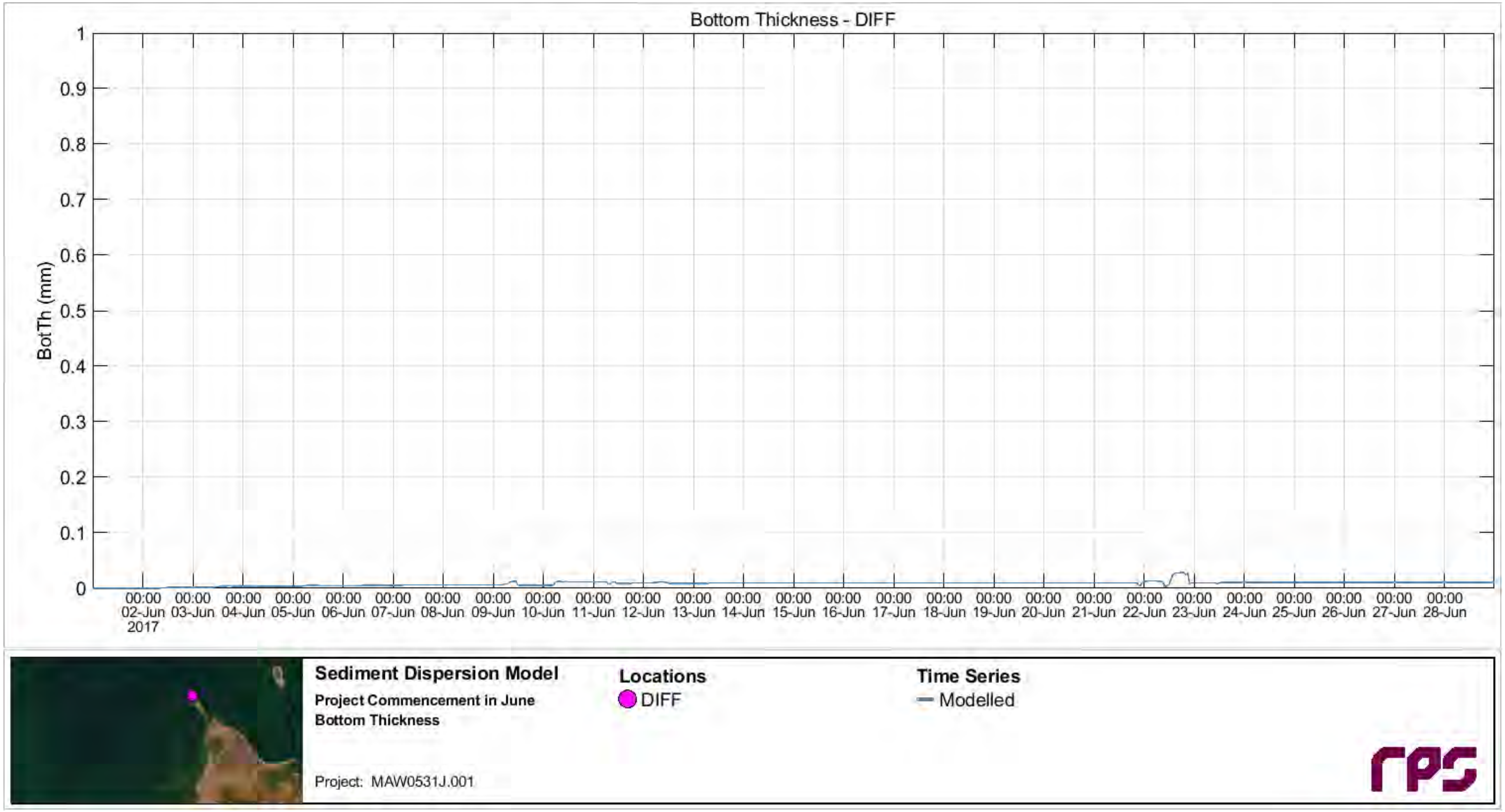

Figure 5.90 Time series of predicted dredge-excess bottom thickness at the *DIFF* site throughout the entire Scenario 2 duration (1 to 29 June 2017).

5.2.3.3 Scenario 3: Winter Start for 6-Week Dredge Program Using Spoil Disposal Site 2

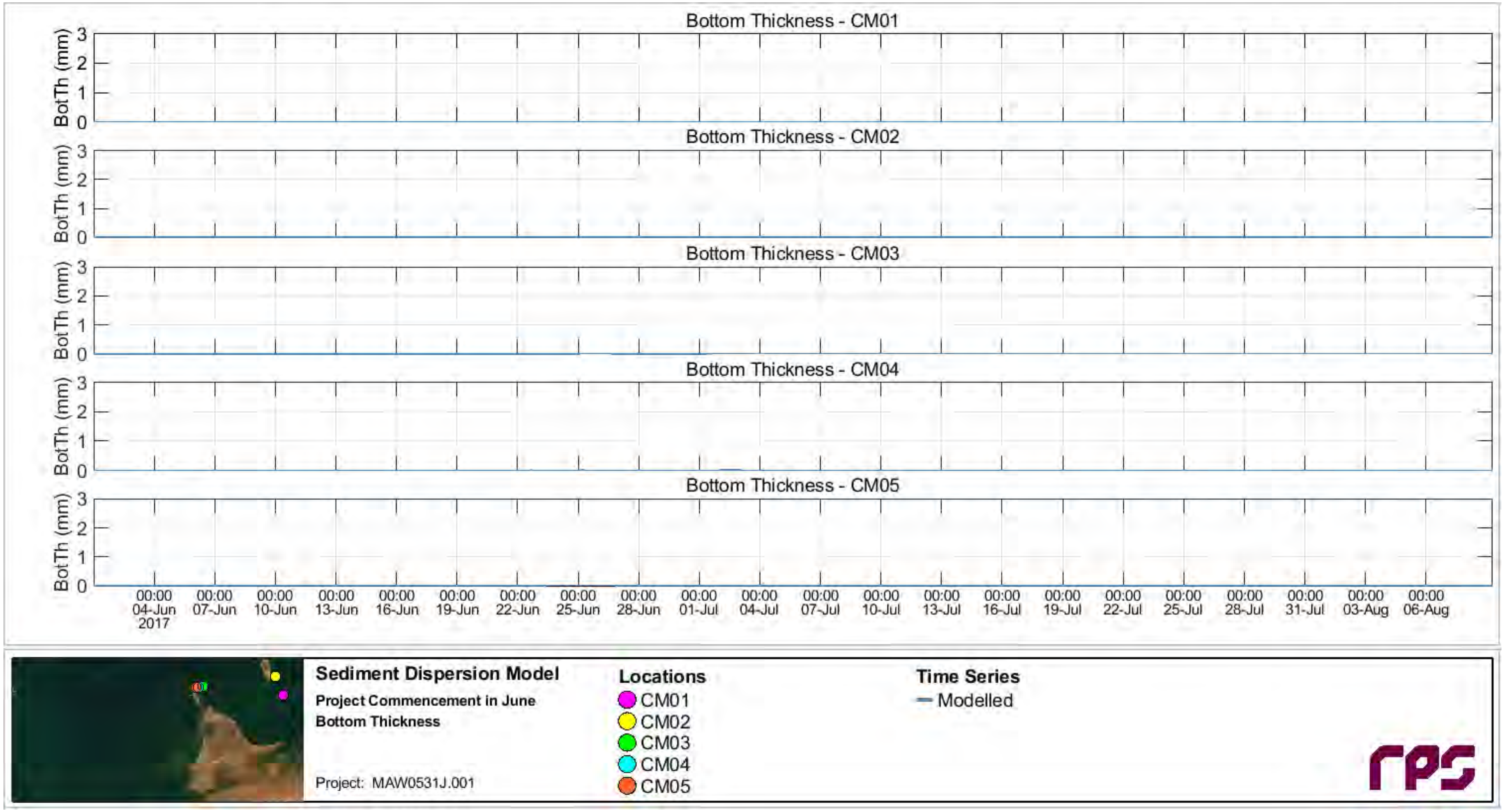

Figure 5.91 Time series of predicted dredge-excess bottom thickness at the *CM01* to *CM05* sites throughout the entire Scenario 3 duration (1 June to 9 August 2017).

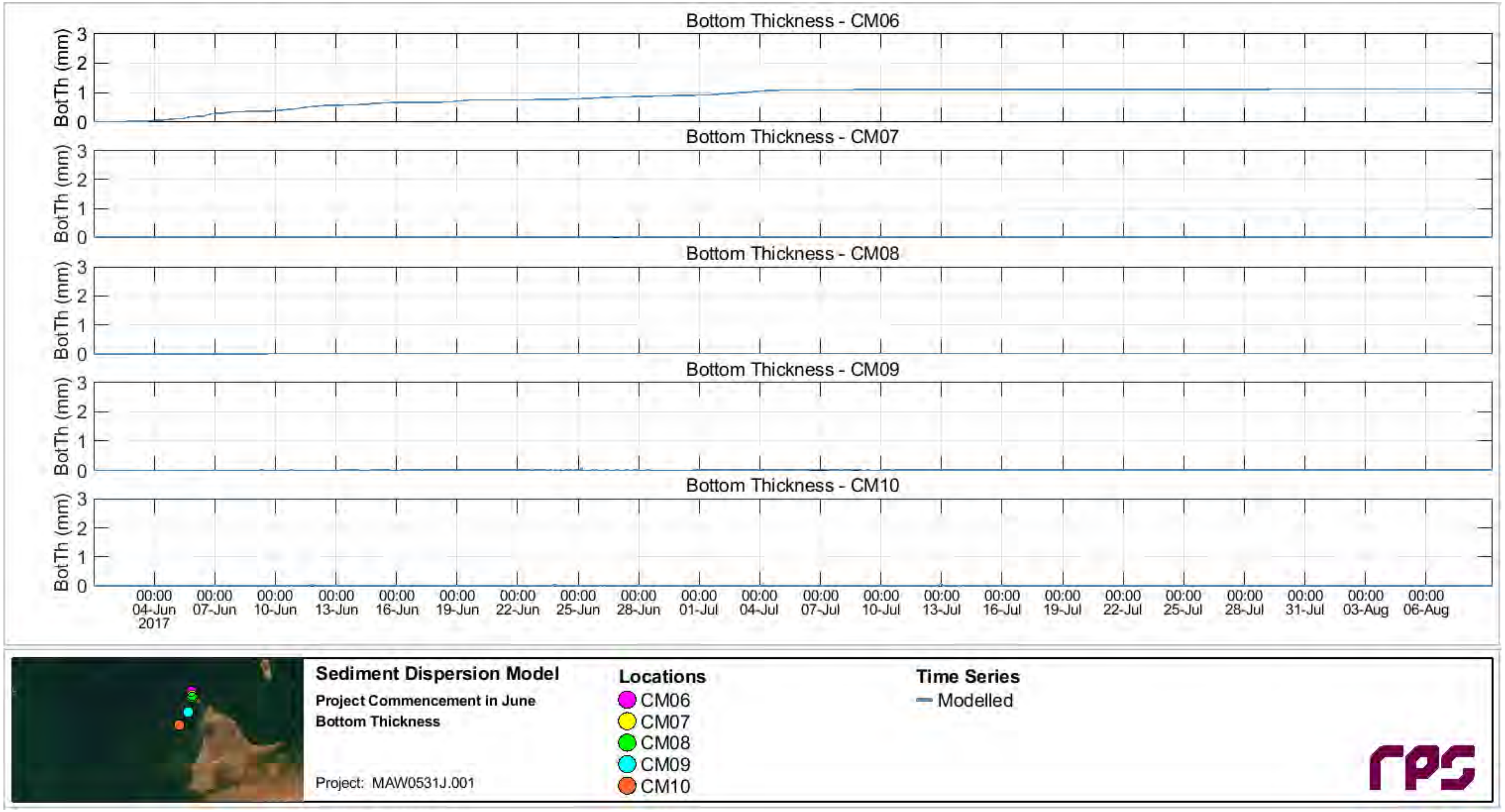

Figure 5.92 Time series of predicted dredge-excess bottom thickness at the *CM06* to *CM10* sites throughout the entire Scenario 3 duration (1 June to 9 August 2017).

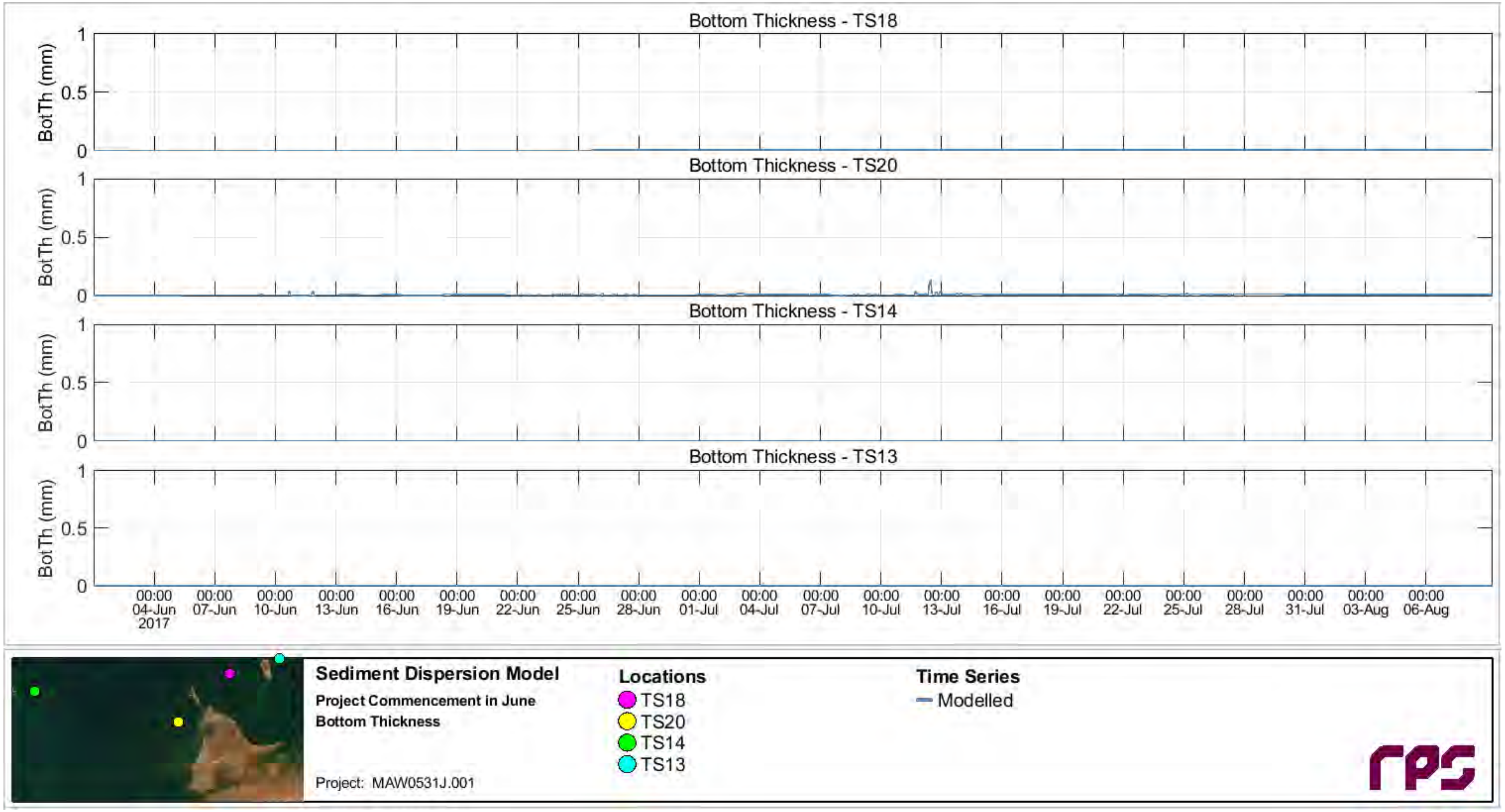

Figure 5.93 Time series of predicted dredge-excess bottom thickness at the *TS18*, *TS20*, *TS14* and *TS13* sites throughout the entire Scenario 3 duration (1 June to 9 August 2017).

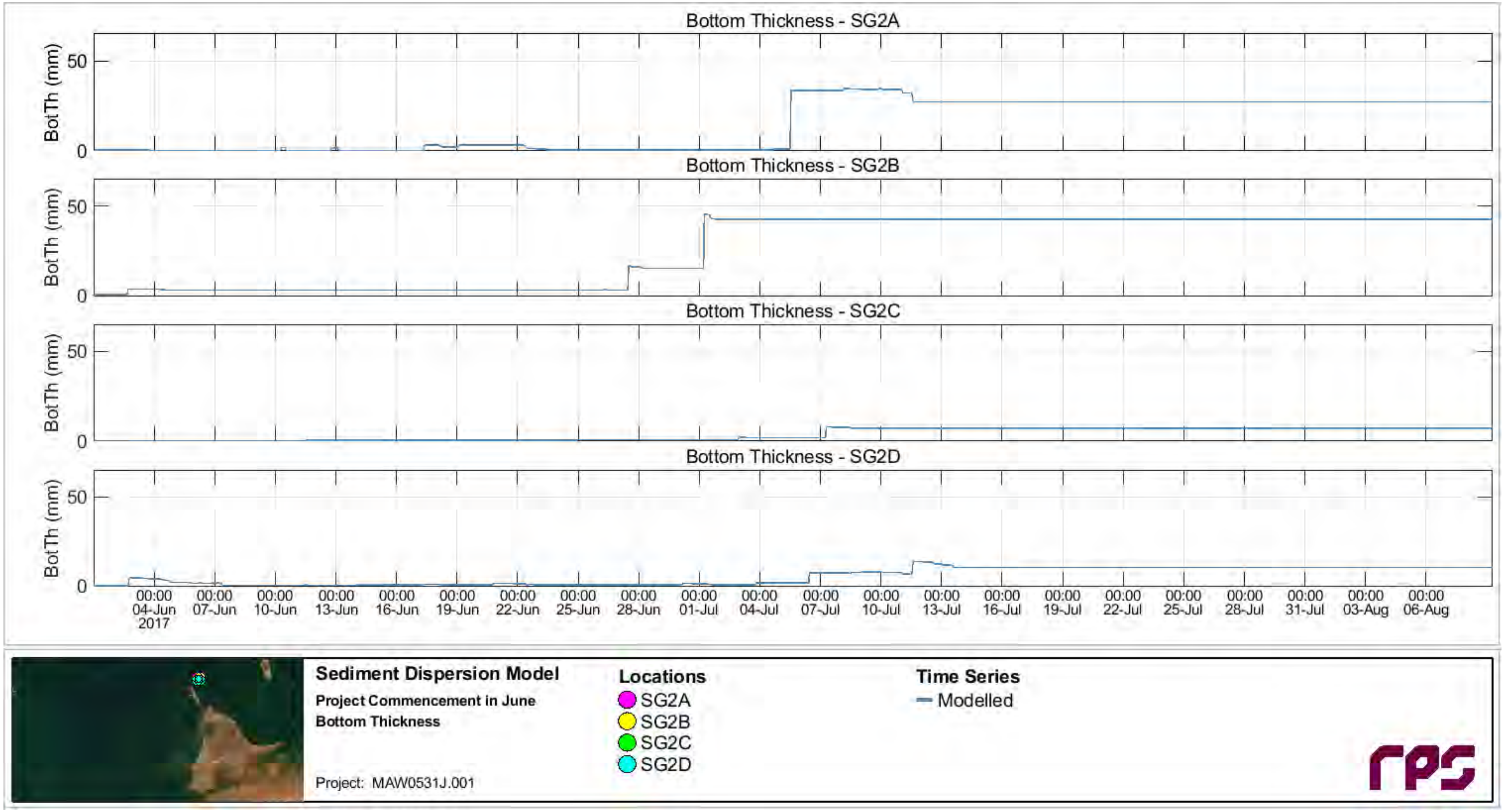

Figure 5.94 Time series of predicted dredge-excess bottom thickness at the *SG2A* to *SG2D* sites throughout the entire Scenario 3 duration (1 June to 9 August 2017).

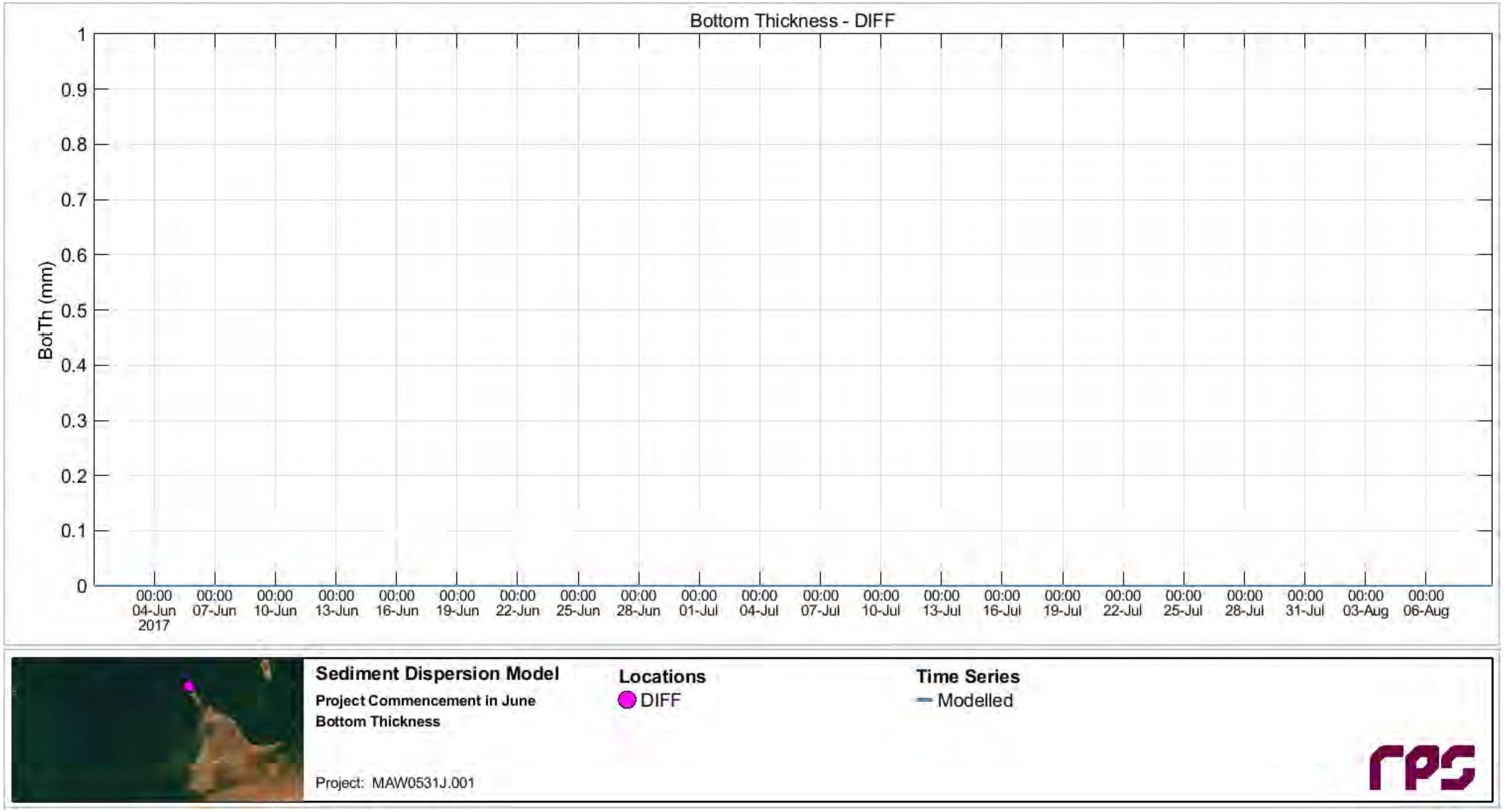

Figure 5.95 Time series of predicted dredge-excess bottom thickness at the *DIFF* site throughout the entire Scenario 3 duration (1 June to 9 August 2017).

5.2.3.4 Scenario 4: Summer Start for 2-Week Dredge Program Using Spoil Disposal Site 1

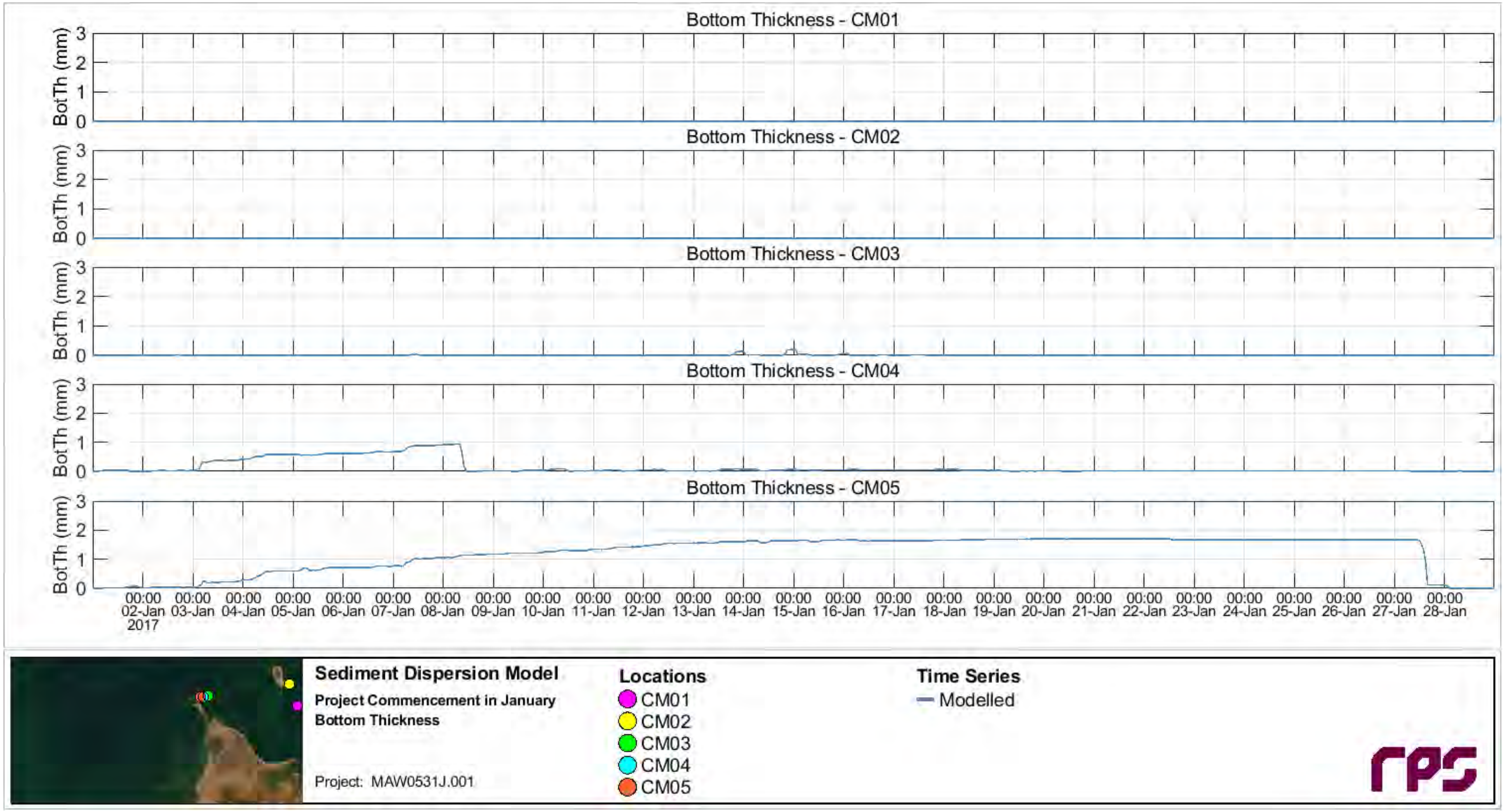

Figure 5.96 Time series of predicted dredge-excess bottom thickness at the *CM01* to *CM05* sites throughout the entire Scenario 4 duration (1 to 29 January 2017).

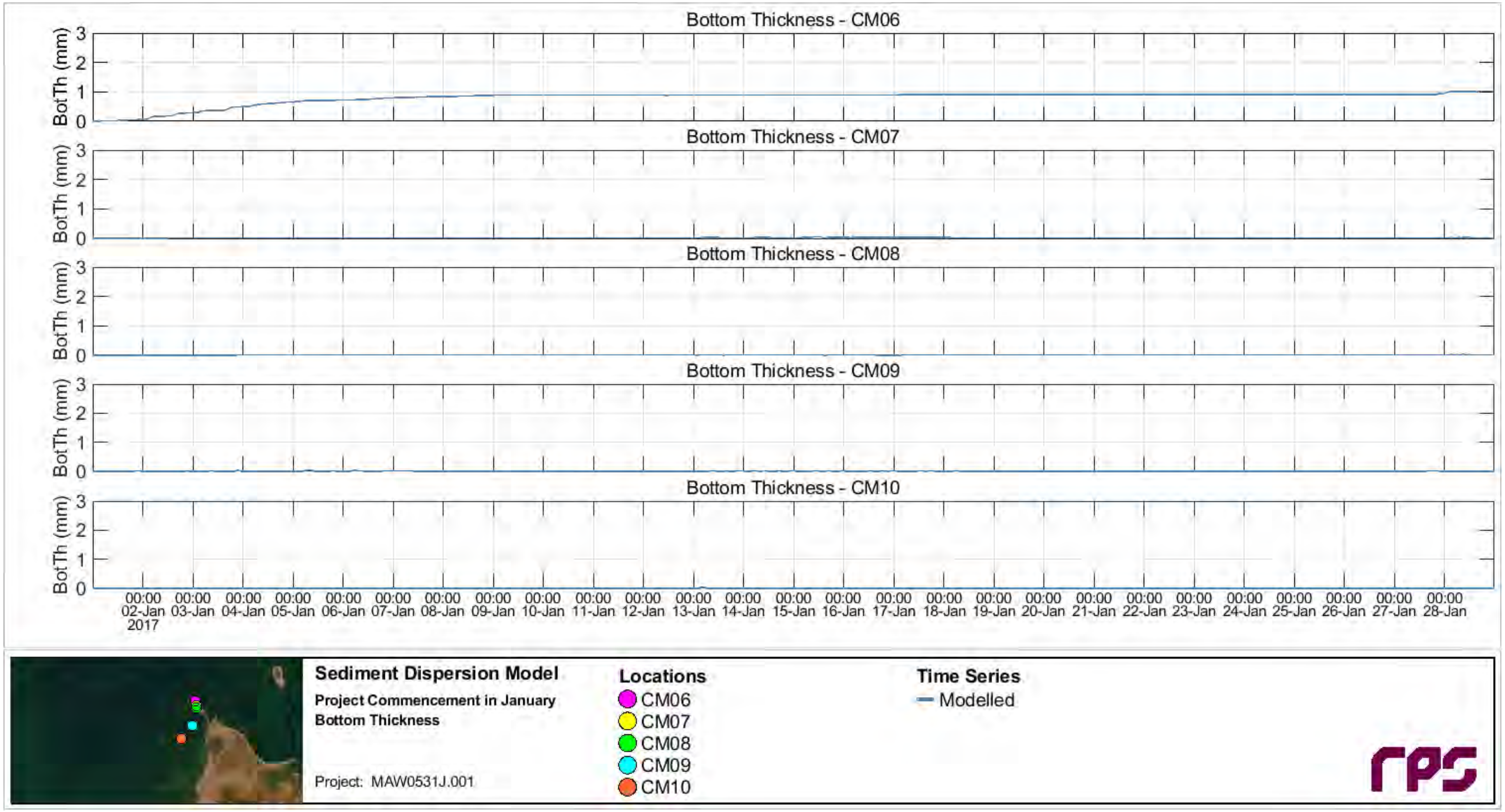

Figure 5.97 Time series of predicted dredge-excess bottom thickness at the *CM06* to *CM10* sites throughout the entire Scenario 4 duration (1 to 29 January 2017).

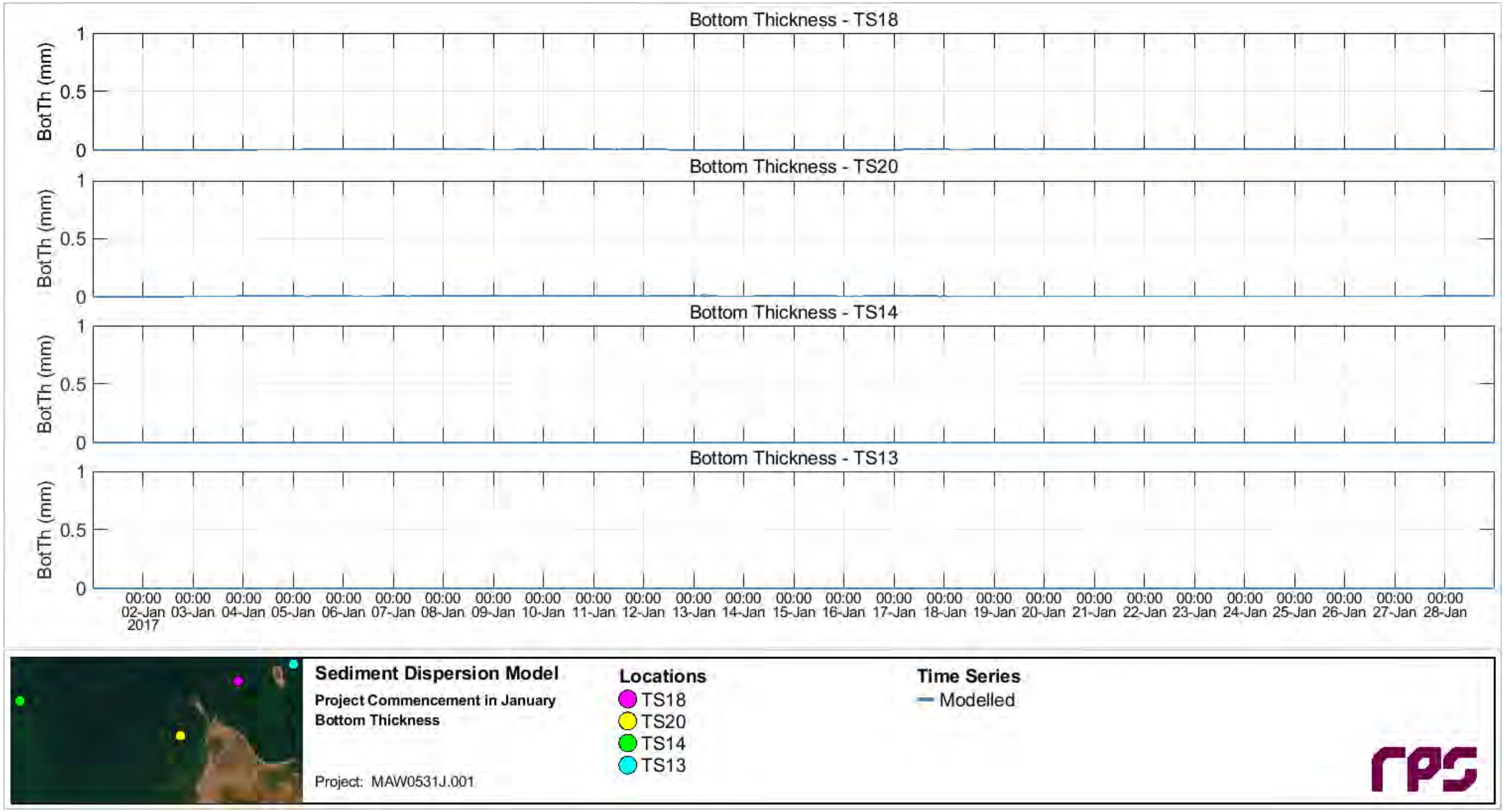

Figure 5.98 Time series of predicted dredge-excess bottom thickness at the *TS18, TS20, TS14* and *TS13* sites throughout the entire Scenario 4 duration (1 to 29 January 2017).

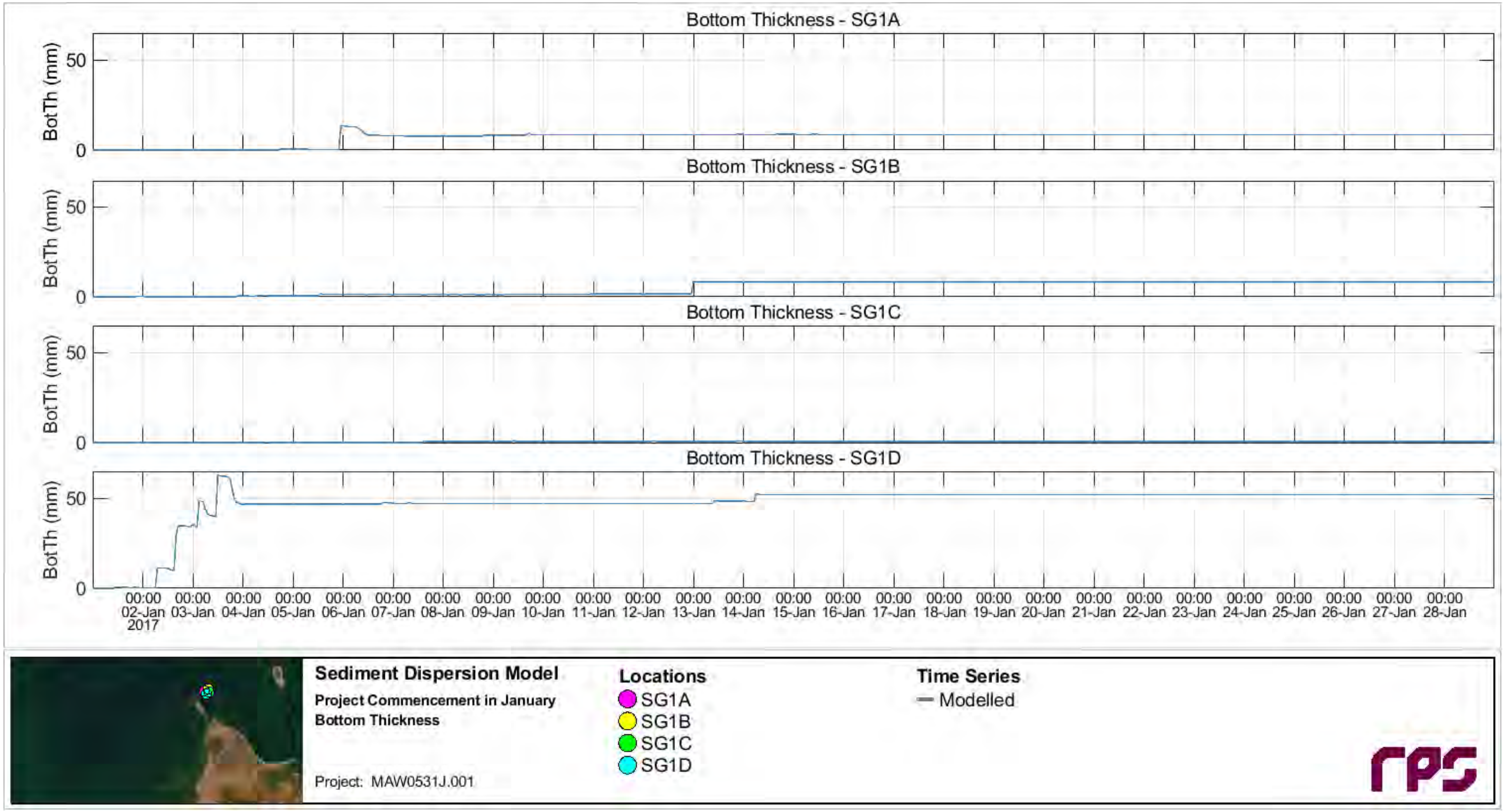

Figure 5.99 Time series of predicted dredge-excess bottom thickness at the *SG1A* to *SG1D* sites throughout the entire Scenario 4 duration (1 to 29 January 2017).

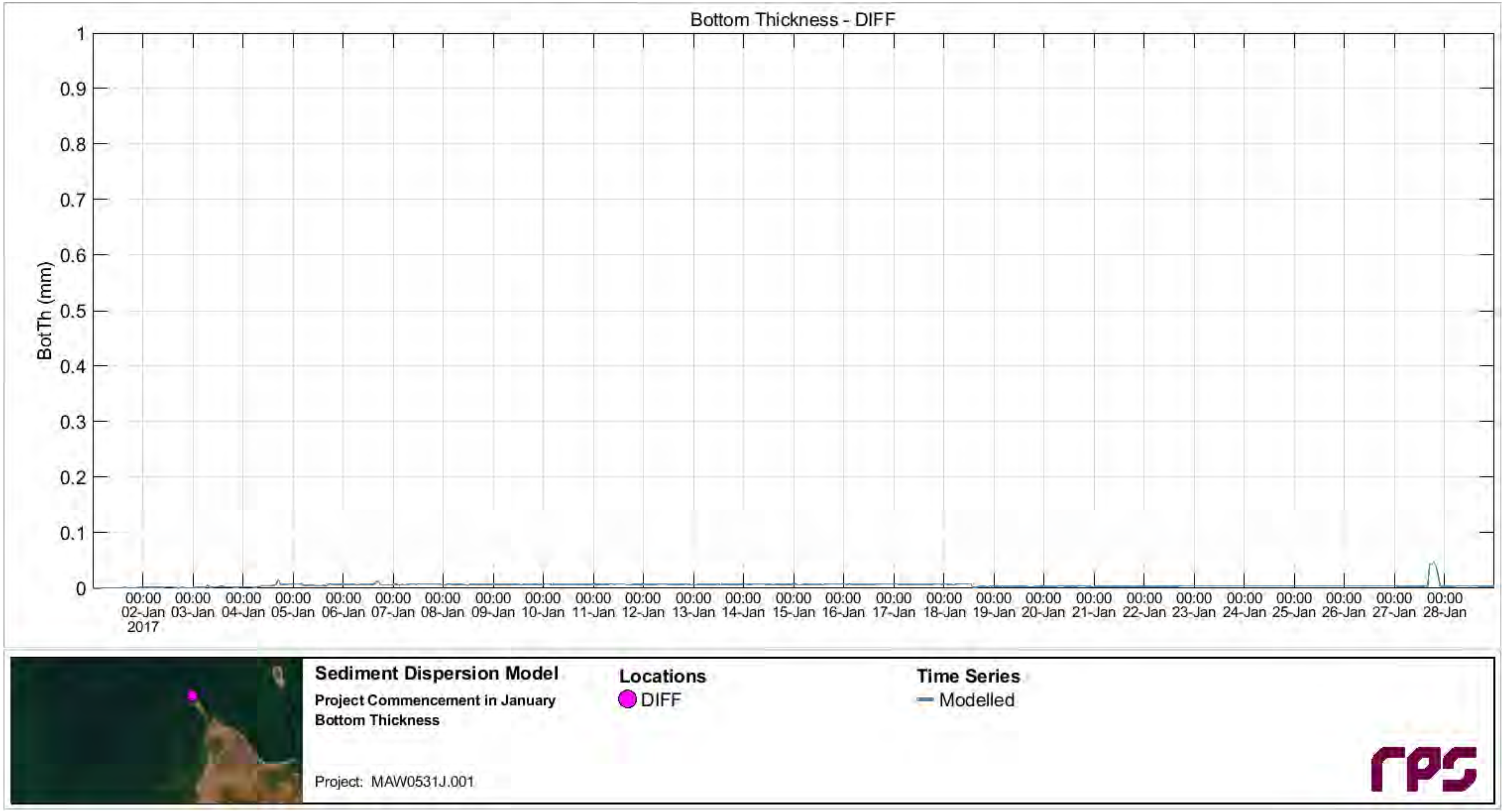

Figure 5.100 Time series of predicted dredge-excess bottom thickness at the *DIFF* site throughout the entire Scenario 4 duration (1 to 29 January 2017).

5.2.3.5 Scenario 5: Summer Start for 6-Week Dredge Program Using Spoil Disposal Site 2

Figure 5.101 Time series of predicted dredge-excess bottom thickness at the *CM01* to *CM05* sites throughout the entire Scenario 5 duration (1 January to 11 March 2017).

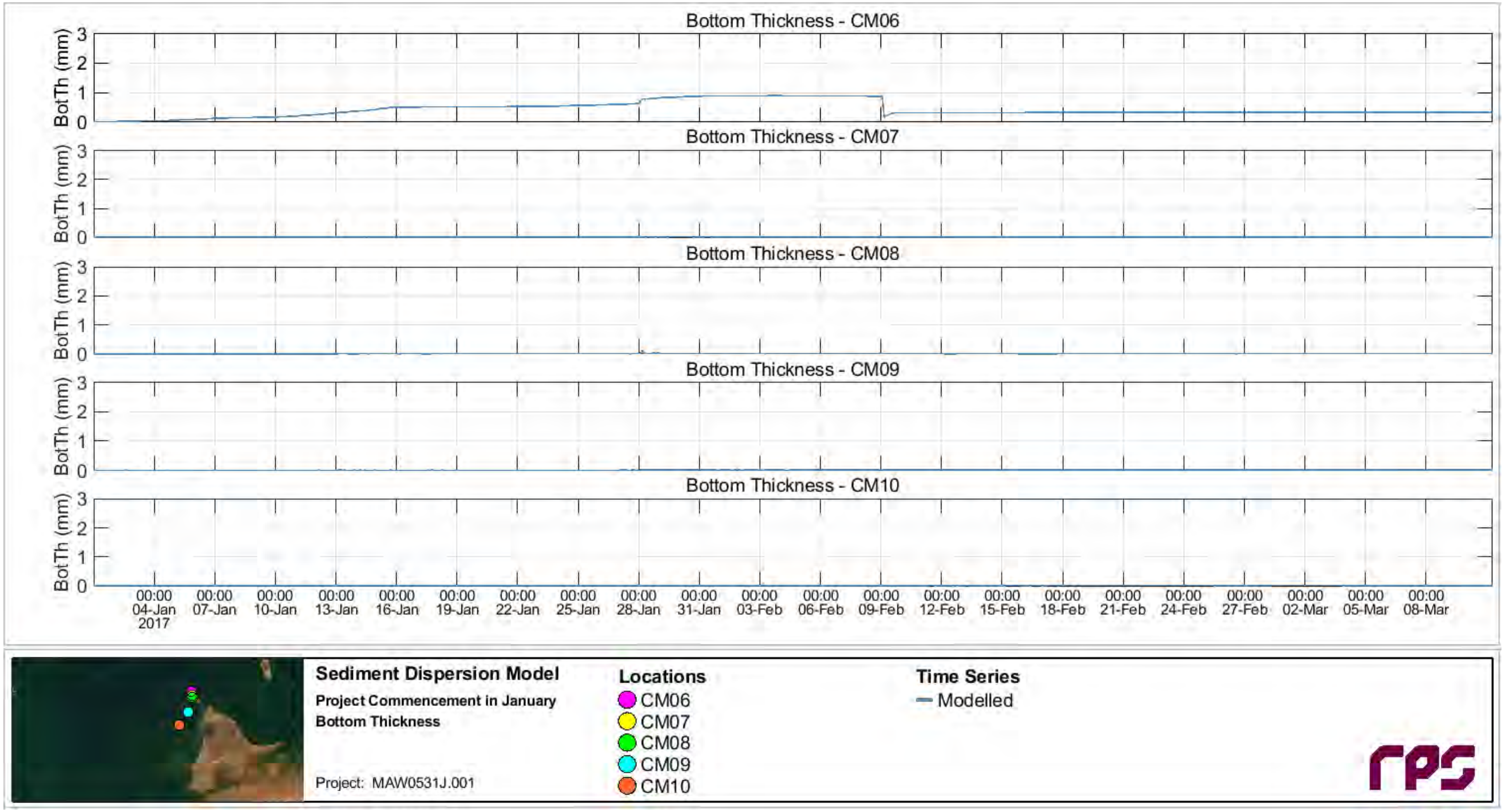

Figure 5.102 Time series of predicted dredge-excess bottom thickness at the *CM06* to *CM10* sites throughout the entire Scenario 5 duration (1 January to 11 March 2017).

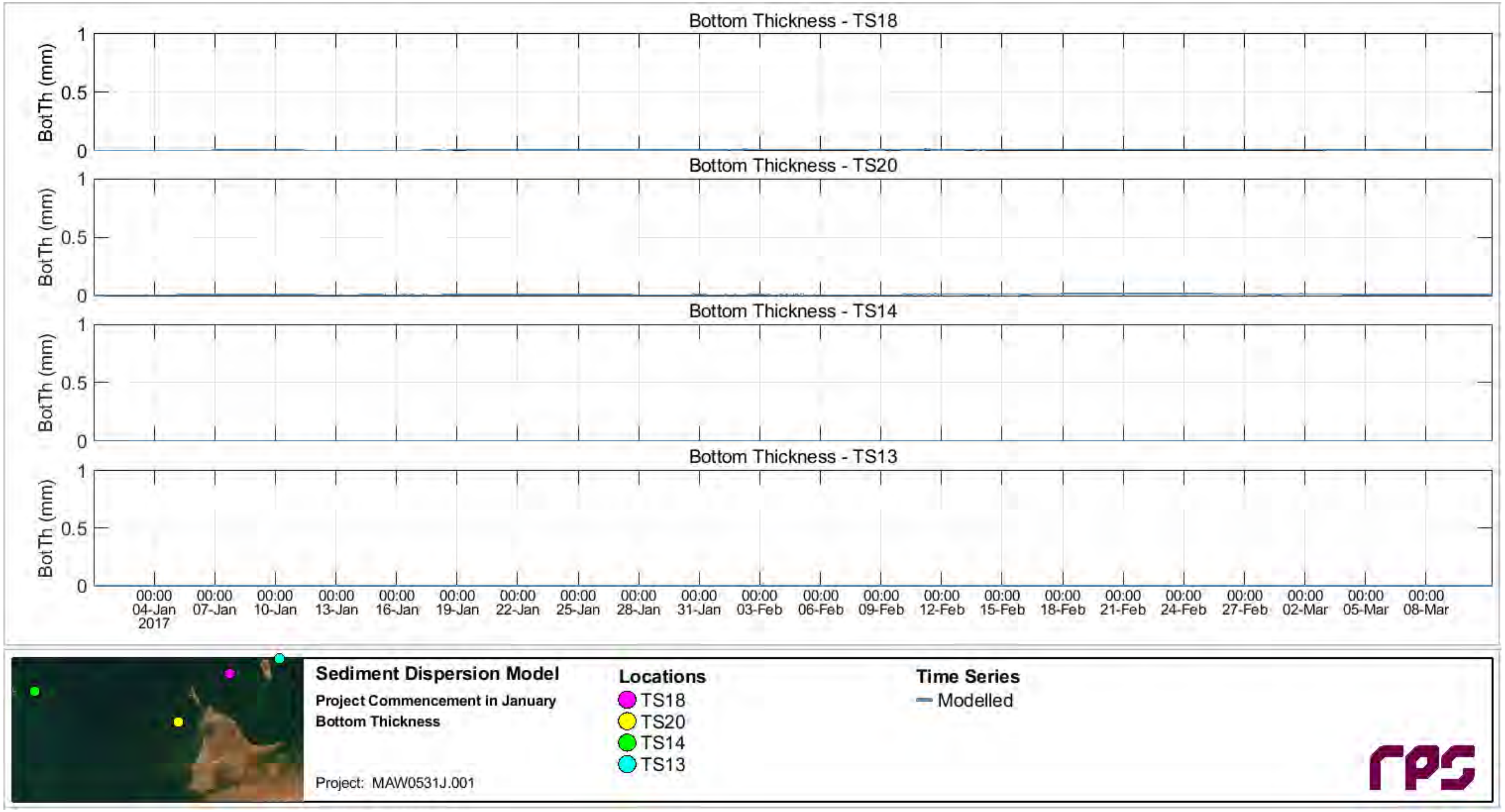

Figure 5.103 Time series of predicted dredge-excess bottom thickness at the *TS18, TS20, TS14* and *TS13* sites throughout the entire Scenario 5 duration (1 January to 11 March 2017).

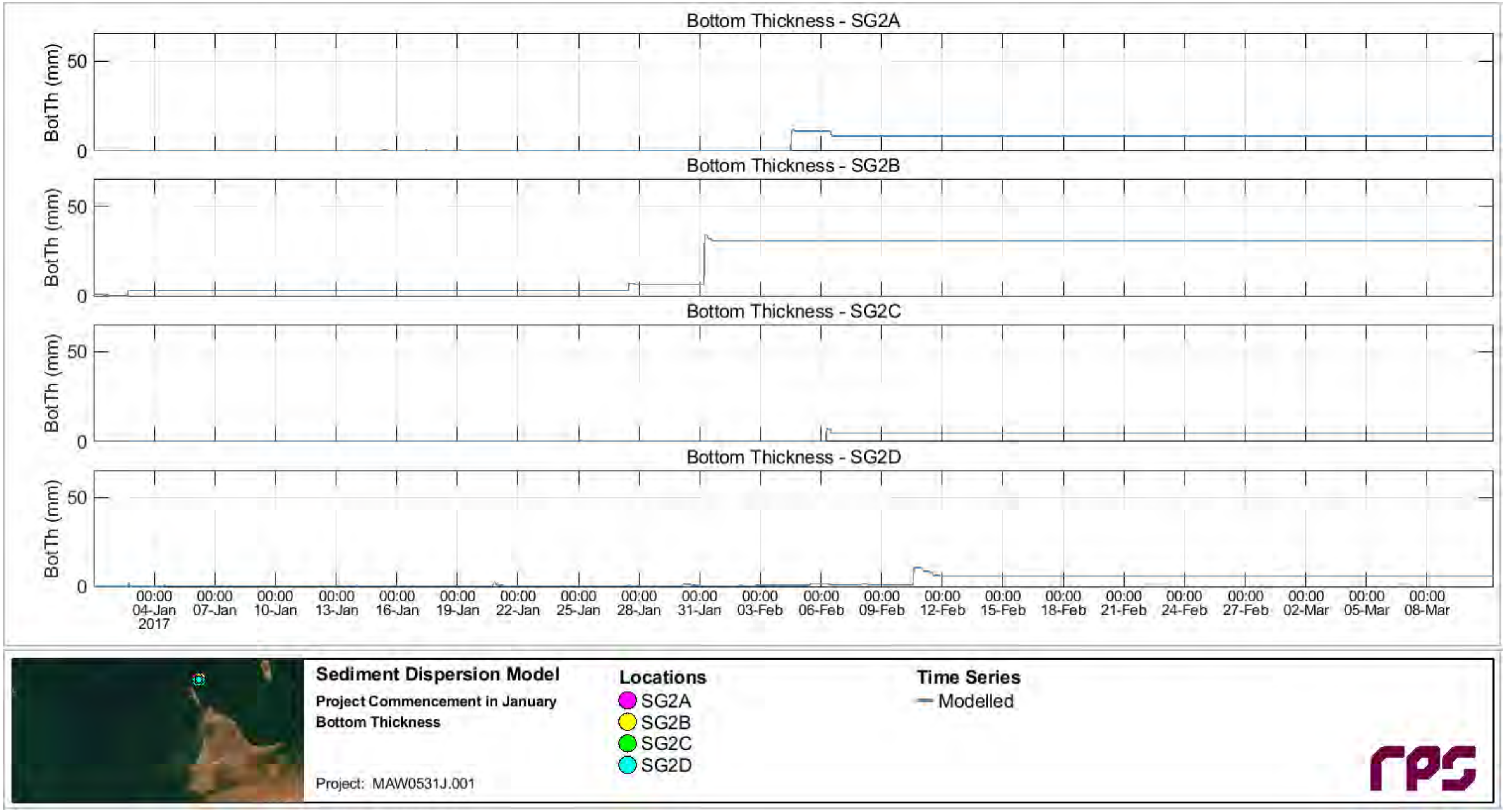

Figure 5.104 Time series of predicted dredge-excess bottom thickness at the *SG2A* to *SG2D* sites throughout the entire Scenario 5 duration (1 January to 11 March 2017).

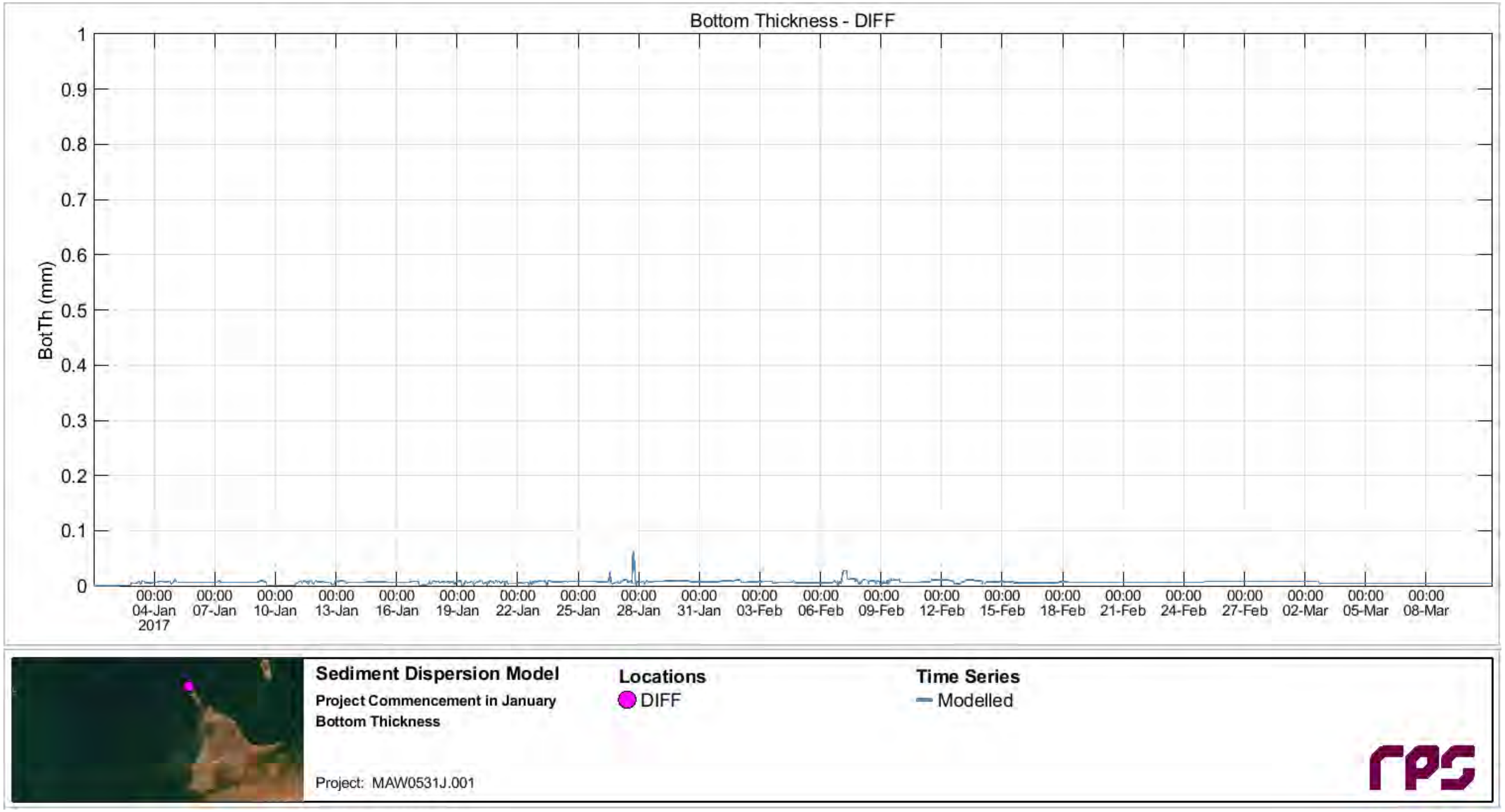

Figure 5.105 Time series of predicted dredge-excess bottom thickness at the *DIFF* site throughout the entire Scenario 5 duration (1 January to 11 March 2017).

5.3 Prediction of Management Zone Extents

5.3.1 Discussion

The calculated extents of the defined management zones – ZoI, ZoMI – Possible Effects and ZoMI – Probable Effects – over the entire program of dredging and disposal operations for each scenario are presented in the following sections.

The ZoI for each scenario is relatively large, covering areas up to 20 km along the coastline to the south-west during winter (Scenarios 1, 2 and 3) and to the north-east – with a smaller extent to the south-west – during summer (Scenarios 4 and 5). This is due to the strong tidal flows and drift currents in the areas where dredging and disposal are planned to occur, combined with extensive areas of shallow bathymetry to the north and particularly the south of the Port, which lead to high levels of dispersion of suspended sediment plumes.

The ZoMI has been calculated based on both depth-averaged and maximum-in-water-column TSSC outputs from the model. Typically, the depth-averaged TSSC is used in analysis when addressing the impact on coral habitats, as the effect of suspended sediment on light climate is a function of the TSSC through the whole water column. The ZoMI has also been calculated using the maximum-in-water-column TSSC to contextualise the depth-averaged results, showing the variability within the water column, and provide a 'worst case' extent of the ZoMI.

In Scenarios 1, 2, 3 and 5, either the ZoMI – Possible Effects and ZoMI – Probable Effects based on the depth-averaged TSSC lie within the footprint of the dredging and disposal areas (identified by default as ZoHI), or no exceedances are predicted. In Scenario 4 (a 2-week dredging program in summer), the ZoMI – Possible Effects and ZoMI – Probable Effects were predicted to extend approximately 300 m and 100 m beyond the disposal area in a south-westerly direction. In no scenario were the ZoMI – Possible Effects and ZoMI – Probable Effects based on depth-averaged TSSC predicted to intersect any areas of coral coverage.

The predicted ZoMI – Possible Effects and ZoMI – Probable Effects based on the maximum-in-water-column TSSC allows comparisons between scenarios and presents 'worst case' ZoMIs. Comparison of Scenarios 1 and 2 (winter conditions) show that the predicted ZoMI – Possible Effects extending from the disposal area is larger in Scenario 2 and has a small area of intersection with coral habitats to the south-west of the Port; however, the predicted extents of the ZoMI – Probable Effects are similar between the scenarios with no coral habitat incursion. In Scenario 3 (also winter conditions), the longer, less intense dredging program results in smaller predicted extents of the ZoMI – Possible Effects and ZoMI – Probable Effects, and no intersection with mapped coral habitats.

The predicted ZoMI – Possible Effects and ZoMI – Probable Effects based on the maximum-in-water-column TSSC for summer (Scenarios 4 and 5) show larger spatial extents than the corresponding winter scenarios, and an intersection with the coral habitats to the north-east of the Port in Scenario 4 (a 2 week dredging program).

5.3.2 Management Zone Figure Index

Figures showing the predicted management zone extents for each scenario are presented in Section 5.3.3. All management zone figures for each scenario are indexed in Table 5.5.

Table 5.5 Index of the management zone figures for each scenario.

Figure content	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
ZoI	Figure 5.106	Figure 5.110	Figure 5.114	Figure 5.117	Figure 5.122
ZoMI – Possible Effects, based on depth-averaged TSSC	Figure 5.107	Figure 5.111	NE	Figure 5.118	Figure 5.123
ZoMI – Probable Effects, based on depth-averaged TSSC	NE	NE	NE	Figure 5.119	NE
ZoMI – Possible Effects, based on maximum-in-water-column TSSC	Figure 5.108	Figure 5.112	Figure 5.115	Figure 5.120	Figure 5.124

Figure content	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
ZoMI – Probable Effects, based on maximum-in-water-column TSSC	Figure 5.109	Figure 5.113	Figure 5.116	Figure 5.121	Figure 5.125

NE: No exceedance of the threshold values for this management zone for all averaging periods for this scenario.

5.3.3 Management Zone – Spatial Maps

5.3.3.1 Scenario 1: Winter Start for 2-Week Dredge Program Using Spoil Disposal Site 1

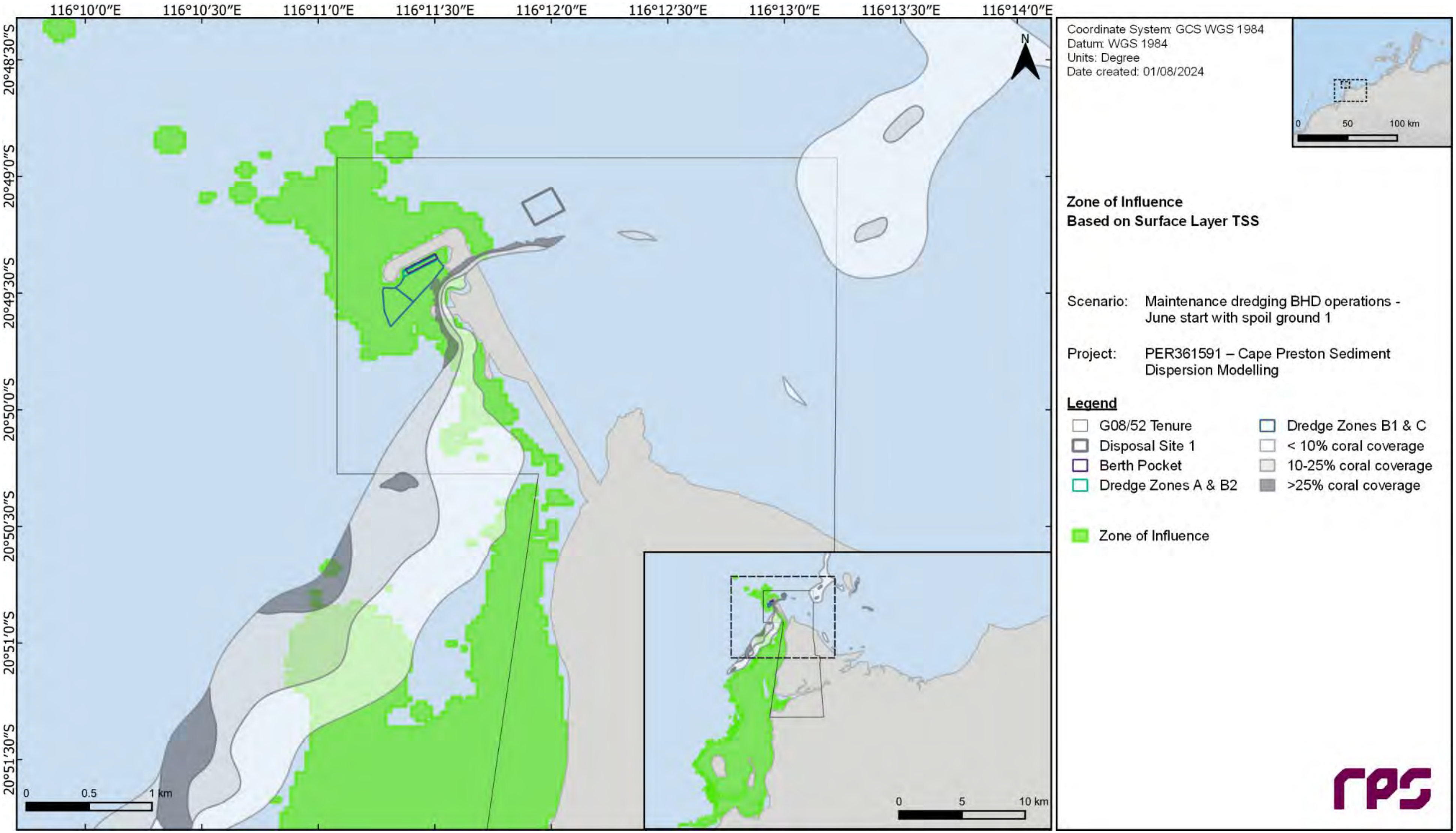

Figure 5.106 Predicted Zone of Influence following application of the appropriate threshold in Table 4.1 to the surface layer TSSC throughout the entire Scenario 1 duration (1 to 29 June 2017).

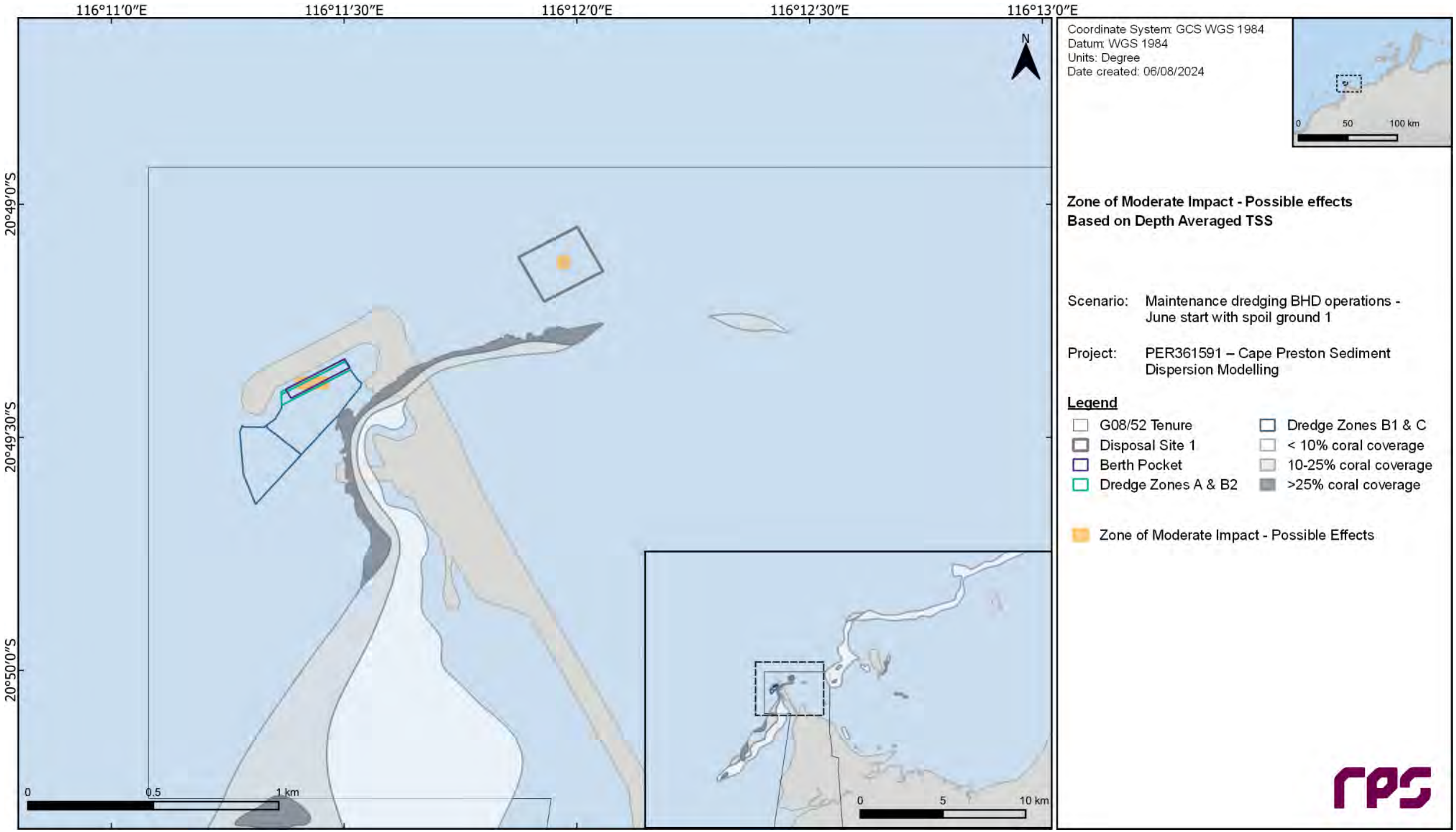

Figure 5.107 Predicted Zone of Moderate Impact – Possible Effects following application of the appropriate thresholds in Table 4.1 to the depth-averaged TSSC throughout the entire Scenario 1 duration (1 to 29 June 2017).

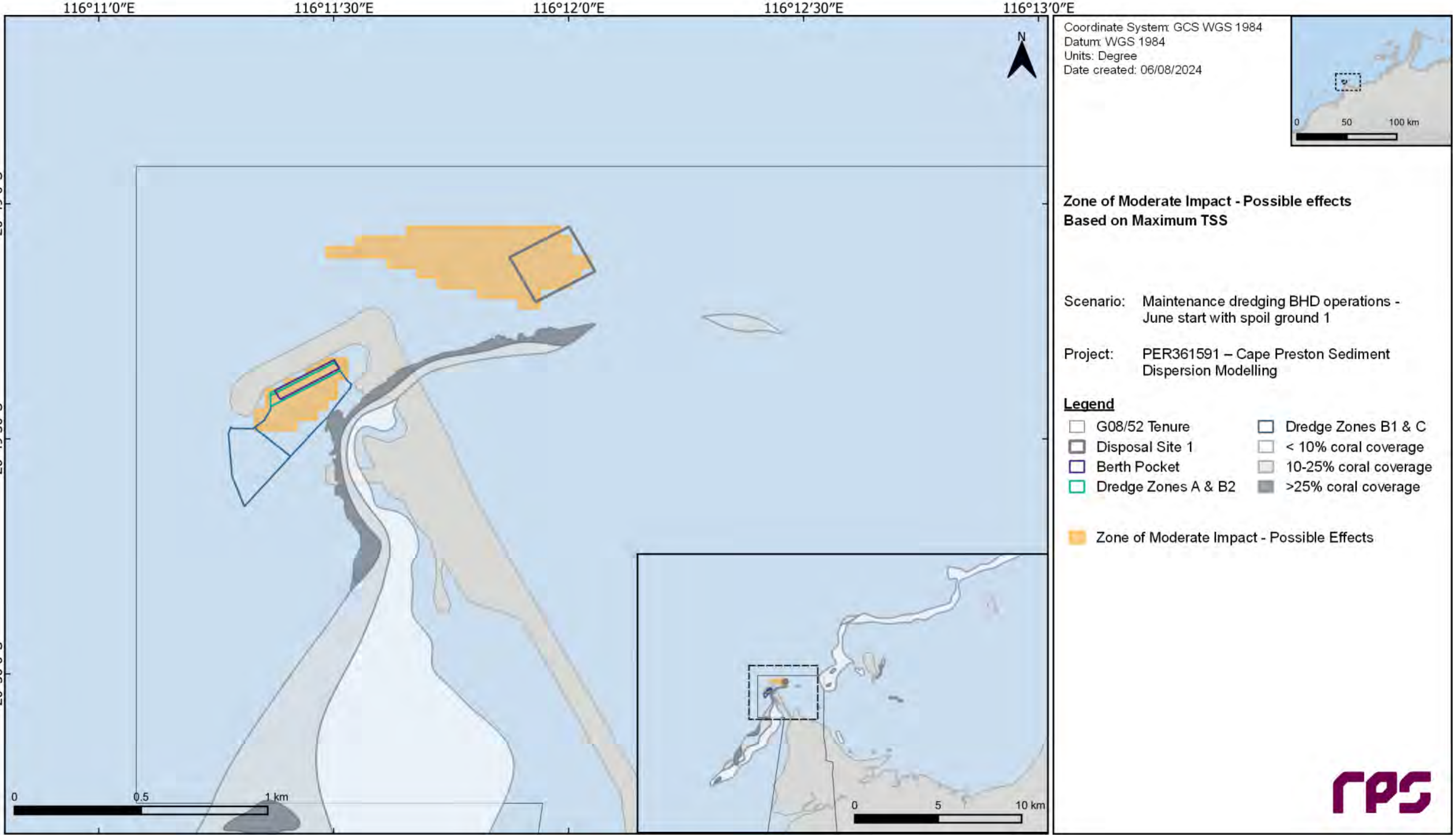

Figure 5.108 Predicted Zone of Moderate Impact – Possible Effects following application of the appropriate thresholds in Table 4.1 to the maximum-in-water-column TSSC throughout the entire Scenario 1 duration (1 to 29 June 2017).

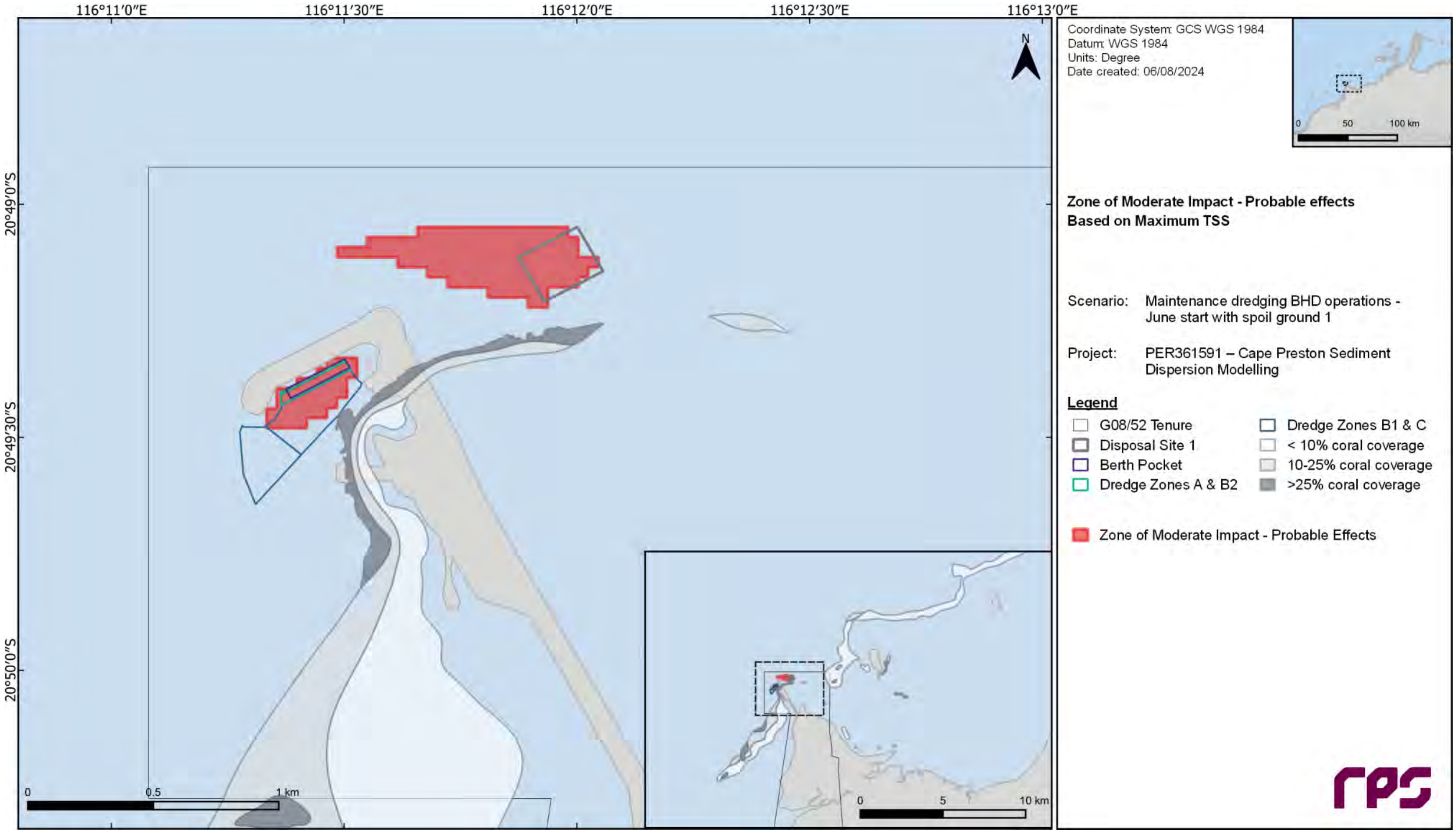

Figure 5.109 Predicted Zone of Moderate Impact – Probable Effects following application of the appropriate thresholds in Table 4.1 to the maximum-in-water-column TSSC throughout the entire Scenario 1 duration (1 to 29 June 2017).

5.3.3.2 Scenario 2: Winter Start for 2-Week Dredge Program Using Spoil Disposal Site 2

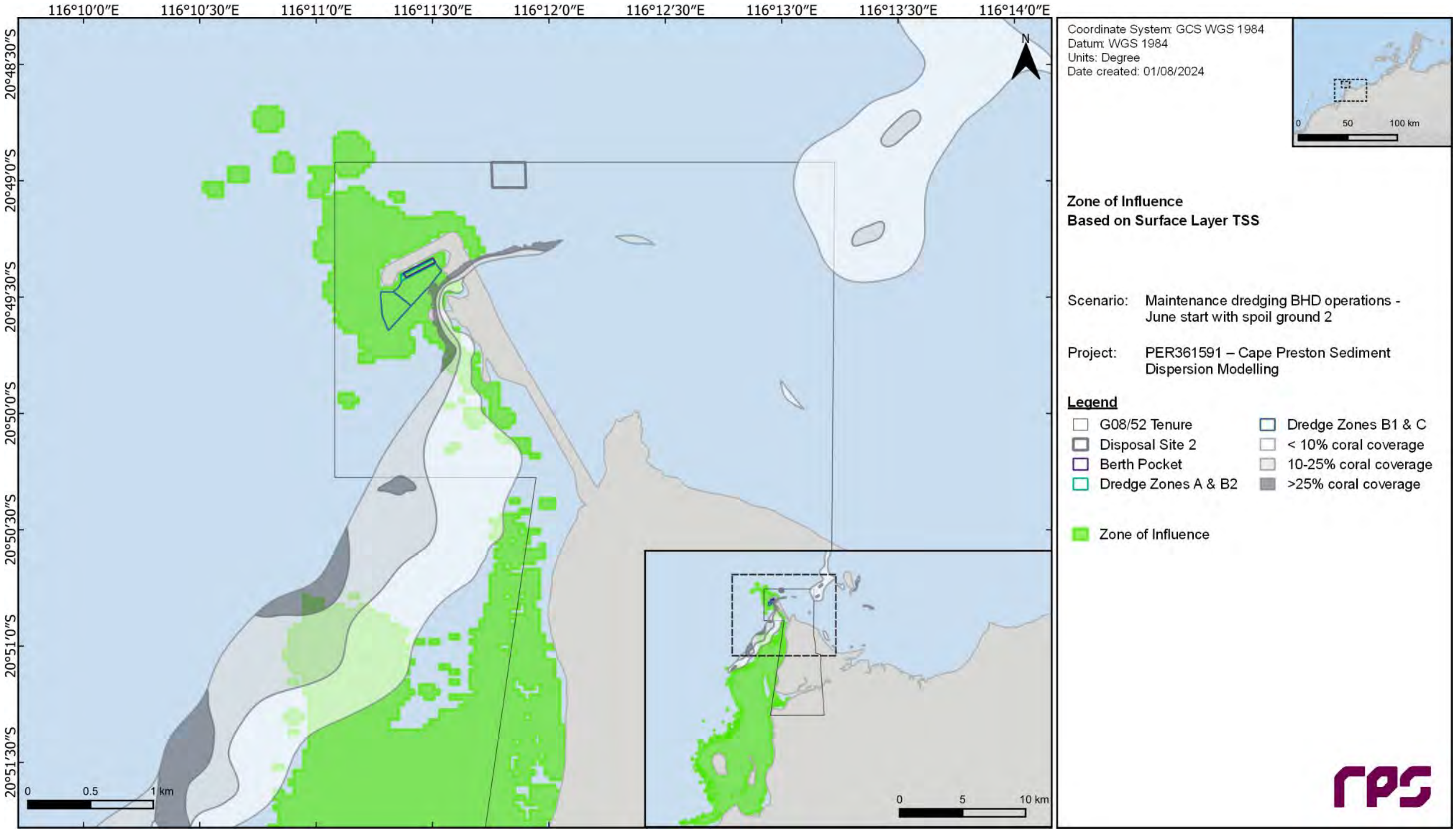

Figure 5.110 Predicted Zone of Influence following application of the appropriate threshold in Table 4.1 to the surface layer TSSC throughout the entire Scenario 2 duration (1 to 29 June 2017).

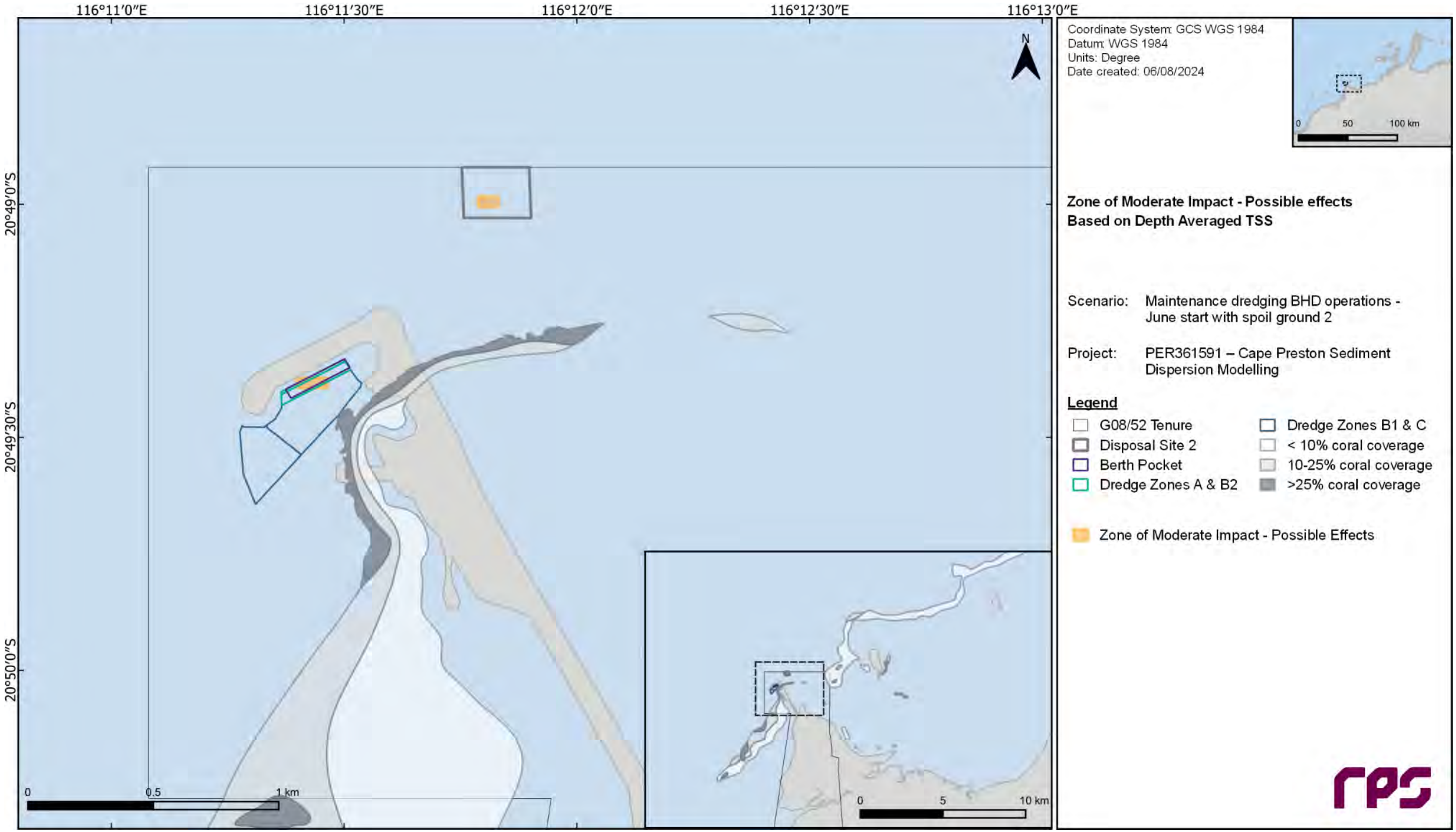

Figure 5.111 Predicted Zone of Moderate Impact – Possible Effects following application of the appropriate thresholds in Table 4.1 to the depth-averaged TSSC throughout the entire Scenario 2 duration (1 to 29 June 2017).

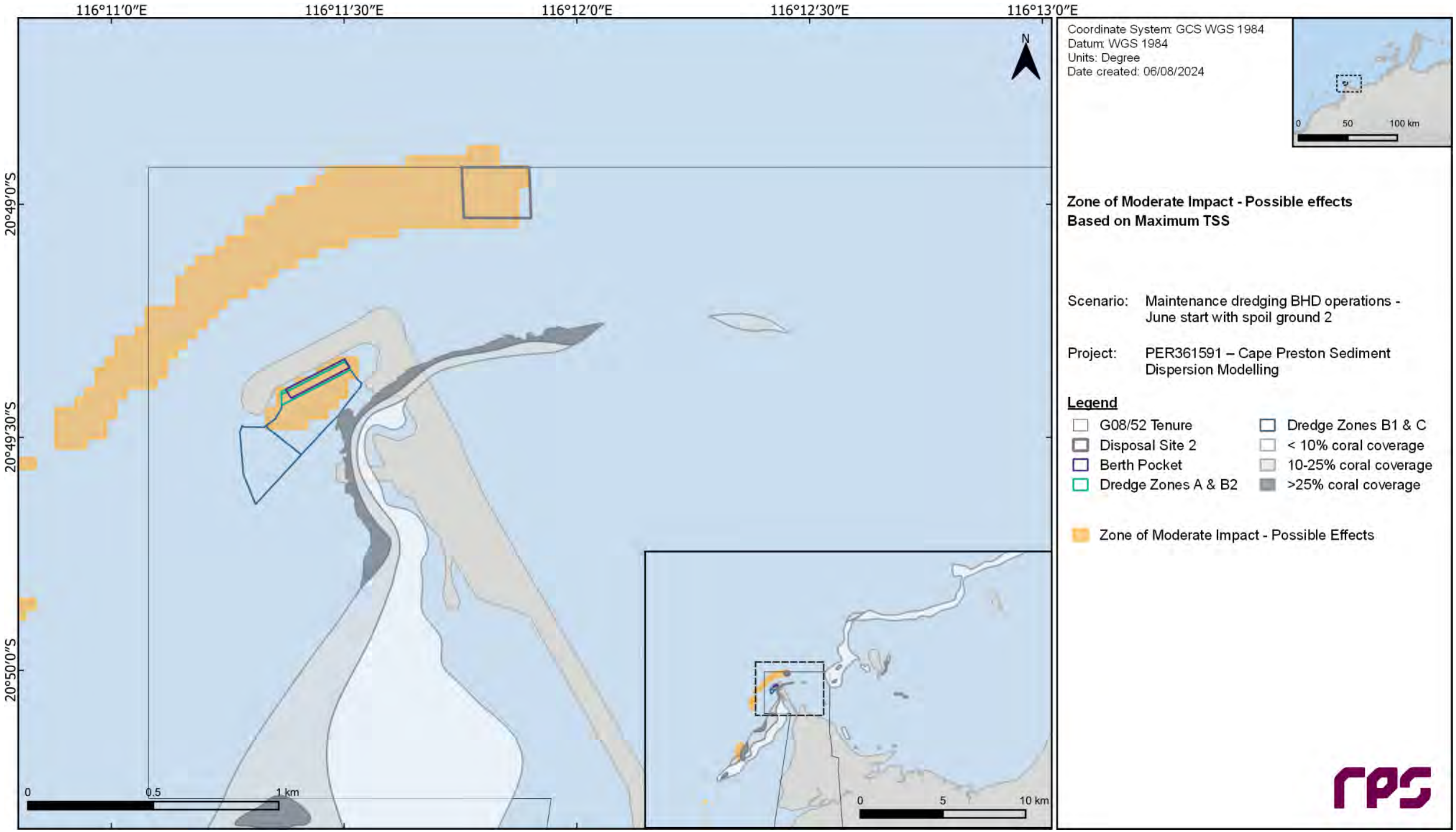

Figure 5.112 Predicted Zone of Moderate Impact – Possible Effects following application of the appropriate thresholds in Table 4.1 to the maximum-in-water-column TSSC throughout the entire Scenario 2 duration (1 to 29 June 2017).

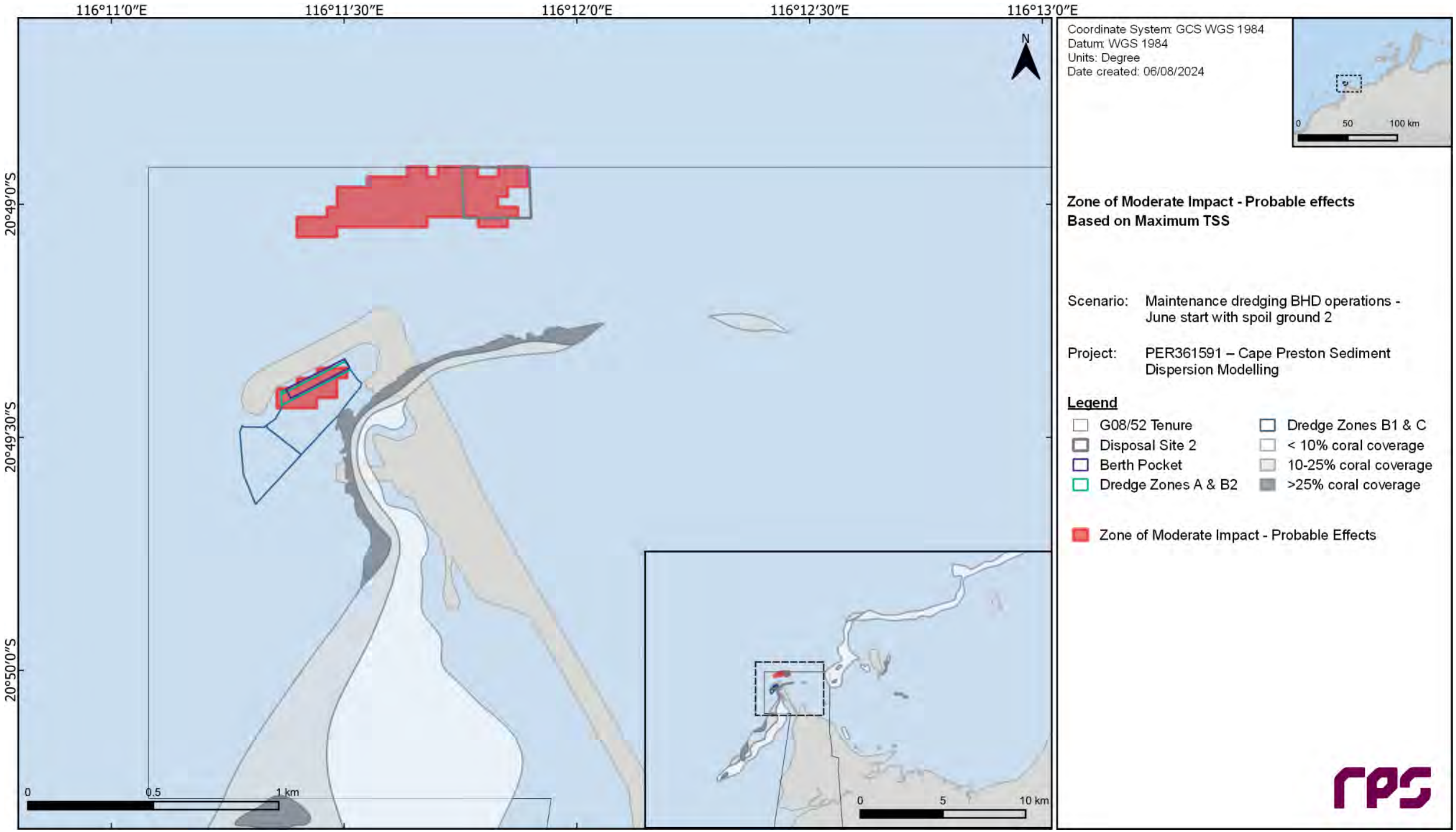

Figure 5.113 Predicted Zone of Moderate Impact – Probable Effects following application of the appropriate thresholds in Table 4.1 to the maximum-in-water-column TSSC throughout the entire Scenario 2 duration (1 to 29 June 2017).

5.3.3.3 Scenario 3: Winter Start for 6-Week Dredge Program Using Spoil Disposal Site 2

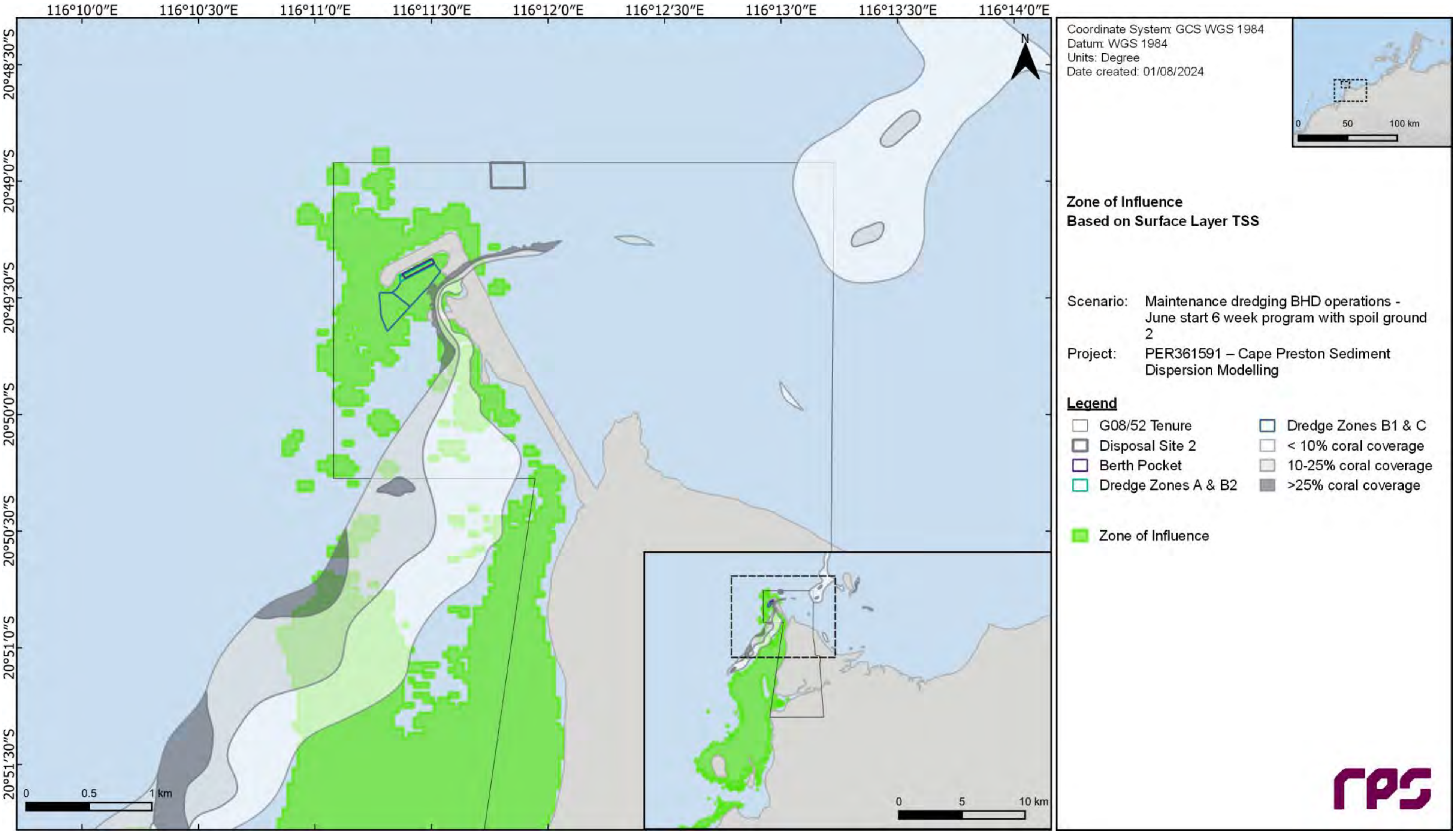

Figure 5.114 Predicted Zone of Influence following application of the appropriate threshold in Table 4.1 to the surface layer TSSC throughout the entire Scenario 3 duration (1 June to 9 August 2017).

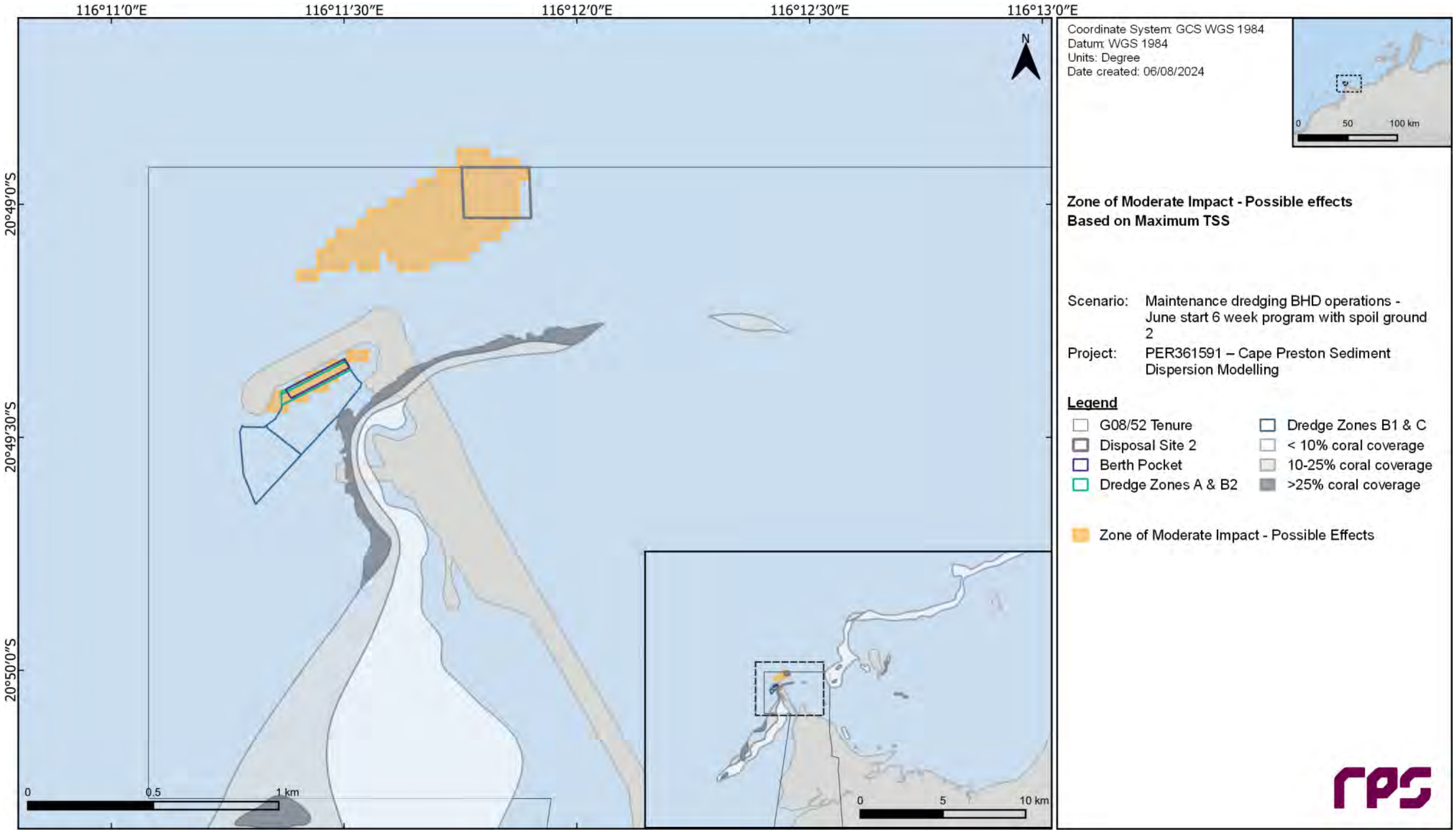

Figure 5.115 Predicted Zone of Moderate Impact – Possible Effects following application of the appropriate thresholds in Table 4.1 to the maximum-in-water-column TSSC throughout the entire Scenario 3 duration (1 June to 9 August 2017).

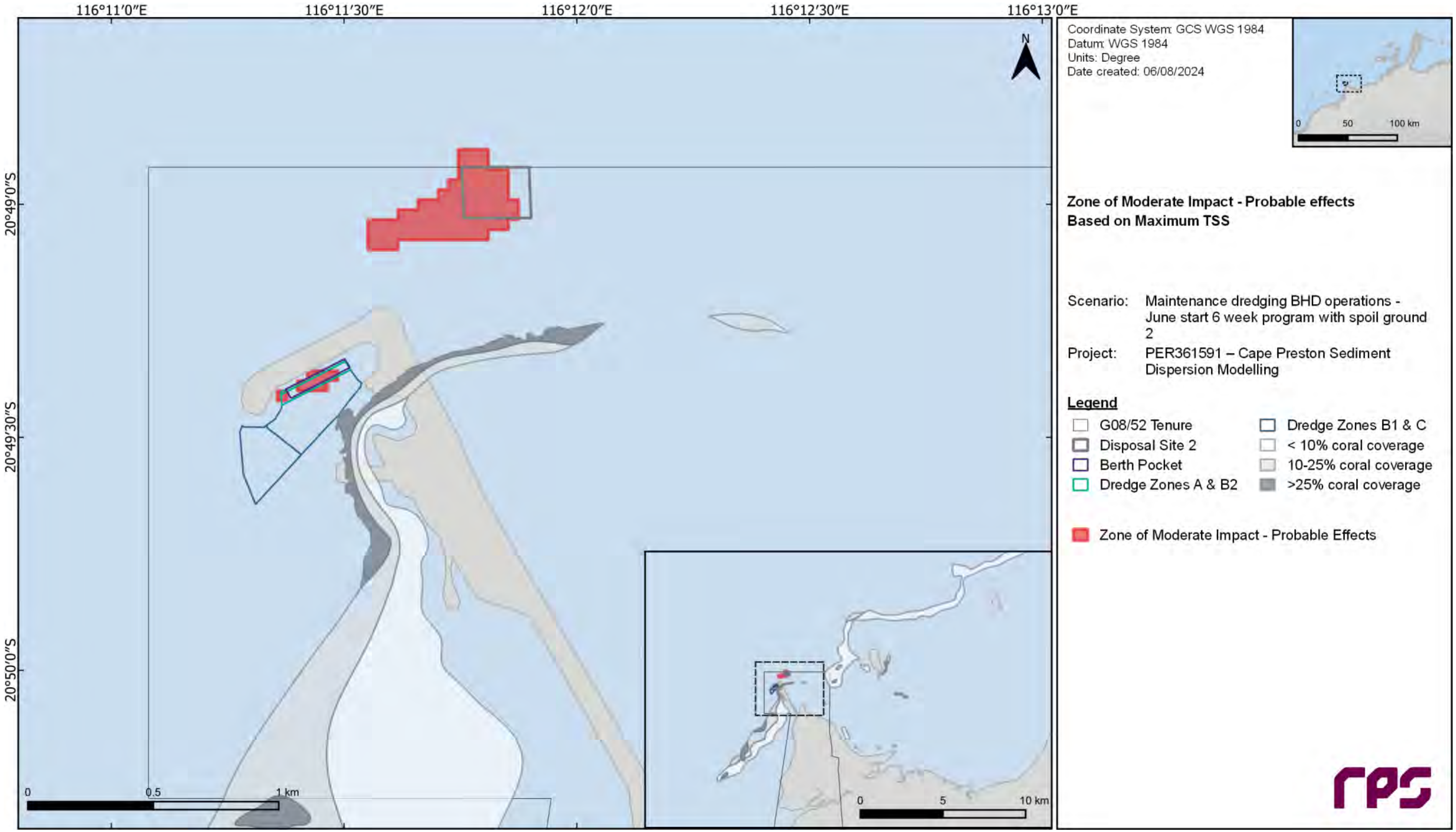

Figure 5.116 Predicted Zone of Moderate Impact – Probable Effects following application of the appropriate thresholds in Table 4.1 to the maximum-in-water-column TSSC throughout the entire Scenario 3 duration (1 June to 9 August 2017).

5.3.3.4 Scenario 4: Summer Start for 2-Week Dredge Program Using Spoil Disposal Site 1

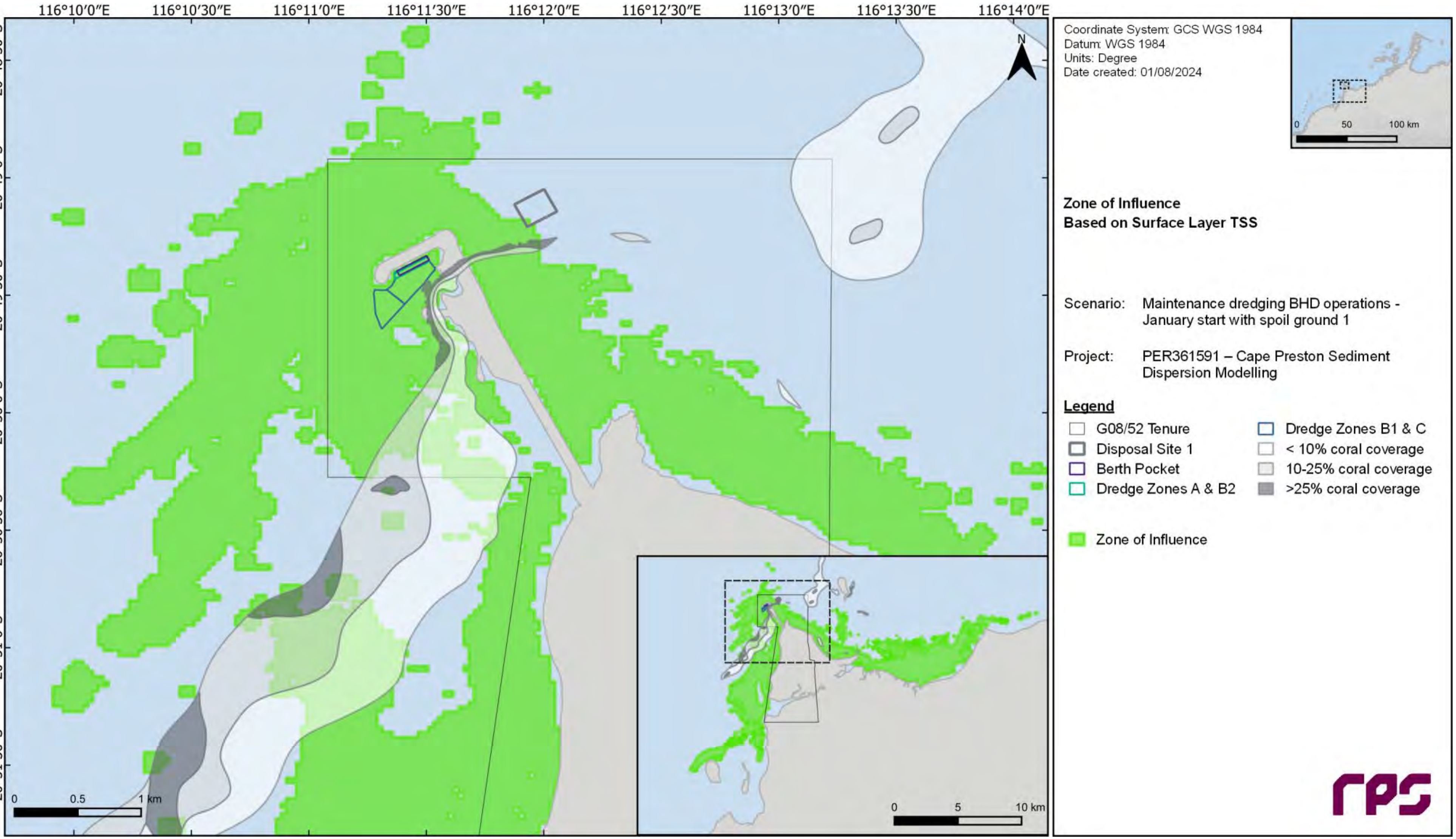

Figure 5.117 Predicted Zone of Influence following application of the appropriate threshold in Table 4.1 to the surface layer TSSC throughout the entire Scenario 4 duration (1 to 29 January 2017).

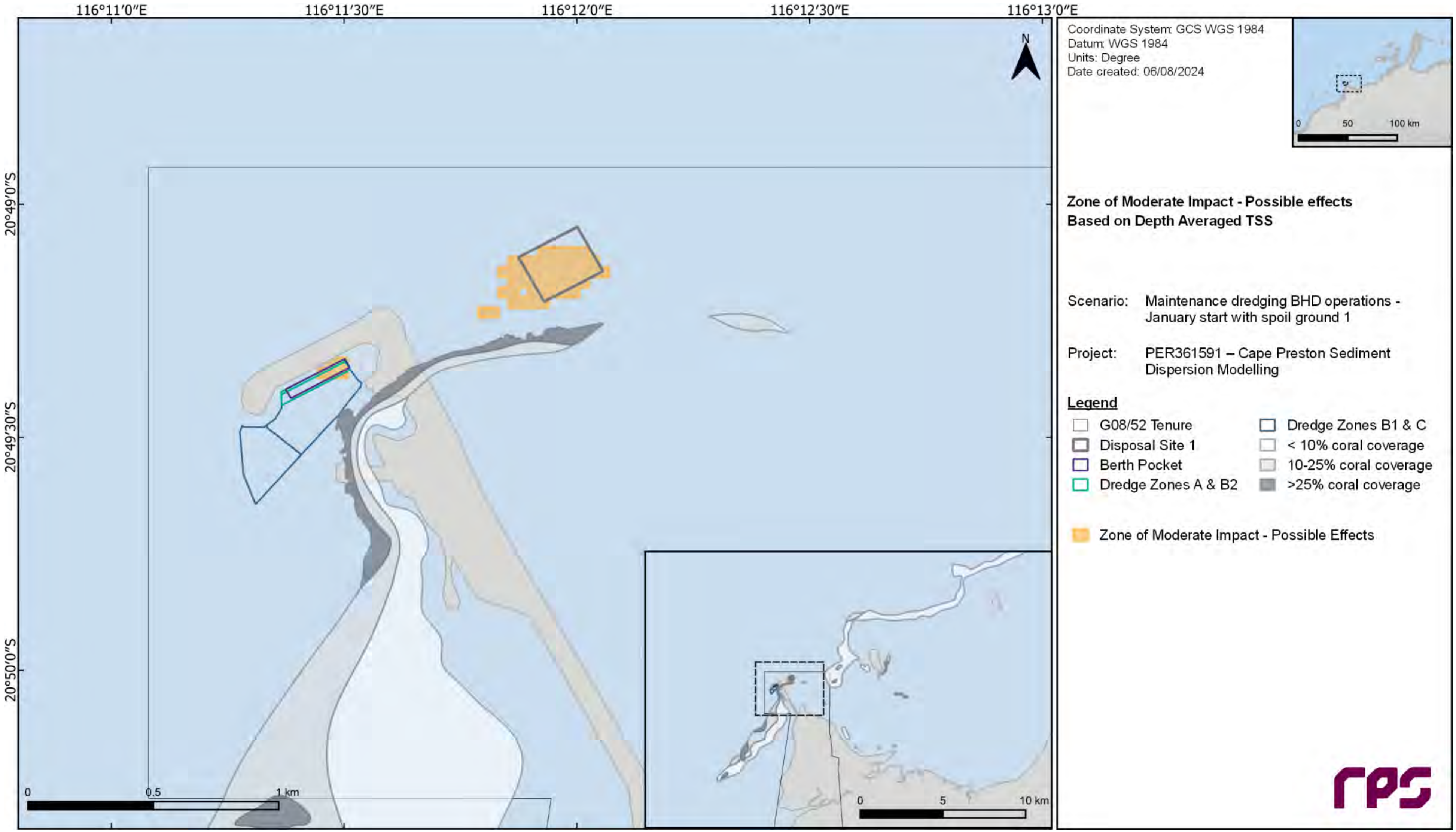

Figure 5.118 Predicted Zone of Moderate Impact – Possible Effects following application of the appropriate thresholds in Table 4.1 to the depth-averaged TSSC throughout the entire Scenario 4 duration (1 to 29 January 2017).

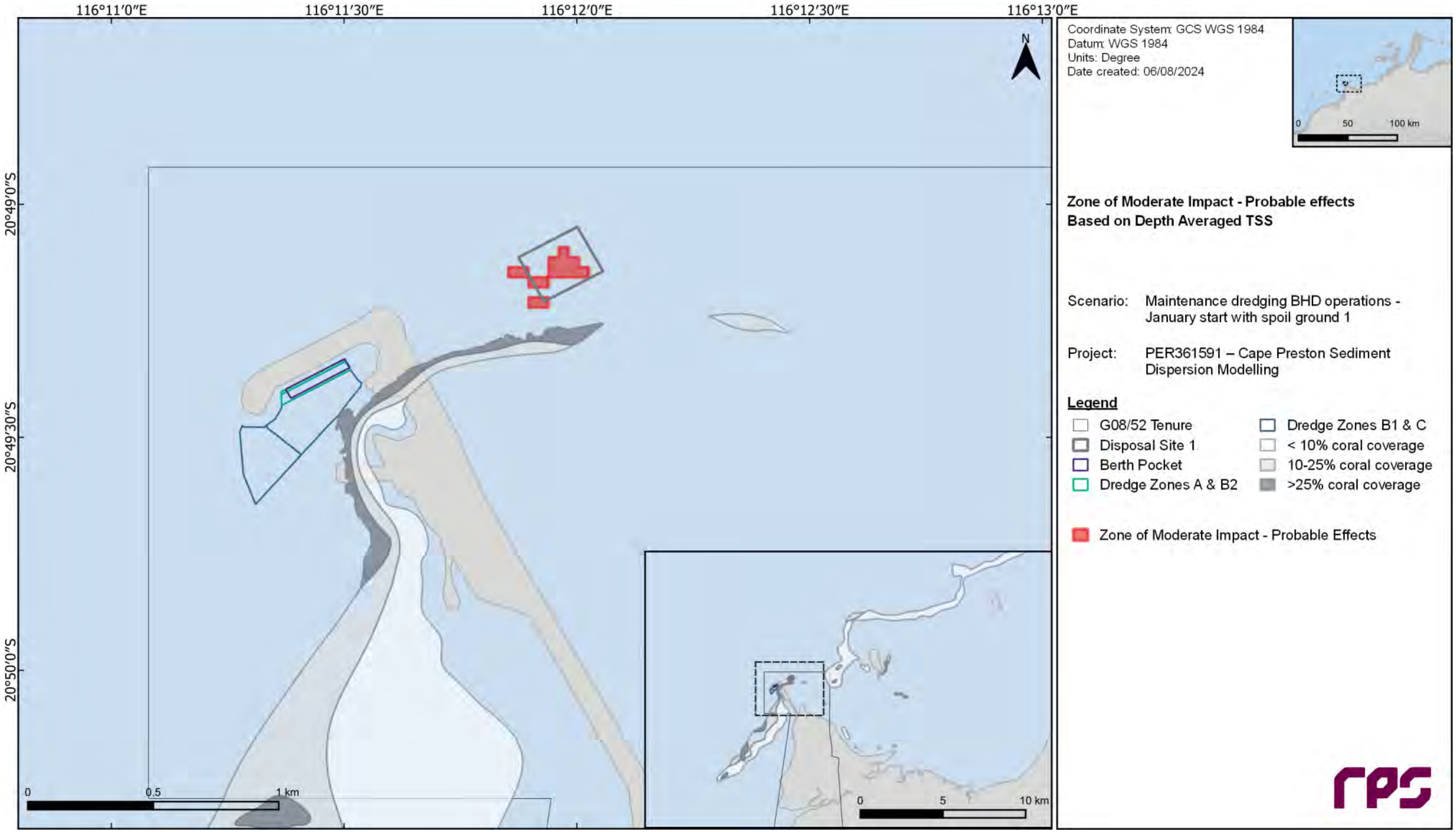

Figure 5.119 Predicted Zone of Moderate Impact – Probable Effects following application of the appropriate thresholds in Table 4.1 to the depth-averaged TSSC throughout the entire Scenario 4 duration (1 to 29 January 2017).

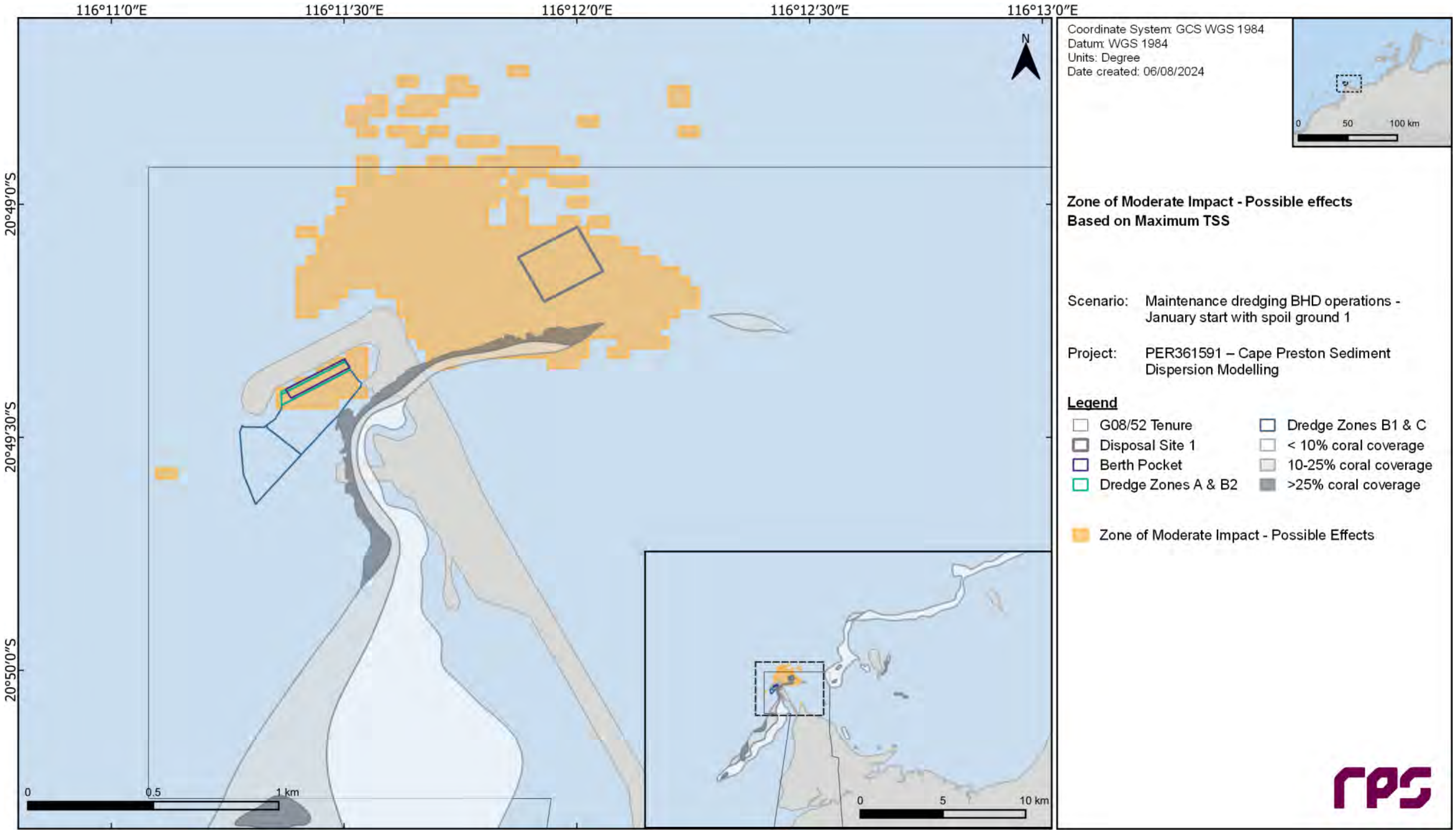

Figure 5.120 Predicted Zone of Moderate Impact – Possible Effects following application of the appropriate thresholds in Table 4.1 to the maximum-in-water-column TSSC throughout the entire Scenario 4 duration (1 to 29 January 2017).

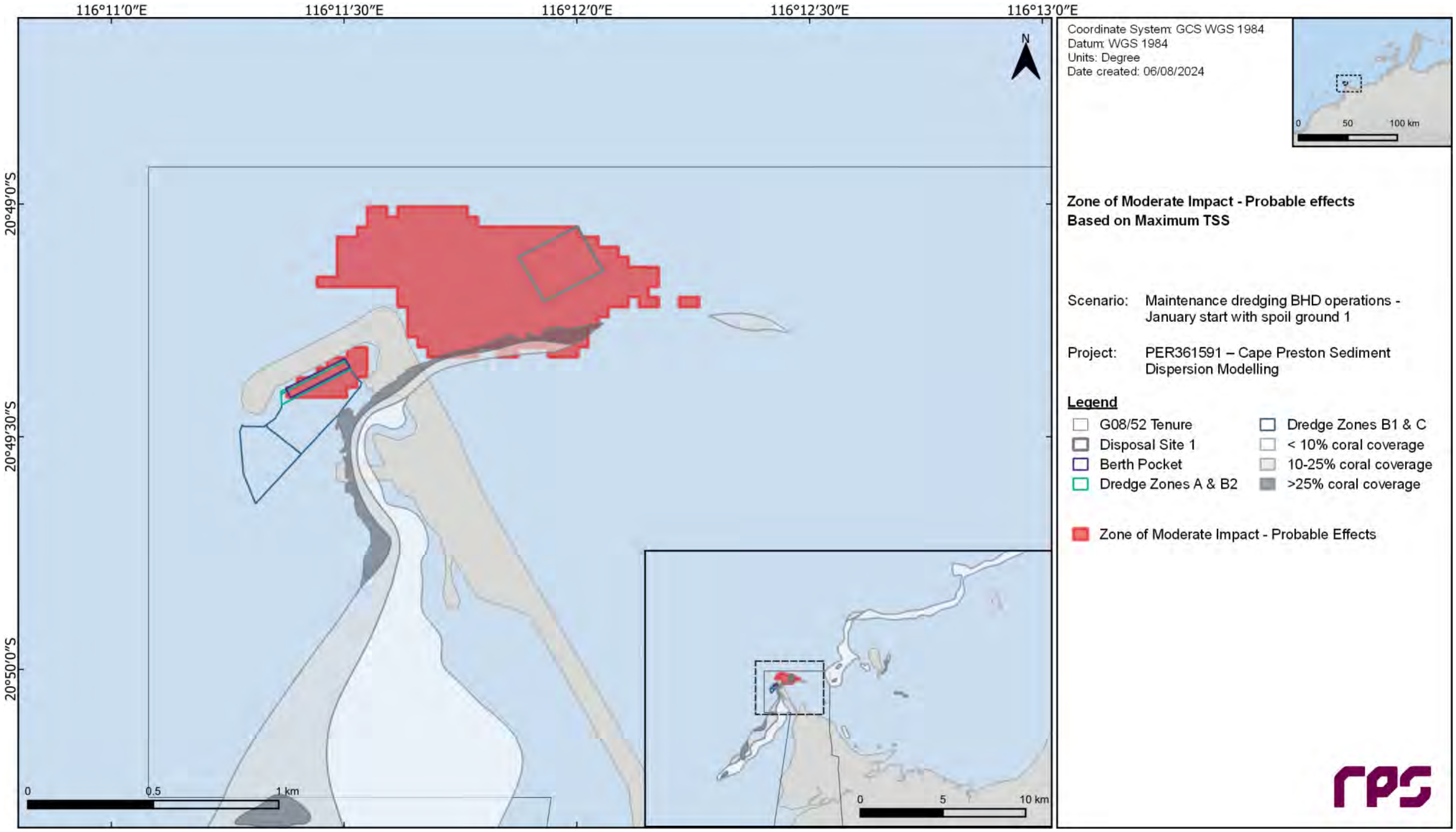

Figure 5.121 Predicted Zone of Moderate Impact – Probable Effects following application of the appropriate thresholds in Table 4.1 to the maximum-in-water-column TSSC throughout the entire Scenario 4 duration (1 to 29 January 2017).

5.3.3.5 Scenario 5: Summer Start for 6-Week Dredge Program Using Spoil Disposal Site 2

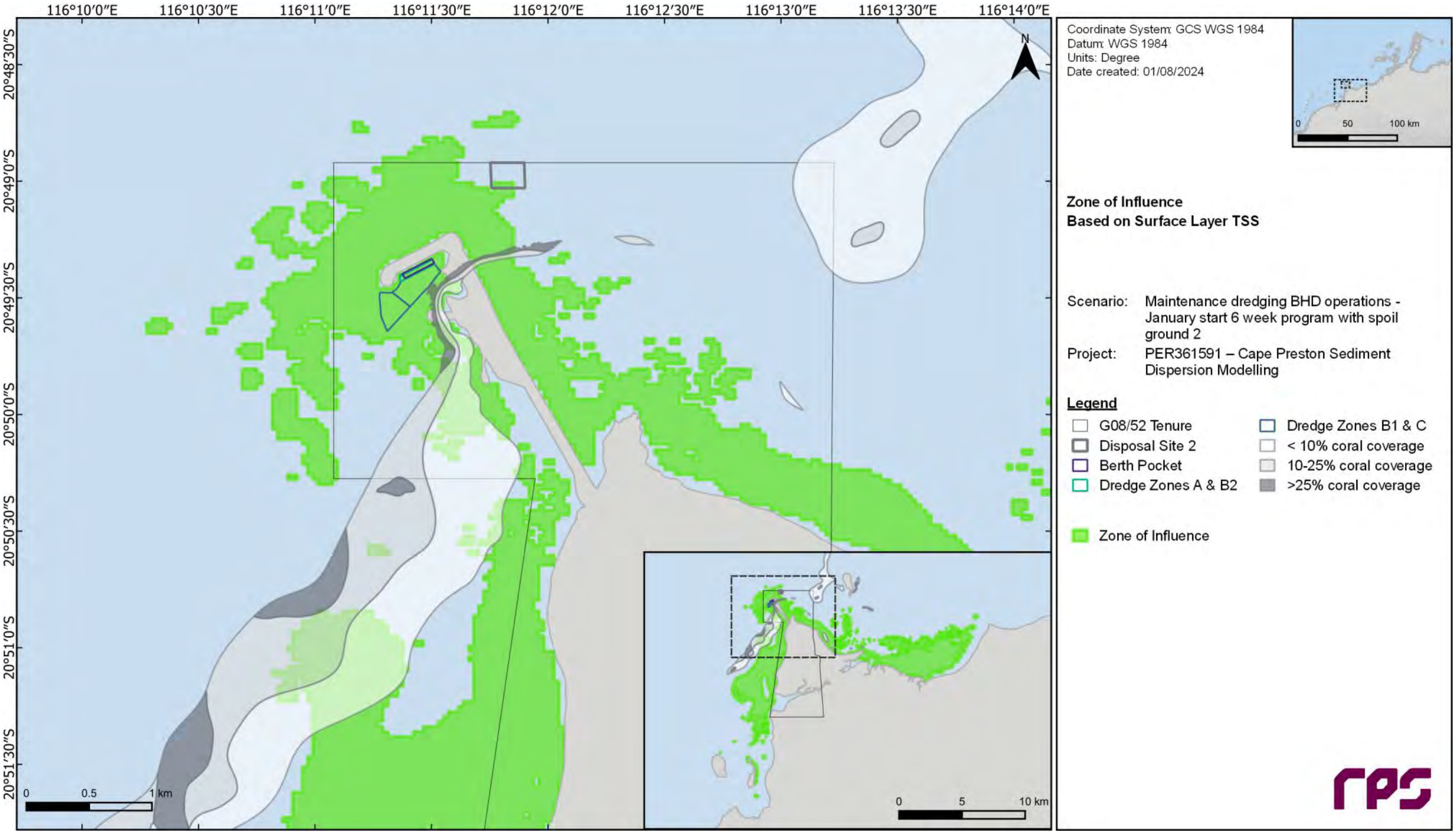

Figure 5.122 Predicted Zone of Influence following application of the appropriate threshold in Table 4.1 to the surface layer TSSC throughout the entire Scenario 5 duration (1 January to 11 March 2017).

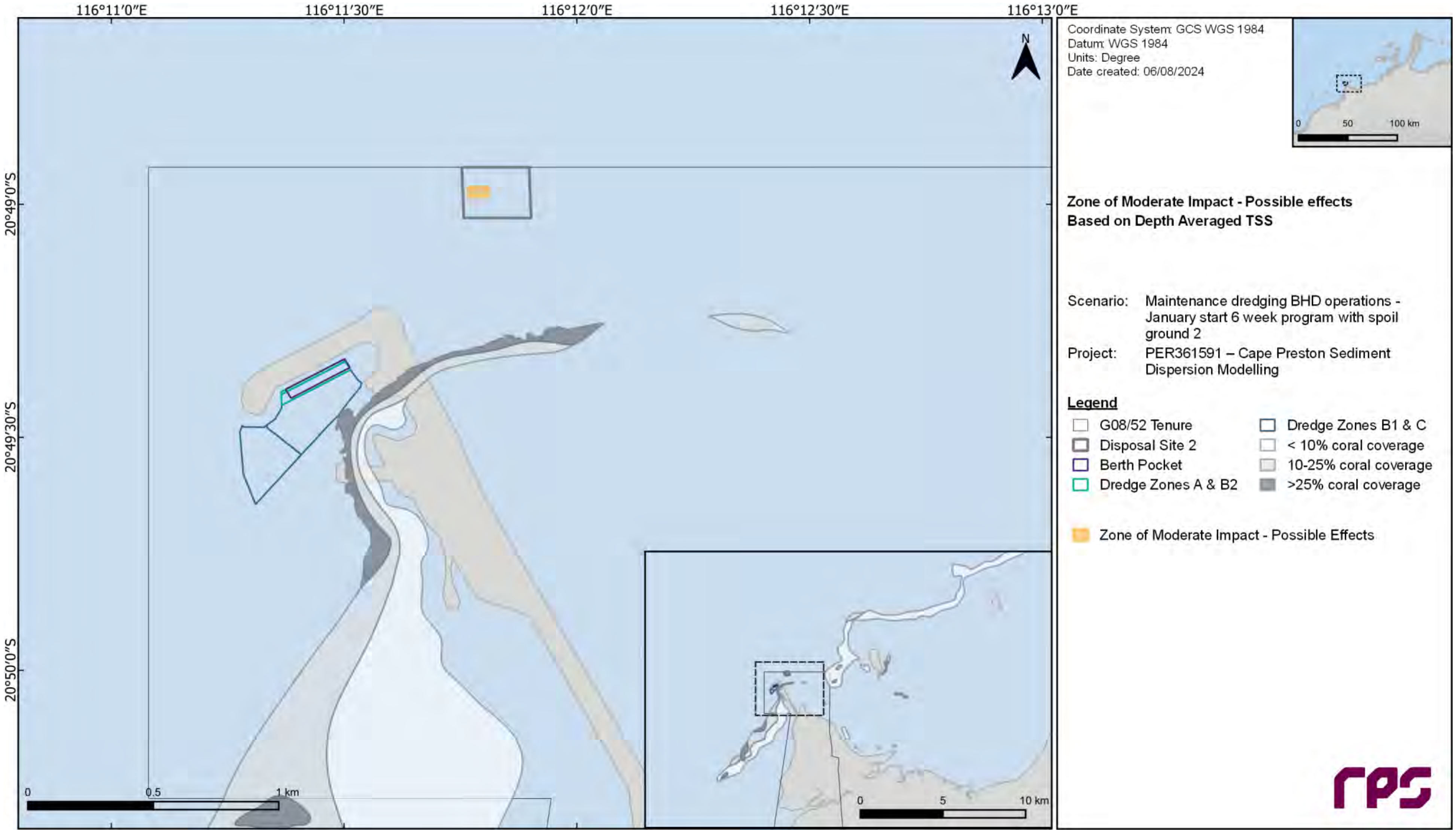

Figure 5.123 Predicted Zone of Moderate Impact – Possible Effects following application of the appropriate thresholds in Table 4.1 to the depth-averaged TSSC throughout the entire Scenario 5 duration (1 January to 11 March 2017).

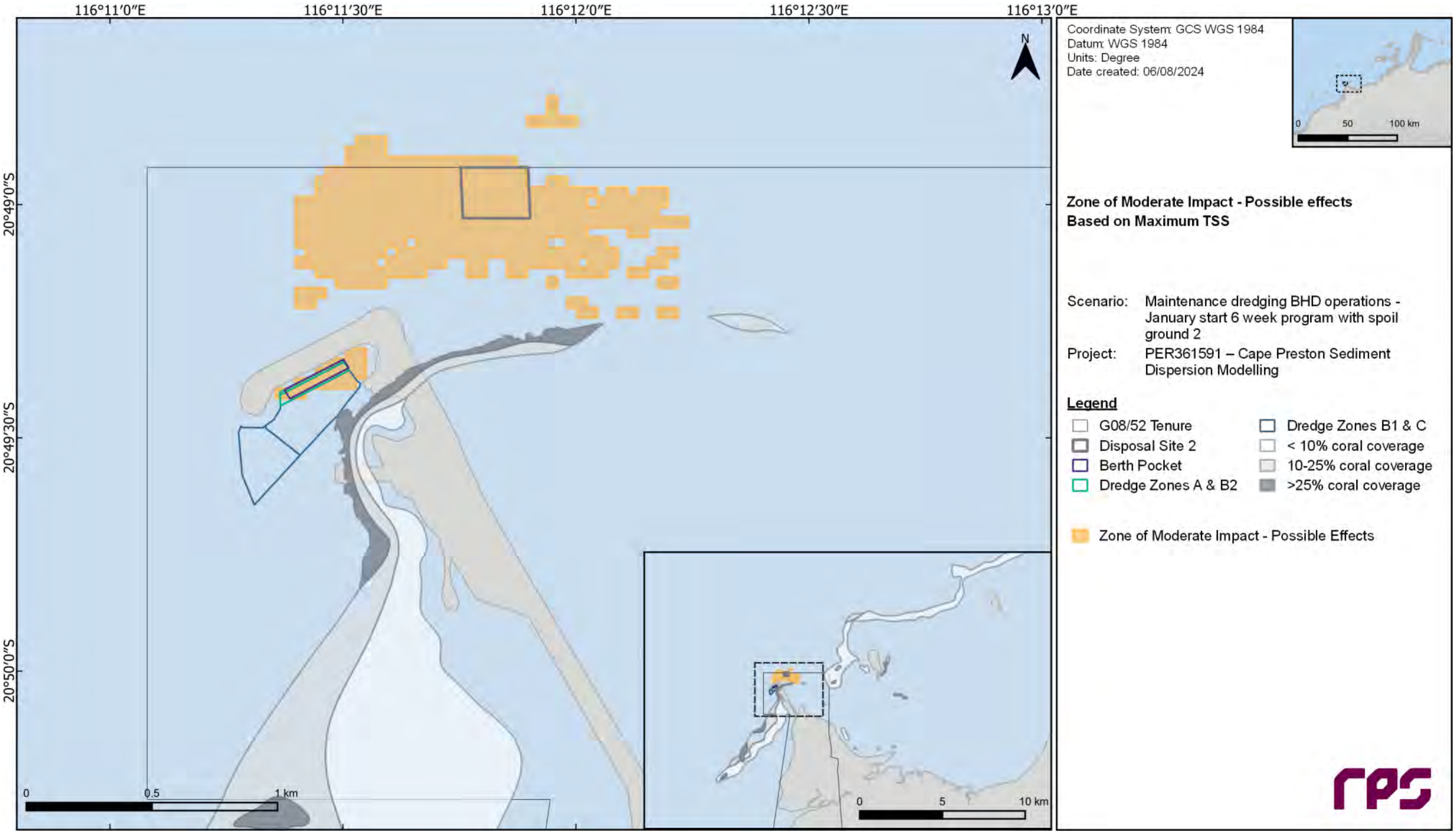

Figure 5.124 **Predicted Zone of Moderate Impact – Possible Effects following application of the appropriate thresholds in Table 4.1 to the maximum-in-water-column TSSC throughout the entire Scenario 5 duration (1 January to 11 March 2017).**

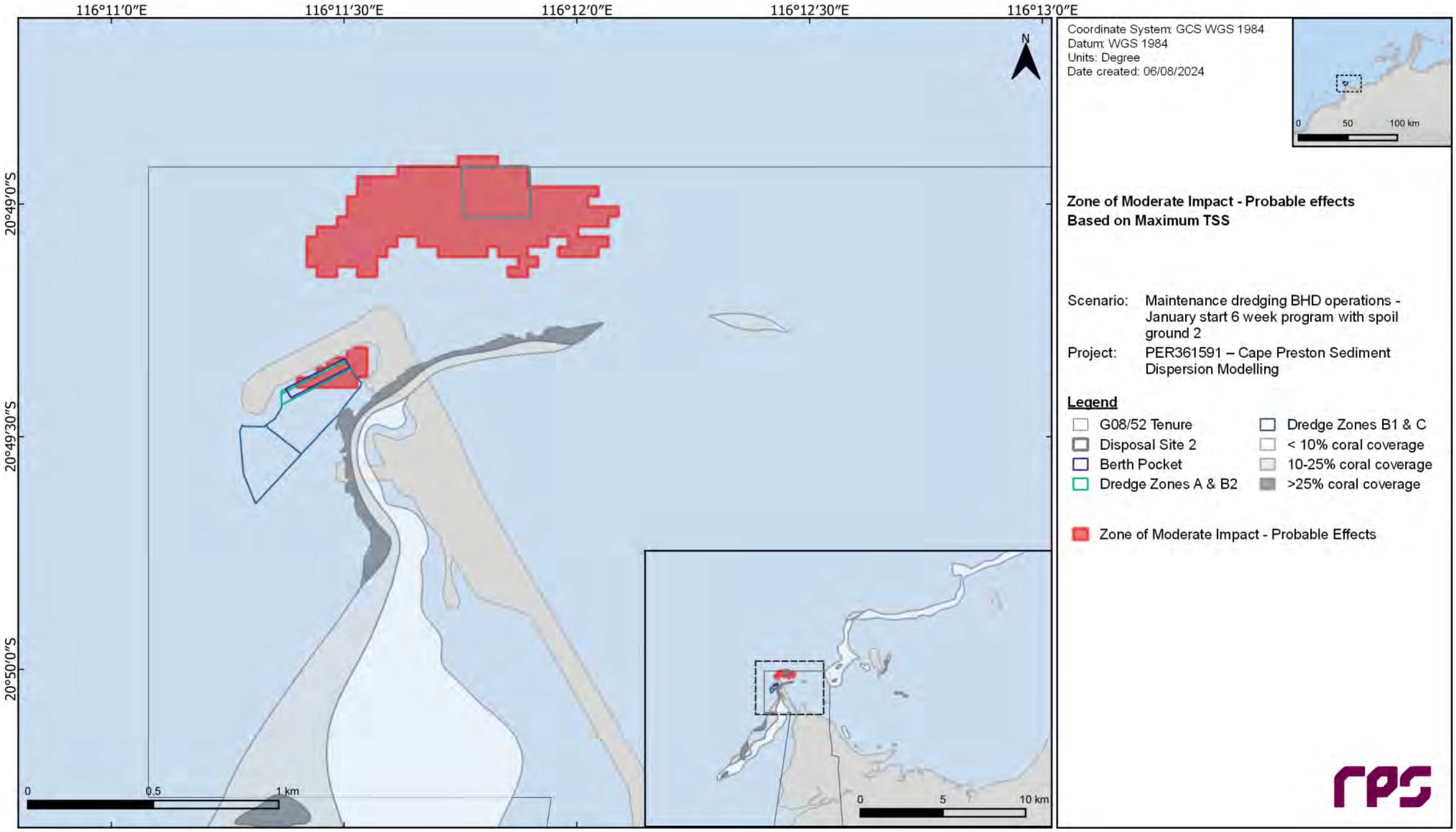

Figure 5.125 Predicted Zone of Moderate Impact – Probable Effects following application of the appropriate thresholds in Table 4.1 to the maximum-in-water-column TSSC throughout the entire Scenario 5 duration (1 January to 11 March 2017).

6 CONCLUSIONS

The main conclusions from the sediment dispersion modelling conducted for the proposed dredging and disposal operations associated with the maintenance dredging program are outlined in the following sections.

6.1 General Plume Movement and Sedimentation Patterns

- The localised movement and dispersion of the dredge-generated suspended sediment is governed over short time scales by the tide. Superimposed on this motion is the gradual migration of sediment due to wind-driven currents, which drive overall drift patterns.
- The predicted sediment plume at the Port typically extends southwards during winter conditions, as seen in the three June-start simulations (Scenarios 1 to 3), and mostly northwards with some southward drift during summer conditions, as seen in the two January-start simulations (Scenarios 4 and 5).
- The extensive shallow bathymetry to the north and south of the Port, and the strong tidal flows in the area, result in limited settlement of the dredge-generated sediment with material being continuously resuspended and plumes having long drift trajectories extending over many kilometres.

6.2 Spatial and Temporal Distributions of TSSC

- There is significant variability in the vertical distributions of TSSC in the water column, with a distinct increase in concentration towards the seabed.
- Comparing plume outcomes in Scenarios 1 and 2, each of which simulate a 2-week dredging program in winter, Scenario 2 predicts lower TSSC values in the vicinity of the spoil ground and higher TSSC values along the coast to the south. The slightly more offshore spoil ground location in Scenario 2 is subject to higher current speeds, which inhibit settling of material and act to promote greater and more rapid dispersion.
- Comparing plume outcomes in Scenarios 2 and 3, each of which use the same spoil ground during winter conditions, the longer, less intense dredging program with significantly lower production rates in Scenario 3 results in prediction of a generally more dilute plume. A similar comparison is found between Scenarios 4 and 5 (summer scenarios), where the longer less intense dredging program of Scenario 5 results in significantly lower TSSC values and smaller spatial extents at each contour value.
- The temporal variation in dredge-excess TSSC at sites to the south-west and north-east of the Port and at the spoil grounds reflects the spatial patchiness of the plumes and the oscillations of the dominant tidal flows in the area, with rapidly changing (over hourly scales) sharp peaks and troughs.
- Exposure to elevated TSSC is typically transient and periodic at all assessed sites, and TSSC is not consistently elevated throughout the dredging and disposal period.
- During winter months, sediment plumes are predicted to rarely reach sites to the north and north-east of the Port breakwaters due to the dominant southward drift direction in the region.
- At the spoil grounds, elevated TSSC levels (of the order of 100-1,000 mg/L) occur immediately after disposal events but are rapidly dispersed and do not persist for long periods of time (scales of hours). The 98th percentile levels for Scenarios 1, 2, 3 and 5 are predicted to be less than 20 mg/L, with that of Scenario 4 being less than 70 mg/L.

6.3 Spatial and Temporal Distributions of Sedimentation

- Sedimentation of >1 mm thickness is typically limited to the vicinity of the dredging and disposal operations, with deposited sediments at greater distances being more likely to consist of finer material that will be transported further before settling.
- At all sites other than those around the disposal area, and *CM04 to CM06* which are relatively close to the dredging and disposal areas, the predicted thicknesses remain less than 0.2 mm.

- The deposition rates at distance from the dredging and disposal areas are low, forming only very thin layers of material, due to the magnitude of the tidal and drift currents in the area and the shallow exposed bathymetry.
- Some slight reductions in predicted bottom thickness can be seen during the run-on periods, but as the deposited material typically comprises coarser sediments the sedimentation levels are relatively stable during ambient conditions.

6.4 Management Zone Extents

- The ZoI for each scenario is relatively large, covering areas up to 20 km along the coastline to the south-west during winter (Scenarios 1, 2 and 3) and to the north-east – with a smaller extent to the south-west – during summer (Scenarios 4 and 5).
- The predicted ZoMI – Possible Effects and ZoMI – Probable Effects based on the depth-averaged TSSC for Scenarios 1, 2, 3 and 5 either lie within the footprint of the dredging and disposal areas (identified by default as ZoHI), or no exceedances are predicted. In Scenario 4 (a 2-week dredging program in summer), the ZoMI – Possible Effects and ZoMI – Probable Effects were predicted to extend approximately 300 m and 100 m beyond the disposal area in a south-westerly direction.
- The predicted ZoMI – Possible Effects and ZoMI – Probable Effects based on depth-averaged TSSC were not predicted to intersect any areas of coral coverage in any scenario.
- The predicted ZoMI – Possible Effects and ZoMI – Probable Effects based on the maximum-in-water-column TSSC show larger spatial extents for summer simulations (Scenarios 4 and 5) compared to corresponding winter simulations (Scenarios 1 and 3), and for the shorter more intense dredging program simulations (Scenarios 1, 2 and 4) compared to the longer less intense dredging program simulations (Scenarios 3 and 5).
- The predicted ZoMI – Possible Effects area based on the maximum-in-water-column TSSC intersected mapped coral habitats in Scenario 2 (winter start 2-week dredging program using spoil ground 2).
- Both the predicted ZoMI – Possible Effects and ZoMI – Probable Effects based on the maximum-in-water-column TSSC intersected mapped coral habitats in Scenario 4 (summer start 2-week dredging program using spoil ground 1).

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19 Appendix E. Stakeholder Consultation Records

Dredge Material Placement Area Disposal Stakeholder Consultation

CPM supplied the Dredge Material Placement Area Disposal Stakeholder Consultation Information Memorandum to the following stakeholders. Where a stakeholder responded the records of correspondence have been provided.

Date	Organisation	Email Address	stakeholder response records
11/10/2024	Aquaculture council of West Australia	ceo@aquaculturecouncilwa.com admin@aquaculturecouncilwa.com	2. Maxima Pearling Company- Steven Gill 3. CPM response to Maxima Pearling Company
2/10/2024	City of Karratha	enquiries@karratha.wa.gov.au	4. CofK
2/10/2024	Department of Biodiversity, Conservation and Attractions	EMBadmin@dbca.wa.gov.au	5. DBCA
2/10/2024	Department of Transport	steven.wenban@transport.wa.gov.au	6. DoT
2/10/2024	Department of Primary Industries and Regional Development	Michael.Dunne@fish.wa.gov.au	7. DPIRD 8. CPM response to DPIRD
2/10/2024	Pilbara Ports	Dan.Pedersen@pilbaraports.com.au	9. PPA
2/10/2024	Western Australian Fishing Industry Council	admin@wafic.org.au	10. WAFIC
11/10/2024	Recfish West	info@recfishwest.org.au	11. Recfish
7/10/2024	Traditional Owners	steve.graham@wacrntbc.com.au janice.brettner@wacrntbc.com.au	**Nill response**
14/10/2024	Traditional Owners Consultant	heritage@wacrntbc.com.au (Simon Davis- RFF)	**Nill response**

1) CPM Dredge Material Placement Area Disposal Stakeholder Consultation Information Memorandum

CPM Dredge Material Placement Area
Disposal Stakeholder Consultation Information Memorandum

CITIC Pacific Mining (CPM) is planning to undertake a small-scale dredging operation within the Cape Preston Port which is already approved under Ministerial Statement 635. CPM is preparing a permit application under the *Environment Protection (Sea Dumping) Act 1981* to dispose of dredged material at an offshore Dredge Material Placement Area (DMPA). Information contained within this memorandum is intended to provide stakeholders with an overview of CPM's proposed use of the DMPA, including a summary of the potential environmental impacts of disposal activities. The provision of this information offers an opportunity for stakeholders to provide general comments and/or raise specific concerns regarding the potential environmental impacts. A stakeholder feedback form is provided in Attachment 2.

1. Introduction

1.1. Project history

CPM operates the Sino Iron Project (the Project), which includes the Cape Preston Port where magnetite concentrate is exported. Following a Public Environmental Review (PER), the Minister for the Environment approved the Project under Ministerial Statement 635 (MS635) in October 2003. MS635 conditionally approves the dredging of up to 4.5 Mm^3 and spoil disposed offshore, although the location of the spoil ground was not specified. The PER described potential dredging activities which included dredging for a shipping channel within the port breakwater structure to a small craft harbour.

Shipping operations at the port commenced in December 2013, where the product is loaded either onto a self-contained transhipment shuttle vessel (TSV) or onto one of four barges that transport the product from the loading berth out to larger ocean-going vessel (OGV) moorings offshore. Sedimentation of the Inner Harbour since 2013 has reduced the natural depths depth of -9.0 m to a declared depth of -8.5 m in 2022, resulting in reduced efficiency and presents a navigational hazard. Maintenance dredging is required to return the Inner Harbour to natural depth.

1.2. Proposed activities

CPM is planning to undertake capital dredging to deepen the Berth Pocket and Inner Harbour at the Sino Iron Terminal (SIT) to a target depth of -12 m (-12.5 m Over Dredge) in the Berth Pocket and -9.5 m (-10 m Over Dredge) in the Inner Harbour / Channel to accommodate new vessels with an increased draft, improve port efficiency and reduce risk for harbour vessels. Proposed activities include maintenance dredging to remove accumulated sedimentation. The total volume of dredge material is estimated to be ~36,000 m^3 (Table 1) proposed to be disposed within the DMPA, a proposed spoil ground located within the tenement G08/52 (Figure 1).

Table 1: Planned CPM dredging campaign details

Reference Area	Dredged Depth (m CD)			Dredge Volumes (m3)		
	Nominal (Target)	Actual (Over Dredge)	Mean Dredge Depth Face	Target	Over Dredge	Total
Berth pocket	-12	-12.5	1.73	14,095	7,048	21,143
Inner harbour	-9.5	-10	0.8	4,612	9,894	14,506
Total				18,707	16,942	35,649

The material will be dredged using a backhoe dredge (~1,120 kW and bucket size 8 m^3) and transported to the DMPA via a split hull barge (SHB) with a capacity of ~1,500 tonnes. The program is expected to require 29 cycles to dispose of the dredged material, with works occurring 24/7 over a period of six weeks. Once permits and approvals have been granted, dredging and associated works will be prepared for and carried out opportunistically to avoid the mobilisation of crew and vessels.

A sea dumping permit (SDP) will be sought under the Sea Dumping Act for the disposal of dredged material at the DMPA. A dredge management plan (DMP) is being prepared to support this SDP and will be submitted to the EPA for approval and made publicly available in accordance with MS635.

Figure 1: Location Overview

2. Summary of potential environmental impacts

A summary of the potential environmental impacts associated with disposal at the DMPA for each of the EPA's relevant environmental factors is provided in (Table 2). With appropriate management, the EPA's objectives for all relevant environmental factors are considered to be met. The activities, potential impacts and proposed management measures described in Table 2 were identified through assessing the environmental impacts in the DMP and were conducted through a risk-based approach.

Table 2: Relevant environmental factors and potential impacts of CPM's disposal at the DMPA

Environmental factor	Receiving environment	Pressures from proposed activities	Management, monitoring & mitigation	Impacts[1]
Benthic Communities and Habitats (BCH)	The Cape Preston region's marine habitats consist predominantly of bare sand or sand-veneered low-profile pavement. A comprehensive mapping of the BCH in the region was completed in 2006/2007 (URS 2008). A targeted BCH investigation was conducted for the DMPA by AECOM in November 2023, these results are overlaid onto the BCH map in Appendix A. <u>Filter feeders</u> AECOM (2024a) identified filter feeder communities of >10% cover associated with sand and sand-veneered pavement between the 11-14 m bathymetry to the southeast and southwest of the DMPA. These communities comprised mostly of sponges Gorgonians (sea whips and fans). This habitat may likely be found northeast and southwest of Cape Preston, along the bathymetric contour where sand or sediment-veneered pavement	Smothering of BCH through disposal of dredged material at the DMPA.	Implement a monitoring programs outlined in the Dredge Management Plan (DMP), including: • Pre, during and post-dredging water quality monitoring at three impact sites and three reference sites (map in Appendix B) • Use existing coral monitoring program to derive baseline conditions prior to commencing dredging. Undertake reactive coral monitoring (if necessary) based on whether water quality thresholds were exceeded during or post-dredging activities • Avoid dredging and disposal activities during coral spawning and settlement events (i.e. last week of March and the first week of April)	**Meets EPA Objective** Sediment plume modelling was undertaken (outputs for both summer and winter scenarios were combined and presented in Appendix B). The Zone of High Impact (ZoHI) has been defined to include a 50 m buffer surrounding the DMPA. It is predicted that the BCH present within the ZoHI will incur a direct irreversible loss due to the disposal of dredge material and burial of BCH. This will total 10.2 ha, including: • 7.6 ha of sand • 1.3 ha of unconsolidated sand with filter feeders • 1.3 ha of veneered pavement with filter feeders Impacts to BCH within the ZoHI are not expected to impede long-term survival (e.g. beyond five years), as only a thin layer of sediment has been modelled to remain at the DMPA post-dredging (50 mm of unconfined material).

Environmental factor	Receiving environment	Pressures from proposed activities	Management, monitoring & mitigation	Impacts[1]
	is present. Benthic habitats of the DMPA and remaining surrounding area were typically characterised by bare sand with potential for sparse filter feeders (<10% cover). <u>Coral communities</u> Coral communities form a band associated with 5-10 m bathymetry contours that span to the southwest and east of the port. A thin band of dense and moderate coral coverage occurs directly south, approximately 500 m from the DMPA. Dominating species include *Porites*, *Goniastrea* and *Lobophyllia* spp., which are typical of nearshore mixed assemblages of the Pilbara with intermediate levels of exposure, turbidity and current flow (Blakeway & Radford 2004). <u>Invertebrates</u> A medium level of bioturbation was observed throughout the DMPA (AECOM 2024a). Motile invertebrates, such as echinoderms and gastropods are also present to the east of the DMPA.			The Zone of Moderate Impact (ZoMI) thresholds for BCH were not exceeded beyond the ZoHI. Therefore, indirect impacts to BCH from dredge or disposal generated suspended sediments are not predicted beyond 50 m surrounding the DMPA. The Zone of Influence (ZoI) represents the spatial extent where suspended sediment concentrations (SSCs) may be above background at some time during dredging or disposal activities, but no impacts to BCH are predicted.
Marine Environment Quality (MEQ)	<u>Sediment Quality</u> Sediment sampling was undertaken in at the proposed DMPA and nearby reference locations shown in Appendix C in AECOM (2024b). Sediments were comprised of clean natural sediment, consistent with an	Disposal of contaminated sediments at the DMPA.	Geochemical testing was undertaken on dredge sediments in accordance with the NAGD (CoA 2009) to evaluate the potential for disposal of contaminated sediments at the DMPA. The location of these sampling sites can be seen on the map provided in Appendix C. This included:	**Meets EPA Objective** The dredge area is comprised of sandy sediments with no significant contaminants of concern. The sediment geochemistry of the dredging area showed that sediments are of 'clean' condition and suitable for unconfined disposal. Similar PSD results in both the dredge footprint and the DMPA

Environmental factor	Receiving environment	Pressures from proposed activities	Management, monitoring & mitigation	Impacts[1]
	undisturbed area which has not been used previously for disposal of dredge material. The particle size distribution (PSD) of sediment samples from the proposed DMPA were comprised of sand (68.5%), gravel (29.0%) and a small composition of fines (~3%). Metal concentrations in sediment across DMPA and reference locations were recorded below NAGD (CoA 2009) screening levels. Aluminium, iron and manganese were slightly elevated within the DMPA than compared to reference sites, likely attributable to differences in organic carbon and PSD. No PAHs or TBTs were detected in sampling conducted at nearby reference sites, it is presumed that this is representative of sediment at the DMPA.		• 10 sampling sites in the Inner Harbour and Berth Pocket • 10 sampling sites in the DMPA • 4 reference sites	indicate that the sediment type would not differ significantly from what is currently there.
	<u>Water Quality</u> Water quality near Cape Preston is generally highly turbid due to the episodic high-volume river flows, strong currents, regular wind-driven wave energy, and dominant marine sediment types (Halpern, Glick and Maunsell, 2006). Previous surveys have highlighted that turbidity varies greatly depending on weather conditions and the time of collection with ambient	Changes to the physicochemical properties of the water column as a result of disposal activities.	Implementation of the Marine Water Quality Monitoring Program outlined in the DMP, including: • Pre, during and post-dredging water quality monitoring at three impact sites and three reference sites (map in Appendix B). • Visual monitoring of satellite imagery to verify surface sediment plumes are following the predicted modelling results.	**Meets EPA Objective** Turbidity is likely to increase with the disposal of sediments into the water column. Due to the small scale of this dredging program, modelling predicted the turbidity outside of the area of direct disturbance (ZoHI) is not predicted to exceed the possible effects of BCH thresholds outlined in the EPA's Technical Guidance for environmental impact assessments of marine dredging proposals (EPA 2021).

Environmental factor	Receiving environment	Pressures from proposed activities	Management, monitoring & mitigation	Impacts[1]
	concentrations of total suspended solids (TSS) ranging from 2 to 3 mg/l in 2000, 2.1 to 25.1 mg/l in 2002, less than 5 mg/L to 48.1 mg/L in 2004 and 2 to 10 mg/L in 2007 (Halpern, Glick and Maunsell, 2006; URS, 2008).	Hydrocarbon and/or disposal of waste into the marine environment	Implement the following CPM management plans and procedures: • Bunkering, Bilge, and Sludge Transfer Procedure (CPPC 2024) • Port of Cape Preston Oil Spill Contingency Plan (CPM 2023) • Section 6.5 'Waste Management' in the Operational Environment Plan (CPM 2018)	**Meets EPA Objective** Direct contact with hydrocarbons can harm marine life including birds, fish and invertebrates. Solid and liquid wastes generated during dredging activities have the potential to negatively impact the surrounding environment. Management responses in the unlikely event of a spill would mitigate potential impacts (in addition to preventing spills from occurring)
Marine Fauna	<u>Reptiles (marine turtles and seasnakes)</u> Flatback, green, and hawksbill turtle species use the Cape Preston area for nesting activities. A turtle habitat usage review conducted by Pendoley Environmental (2006) concluded that the beaches of Cape Preston are utilised for a very limited amount of turtle breeding activities. These results suggested the northern end of the western beach is favoured by hawksbill turtles, the eastern beaches favoured by green turtles, and the southwest beaches by flatback turtles. Additionally, nearshore subtidal areas are likely to provide a feeding habitat for the above marine turtles. Cape Preston is a location of biologically important areas (BIAs) for internesting and foraging by flatback turtle's, as well as foraging BIA for green and hawksbill turtles.	Underwater noise, lighting, and vessel strike as a result of vessel movements to and from the DMPA. Hydrocarbon and/or disposal of waste into the marine environment.	Vessel crew trained in marine fauna observations and management actions, including: • Target marine species including behaviour characteristics and common impacts from dredging/disposal activities • Vessel speed restrictions • Marine fauna exclusion zones • Pre-start, soft start-up, shut-down and low-visibility procedures • Trained marine fauna observer (MFO) recording and reporting • Additional management actions as a contingency during ecological windows (i.e. the southern humpback whale migration and turtle nesting/hatching) which include dedicated MFOs Trained MFOs will be onboard each SHB during dredging/disposal activities.	**Meets EPA Objective** The area of disposal activities is not likely to represent a critical habitat for any conservation significant of marine fauna. The risk of death or injury to marine fauna is considered to represent a very low risk provided that management is implemented in accordance with DMP (O2 Marine 2024).

Environmental factor	Receiving environment	Pressures from proposed activities	Management, monitoring & mitigation	Impacts[1]
	The leaf-scaled seasnake is known to be present and the short-nosed seasnake is likely to be present in the vicinity of the disposal site and both species are listed as critically endangered species. <u>Mammals (whales and dolphins)</u> Various mammals listed as Migratory, including dugongs, humpback whales, spotted bottlenose dolphins and the Australian humpback dolphin, are likely to use the Cape Preston area. Humpback whales migrate annually along the WA coast from feeding grounds to calving grounds. The southern migration is the period when they are closest to shore, with the peak occurring between August and September in the Cape Preston region. <u>Fish (sharks, rays and sawfish)</u> The distribution of dwarf and green sawfish species includes the Cape Preston area. They are both listed as Vulnerable and Migratory. Green sawfish were recorded at the mouth of the Fortescue River in 2023, indicating juvenile nursery habitats associated with the river (Morgan et al. 2022). The narrow sawfish is likely to be present and is listed as Migratory. The reef manta ray is listed as Migratory and likely to be present.		Mitigation actions will be aligned to the EPBC Act Policy Statement 2 (DEWHA 2008), including • Shut-down procedures to be implemented within two minutes (or as soon as safely possible) of any target marine species entering the exclusion zone • Dredge material will not be disposed of within the Caution Zone for vessel movement (CoA 2017) Implement hydrocarbon and waste mitigations and management procedures for Water Quality under the Marine Environmental Quality factor.	

Environmental factor	Receiving environment	Pressures from proposed activities	Management, monitoring & mitigation	Impacts[1]
	The scalloped hammerhead and southern bluefin tuna are both likely to be present and are listed as Conservation Dependent.			
	Introduced marine organisms *Didemnum perlucidum* is known to be present at Cape Preston; this species is considered cryptogenic and widespread within Western Australian waters. No management action is required for *Didemnum perlucidum* at Cape Preston as it is monitored by Department of Primary Industries and Regional Development (DPIRD).	Introduced marine organisms translocation from construction or operational vessels.	All vessels arriving will comply with CPM's Ballast Water and Biofouling Management Plan (GHD 2009) which ensures: • The AQIS ballast water requirements are met for vessels arriving from overseas • The objectives of the National System for the Prevention and Management of Marine Pest Incursions • Australian National Biofouling Guidelines will be adhered to • Before mobilisation to Cape Preston, vessels assessed as posing a risk should be inspected to ensure they are free of biofouling and dry-docked if needed for cleaning and repair/renewal of the antifouling system. DPIRD will continue monitoring for IMP at Cape Preston Port.	**Meets EPA Objective** There is considered to be no pathway for *Didemnum perlucidum* to become established at the DMPA as the dredged material, both before and following placement at the DMPA, does not represent a suitable substrate for the colonisation, or survival, of the species. The risk for the establishment of a new IMP is low with CPM management implemented.
Social Surrounds	Nearby public camping and boat launching access at the mouth of the Fortescue River (~20 km southwest of Cape Preston) and 40 Mile Beach (~15 km east of Cape Preston).	Disruption to recreational use of marine waters surrounding Cape Preston.	A temporary marine notice to mariners will be issued to the Department of Transport prior to dredging and disposal commencing identifying the works being undertaken.	**Meets EPA Objective** Low utilisation of near Port waters by the public. Small spatial area and short-term activities. DMPA within mining lease boundary.

Environmental factor	Receiving environment	Pressures from proposed activities	Management, monitoring & mitigation	Impacts[1]
	Potential for area to be utilised for transient commercial fishing or other commercial activities.			

[1] Potential environmental impacts have been determined in consideration of relevant EPA policy and guidance documents for each environmental factor.

3. Supplementary information

The information contained within the CPM Dredge Material Placement Area – Stakeholder Consultation Disposal Information Memorandum is intended to provide stakeholders with an overview of CPM's disposal activities associated with their upcoming dredging campaign and the potential environmental impacts.

Should you wish to review elements of the work covered under the potential environmental impacts in greater detail please contact Harley Barron to arrange supply of supplementary information.

Contact details for Harley Barron is provided below:

Harley Barron

Manager – Environment

(08) 9226 8398

Harley.Barron@citicpacificmining.com

4. References

AECOM (2024a). Benthic Habitat Characterisation Report [Report to Sino Iron Ore Project for Citic Pacific Mining Pty Ltd].

AECOM. (2024b). Sampling Analysis Plan Implementation Report—November 2023 [Report to Sino Iron Ore Project for Citic Pacific Mining Pty Ltd].

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Morgan D, Krispyn K, Fazeldean T, Tweedley J, K Lear (2022), Survey of the Fishes of the Fortescue River Estuary, Western Australia 2022. [Prepared for O2 Marine Pty Ltd].

O2 Marine (2024) Dredge Management Plan (DMP). [Prepared for Sino Iron Ore Project for Citic Pacific Mining Pty Ltd].

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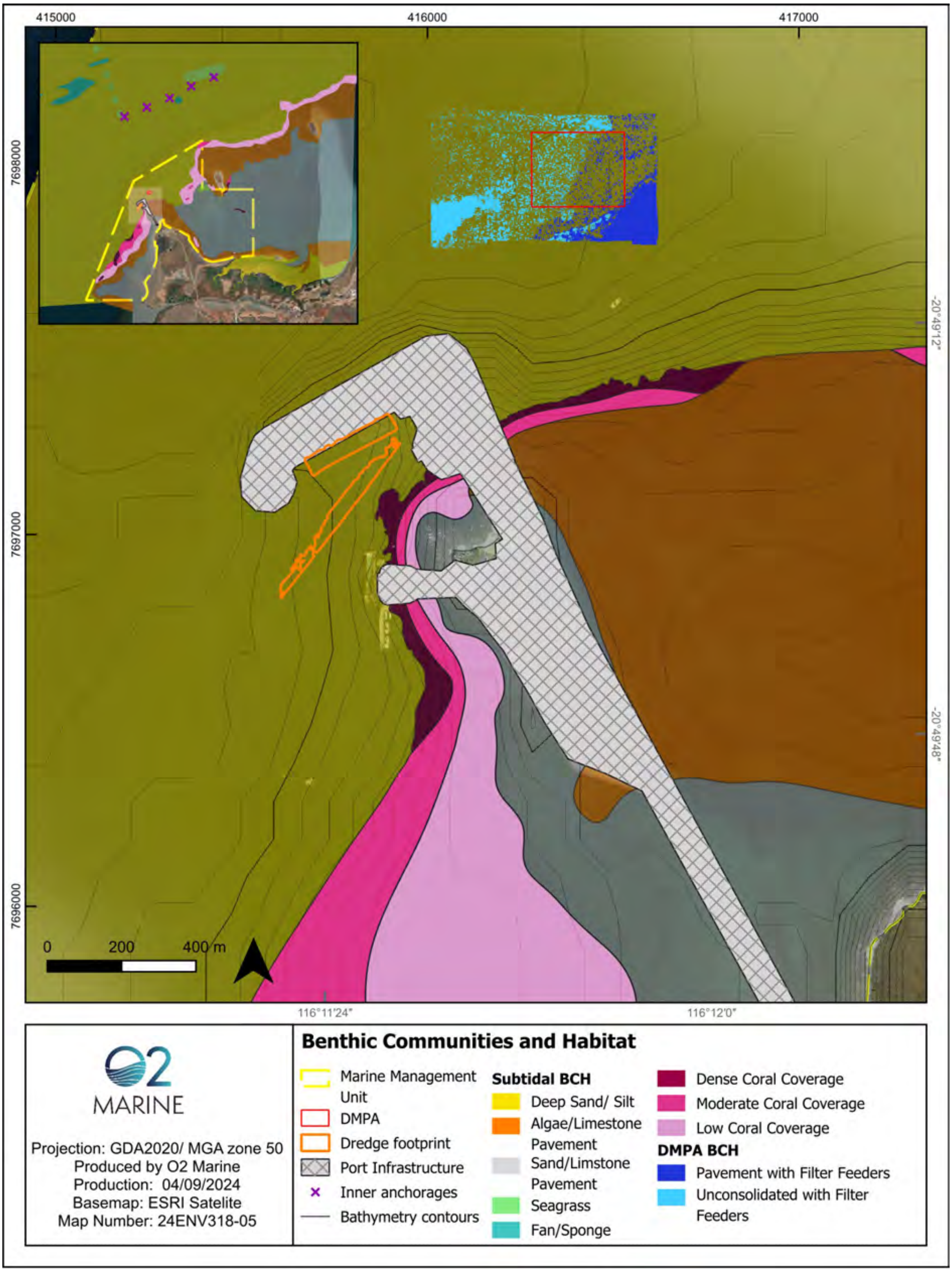
Wells FE, McDonald JI, Huisman JM (2009). Introduced Marine Species in Western Australia. Western Australian Department of Fisheries, Occasional Publications 57:1-97

Appendix A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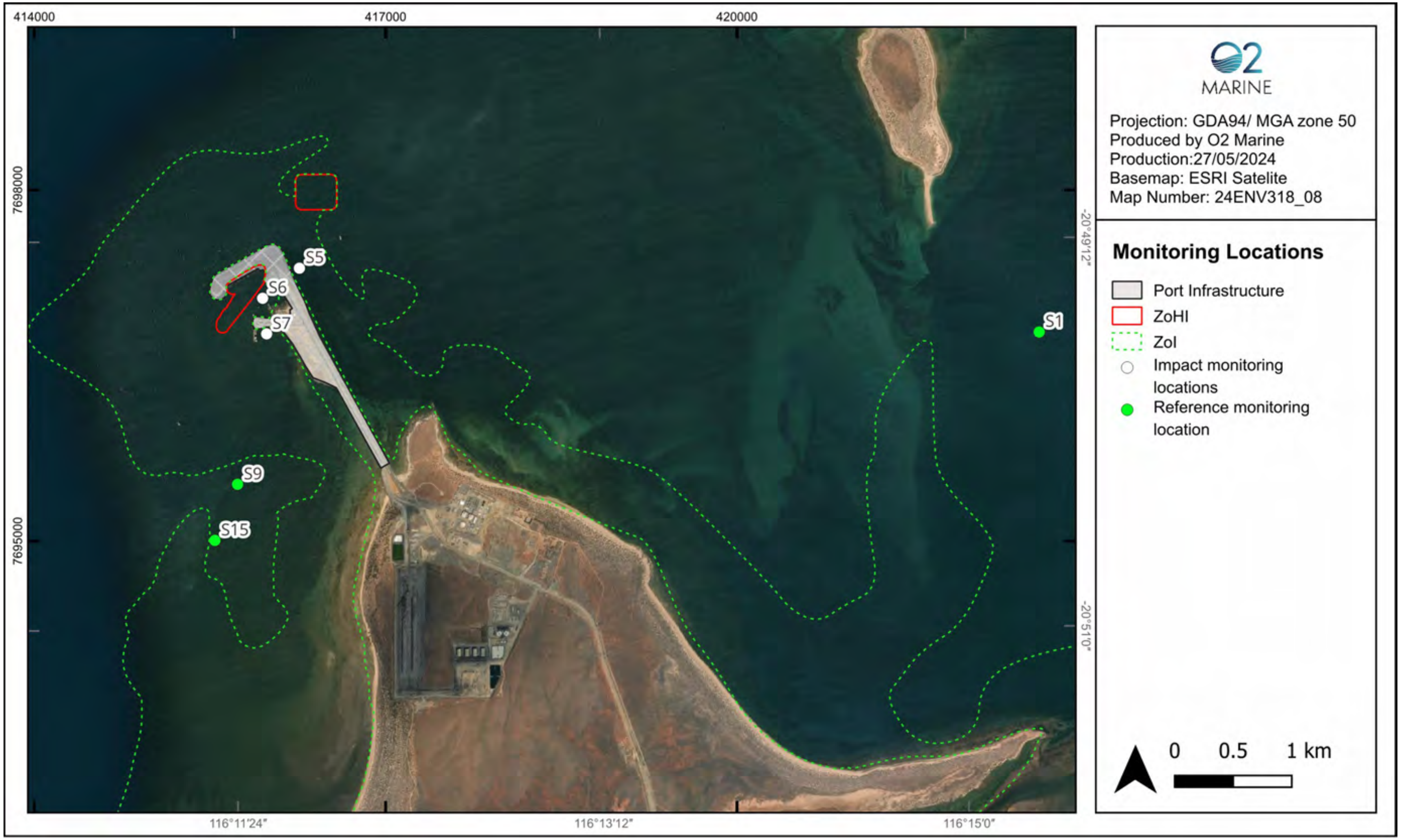
MARINE
Projection: GDA2020/ MGA zone 50
Produced by O2 Marine
Production: 04/09/2024
Basemap: ESRI Satelite
Map Number: 24ENV318-05
Benthic Communities and Habitat
Marine Management Unit
DMPA
Dredge footprint
Port Infrastructure
Inner anchorages
Bathymetry contours
Subtidal BCH
Deep Sand/ Silt
Algae/Limestone Pavement
Sand/Limstone Pavement
Seagrass
Fan/Sponge
Dense Coral Coverage
Moderate Coral Coverage
Low Coral Coverage
DMPA BCH
Pavement with Filter Feeders
Unconsolidated with Filter Feeders

Appendix B



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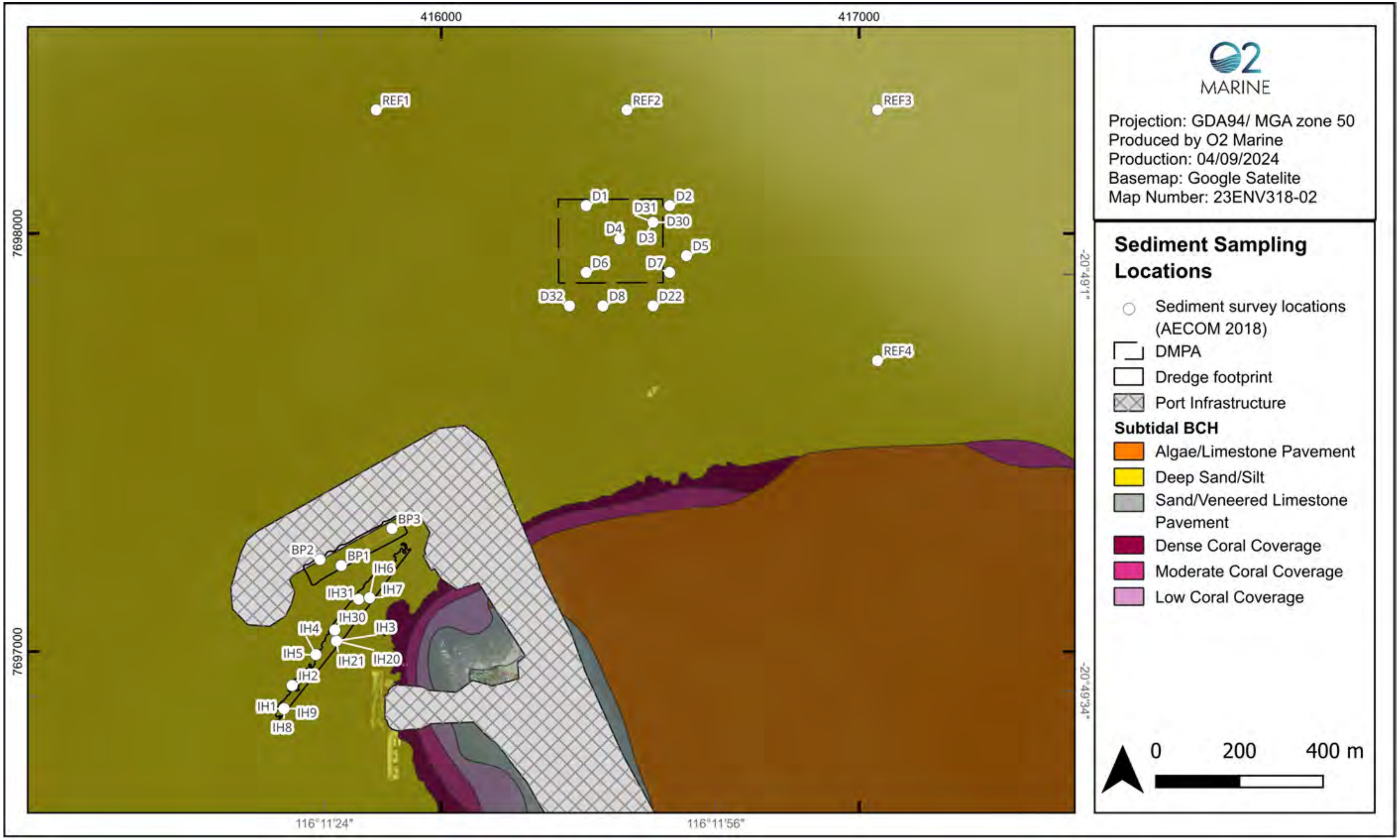
S9
S15
O2 MARINE
Projection: GDA94/ MGA zone 50
Produced by O2 Marine
Production:27/05/2024
Basemap: ESRI Satelite
Map Number: 24ENV318_08
Monitoring Locations
Port Infrastructure
ZoHI
ZoI
Impact monitoring locations
Reference monitoring location
0 0.5 1 km

Appendix C



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REF1
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REF4
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D31
D30
D4
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D5
D6
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D32
D8
D22
BP3
BP2
BP1
IH6
IH31
IH7
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IH4
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IH21
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IH2
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IH9
IH8
O2 MARINE
Projection: GDA94/ MGA zone 50
Produced by O2 Marine
Production: 04/09/2024
Basemap: Google Satelite
Map Number: 23ENV318-02
Sediment Sampling Locations
Sediment survey locations (AECOM 2018)
DMPA
Dredge footprint
Port Infrastructure
Subtidal BCH
Algae/Limestone Pavement
Deep Sand/Silt
Sand/Veneered Limestone Pavement
Dense Coral Coverage
Moderate Coral Coverage
Low Coral Coverage
0
200
400 m

Attachment 2 – Stakeholder Feedback Form

Organisation:		**Name:**	
Phone:		**Email:**	
Do you have any comments/concerns regarding the location of the proposed Dredge Material Placement Area (DMPA)?			
Do you have any comments/concerns regarding the potential environmental impacts of using the DMPA as a spoil ground?			
Do you require any additional information regarding the dredging program, or environmental studies undertaken to support approvals? If so, please list below. If a meeting is required, please advise.			
Do you wish to receive updates on the dredging program? (Yes/No) If yes, please provide email address.			

Stakeholder feedback forms should be completed and emailed to Harley.Barron@citicpacificmining.com ***no later than Close of Business on Monday 25 October 2024.***

2) Maxima Pearling Company (Steven Gill) - Stakeholder Feedback Form

O2 MARINE

Attachment 2 – Stakeholder Feedback Form

Organisation:	Maxima Pearling Company	**Name:**	Steven Gill
Phone:	0488698875	**Email:**	steven.gill@maximaopportunity.com.au
Do you have any comments/concerns regarding the location of the proposed Dredge Material Placement Area (DMPA)?			
We are a pearling and aquaculture company that operates in the Pilbara and Kimberley of WA. Pearling operations are sensitive to any environmental change. As such we are concerned about the potential of the dredging program to impact pearl quality at our lease sites in Flying Foam Passage.			
Do you have any comments/concerns regarding the potential environmental impacts of using the DMPA as a spoil ground?			
Our concerns relate to the broader environmental impact and the potential of fine material to remain suspended and be carried to the region of our pearl farm and impact the quality of pearls and also the potential impact on pearl oyster meat quality and saleability. The WA shellfish quality assurance programm requires heavy metal testing and oysters can bioaccumulate.			
Do you require any additional information regarding the dredging program, or environmental studies undertaken to support approvals? If so, please list below. If a meeting is required, please advise.			
THe documents do not provide any indication of the hydrodynamics or the area and the likely dispersal patterns of fine dredge material. Has there been any core sampling of the dredge material to document the heavy metal content of the spoils and its dispersal pattern?.			
Do you wish to receive updates on the dredging program? (Yes/No) If yes, please provide email address.			
yes we require data on the content of the dredge spoil and its dispersal patterns from the dump site.			

Stakeholder feedback forms should be completed and emailed to Harley.Barron@citicpacificmining.com ***no later than Close of Business on Monday 25 October 2024.***

3) CPM response to Maxima Pearling Company (Steven Gill) - Stakeholder Feedback Form

CPM Ref: ENVDR-1084915769-4355

18 October 2024

Attention: Steven Gill, General Manager
Steven.gill@maximaopportunity.com.au

Maxima Opportunity Group
PO Box 8311
SUBIACO, 6008

Dear Steven,

Stakeholder Consultation to support a Sea Dumping Permit Application

Thank you for your enquiries regarding CITIC Pacific Mining's planned dredging program at Cape Preston Port. We understand your concerns about the potential effects on your pearling operations in the Flying Foam Passage, Dampier Archipelago.

In 2003, CITIC Pacific Mining (CPM) received environmental approval to dredge 4.5 million cubic metres, including offshore disposal, for the construction of Cape Preston Port. To date, no dredging has occurred. The current proposed dredge volume is approximately 36,000 cubic metres—less than 1% of the originally approved amount.

As discussed during our phone call, CPM has already submitted a Dredge Management Plan to the Western Australian Environmental Protection Authority for approval. This consultation relates to CPM's application for a Sea Dumping Permit from the Commonwealth Department of Climate Change, Energy, the Environment and Water.

To assist with the approval process CPM engaged specialist environmental consulting companies to carry out sediment analyses and sediment transport modelling under different seasonal conditions, including summer and winter. As requested, we have attached two maps produced by our consultants showing the modelled maximum extent of the Zone of High Impact (ZoHI) and the Zone of Influence (ZoI) for the summer and winter models. The assessment of impact is aligned with WA *EPA's Technical Guidance for Environmental Impact Assessment of Marine Dredging Proposals*. In the guidance the ZoHI refers to areas where significant damage to benthic communities is predicted, or where impacts are considered irreversible. This typically includes areas within and immediately adjacent to the dredging and disposal sites where direct removal or smothering of substrate occurs. The ZoI refers to areas where changes in environmental quality are anticipated during dredging, but where these changes are not expected to have a detectable impact on benthic communities.

The results show that in summer, the ZOI (elevated sediment concentrations) would extend south along a stretch of mainland for up to 20 km and extend north-east along the coastline up to 14 km from the Port, whereas in winter, it would only extend south for up to 20 km. The ZoHI is significantly more constrained and is essentially the area being dredged and the disposal site.

We have also conducted testing of the material to be dredged for heavy metals, including arsenic and cadmium. These tests show that the sediments are clean (as defined by the National Assessment Guidelines for Dredging 2009). No elevated cadmium levels were found in all tested sediment samples. Although arsenic levels in the nearshore area around Cape Preston are higher than the Default Guideline Values in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (available at www.waterquality.gov.au/anz-guidelines), these elevated levels are attributed to naturally occurring background arsenic concentrations from local geological sources, such as weathering of bedrock in the catchment. All other measured parameters, including tributyltin, polycyclic aromatic hydrocarbons, and total metals, were below the Default Guideline Values.

To summarise the impact assessment, the area that is identified as the ZoI where changes in environmental quality associated with dredge plumes are predicted and anticipated during the dredging operations, changes would not result in a detectible impact on benthic biota (e.g. a reduction in biomass). Furthermore, the dredge area is comprised of sandy sediments with no significant contaminants of concern. The sediment geochemistry of the dredging area showed that sediments are of 'clean' condition and suitable for unconfined disposal. Similar sediment sampling results in both the dredge footprint and the Dredge Material Placement Area indicate that the sediment type would not differ significantly from what is currently there.

As discussed over the phone, your lease site between Angel and Dolphin Islands in the Dampier Archipelago is approximately 75 kilometres northeast of the Cape Preston Port. Due to this distance, the location and the modelled extend of the dredge plume, no impacts from the dredging activities are anticipated in your area.

We hope this additional information addressed your concerns. Please feel free to contact us if you have any further questions. As requested, please find attached tables that show sediment analysis results and relevant plume extension maps.

If you have any further queries regarding the enclosed information, please contact Harley Barron directly on (08) 9226 8398 or email Harley.barron@citicpacificmining.com.

Yours sincerely

Harley Barron
Manager – Environment
CITIC Pacific Mining Management Pty Ltd

ENC Attachment 1 – Dredge impact summer scenario
Attachment 2 – Dredge impact winter scenario
Attachment 3 – Sediment Analysis Table

Figure 6: Summer sediment plume modelling

Figure 7: Winter sediment plume modelling

Attachment - Sediment Analysis Results

Table 1 Summary Statistics (Metals, mg/kg) - Inner Harbour and Berth Pocket

	Screening Values			Observed Values			
Metal	SQGV[1] (NAGD 2009)	SQGV High (NAGD 2009)	80th Percentile	Minimum	Maximum	Median	95%UCL[2]
Aluminium	NG	NG	4,530	1,510	3,620	1,790	2,170.4
Antimony	2	25	-	<0.5	<0.5	<0.5	-
Arsenic	20	70	16.7	17.1	**27.8**	**20.45**	**22.54**
Cadmium	1.5	10	-	<0.1	<0.1	<0.1	-
Chromium	80	370	25.1	9.1	19.8	10.60	12.2
Cobalt	NG	NG	4.7	2	4.4	2.25	2.8
Copper	65	270	5.4	1.3	7.7	1.90	3.1
Iron	NG	NG	15,100	8,840	**20,600**	10,800	13,537.6
Lead	50	220	3.0	1.4	2.4	1.60	1.8
Manganese	NG	NG	196	143	**258**	191	212.6
Mercury	0.15	1	-	<0.01	<0.01	<0.01	-
Nickel	21	52	9.8	2.7	8.7	3.35	4.4
Selenium	NG	NG	0.2	0.1	0.2	0.10	0.17
Silver	1	4	-	<0.1	<0.1	<0.1	-
Vanadium	NG	NG	26.2	20.4	**28.1**	22.60	24.3
Zinc	200	410	10.5	3	30	4.20	9.3

1: Reference in the NADG to the interim sediment quality guidelines (ISQG) has been superseded by the revised sediment quality guidelines (2013) and form the basis of applicable threshold levels as directed

2: Where results were reported as less than the laboratory practical quantitation limit (PQL), results were noted as half the PQL

Key

NG No guideline

BOLD Exceeds the NAGD (2009) Screening Level (ISQG Low) or 80th percentile of reference site concentrations.

BOLD Exceeds the NAGD (2009) Screening Level (ISQG High)

Table 2 Summary Statistics (Metals, mg/kg) Dredged Material Placement Area and Reference Locations

Metal	SQGV[1] (NAGD 2009)	SQGV High (NAGD 2009)	Minimum	Maximum	Mean	95%UCL[2]
Aluminium	NG	NG	2350	4790	4012.5	4340
Iron	NG	NG	8200	15600	13687.5	14626
Antimony	2	25	<0.5	<0.5	<0.5	-
Arsenic	20	70	13.9	19.2	15.8	16.38
Cadmium	1.5	10	<0.1	<0.1	<0.1	-
Chromium	80	370	16.8	26.7	22.7	24
Copper	65	270	2.4	6	4.6	5.05
Lead	50	220	1.8	3.2	2.7	2.86
Manganese	NG	NG	138	203	176.4	185.6
Nickel	21	52	5.6	10.4	8.6	9.23
Silver	1	4	<0.1	<0.1	<0.1	-
Zinc	200	410	5.2	11.6	8.8	9.59
Mercury	0.15	1	<0.01	<0.01	<0.01	-

1: Reference in the NADG to the interim sediment quality guidelines (ISQG) has been superseded by the revised sediment quality guidelines (2013) and form the basis of applicable threshold levels as directed

2: Where results were reported as less than the laboratory practical quantitation limit (PQL), results were noted as half the PQL

Key

NG No guideline

BOLD Exceeds the NAGD (2009) Screening Level (ISQG Low).

BOLD Exceeds the NAGD (2009) Screening Level (ISQG High)

4) CofK response to CPM

From: Harley Barron
To: Brendan White; Oliver Krumholz
Subject: FW: ENVDR-1084915769-4343 LTR2024.10.02 CPM to City of Karratha Stakeholder Consultation to Support SDP Application
Date: Wednesday, 16 October 2024 12:49:52 PM
Attachments: image001.png
LTR2024.10.02 CPM to City of Karratha Stakeholder Consultation to Support SDP Application.pdf

---

Gents, good news from CofK.

Regards,

Harley Barron
T (08) 9226 8398 | M 0409 685 147
Advanced leave notice:

From: Clair Morrison <clair.morrison@karratha.wa.gov.au>
Sent: Wednesday, October 16, 2024 12:45 PM
To: Harley Barron <Harley.Barron@citicpacificmining.com>
Subject: ENVDR-1084915769-4343 LTR2024.10.02 CPM to City of Karratha Stakeholder Consultation to Support SDP Application

Good afternoon,

[LM24173] ENVDR-1084915769-4343 LTR2024.10.02 CPM TO CITY OF KARRATHA STAKEHOLDER CONSULTATION TO SUPPORT SDP APPLICATION

Thank you for your email dated 2 October 2024 relating to CITIC Pacific Mining's proposed capital dredging programme.

The City has reviewed the attached information and have no comments on the proposed works.

If you have any questions or would like to discuss further, please do not hesitate to get in touch.

Kind regards,

Clair Morrison
Senior Strategic Planner

Direct: (08) 9186 8574
Email: clair.morrison@karratha.wa.gov.au
Tel: (08) 9186 8555
www.karratha.wa.gov.au

The City of Karratha acknowledges the Ngarluma people as the Traditional Owners of the land on which we live and work.
We pay our respect to Aboriginal and Torres Strait Islander cultures; and to Elders past and present.

From: Emma Rayson <Emma.Rayson@citicpacificmining.com> **On Behalf Of** HSE admin
Sent: Wednesday, October 2, 2024 3:53 PM
To: Public Enquiries <enquiries@karratha.wa.gov.au>
Cc: HSE admin <HSEadmin@citicpacificmining.com>; Harley Barron <Harley.Barron@citicpacificmining.com>
Subject: ENVDR-1084915769-4343 LTR2024.10.02 CPM to City of Karratha Stakeholder Consultation to Support SDP Application

Attention: Development Services Department

Please find attached CPM letter (ENVDR-1084915769-4343) together with attachments, seeking feedback on CITIC Pacific Mining's proposed capital dredging programme.

Please note that feedback is required by close of business Wednesday 16th October 2024.

Kind regards,

HSE Admin | CITIC Pacific Mining | Sino Iron project
T (08) 9178 3342 **| E** HSEadmin@citicpacificmining.com

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5) DBCA response to CPM

From:	Harley Taylor
To:	Brendan White; Emma Rayson
Cc:	Harley Barron; David Pickles; Luke Porter
Subject:	FW: ENVDR-1084915769-4345 LTR2024.10.02 CPM to DBCA Stakeholder Consultation to Support SDP Application
Date:	Monday, 14 October 2024 12:52:56 PM
Attachments:	LTR2024.10.02 CPM to DBCA Stakeholder Consultation to Support SDP Application.pdf CPM proposed dredging consultation.msg

Hi Brendan,

Thank you for contacting the Department of Biodiversity, Conservation and Attractions (DBCA) seeking review and comment on the proposed dredging associated with the Cape Preston Port.

As discussed on Friday, given that the Dredge Management Plan is regulated under the *Environmental Protection Act 1986*, DBCA would typically provide advice to the regulator, in this instance DWER, rather than the proponent.

DBCA's advice is pursuant to the department's legislative responsibilities, namely the *Conservation and Land Management Act 1984* and the *Biodiversity Conservation Act 2016*.

I've contacted Nathan Sumner at DWER, who will seek advice from DBCA where appropriate.

Kind Regards,

Harley Taylor
A/Principal Environmental Officer (North)
Environmental Management Branch| Parks & Wildlife Service
Department of Biodiversity, Conservation and Attractions
☎(08) 9219 9520

From: Emma Rayson <Emma.Rayson@citicpacificmining.com> **On Behalf Of** HSE admin
Sent: Wednesday, October 2, 2024 3:54 PM
To: EMBAdmin <EMBadmin@dbca.wa.gov.au>
Cc: HSE admin <HSEadmin@citicpacificmining.com>; Harley Barron <Harley.Barron@citicpacificmining.com>
Subject: ENVDR-1084915769-4345 LTR2024.10.02 CPM to DBCA Stakeholder Consultation to Support SDP Application

Attention: Michelle Corbellini, Manager – Environmental Management Branch

Please find attached CPM letter (ENVDR-1084915769-4345) together with attachments, seeking feedback on CITIC Pacific Mining's proposed capital dredging programme.

Please note that feedback is required by close of business Wednesday 16th October 2024.

Kind regards,

HSE Admin | CITIC Pacific Mining | Sino Iron project
T (08) 9178 3342 **| E** HSEadmin@citicpacificmining.com

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6) DoT response to CPM

From:	Wenban, Steven
To:	Harley Barron; Harbour Master
Cc:	HSE admin; Brendan White; Oliver Krumholz
Subject:	RE: ENVDR-1084915769-4344 - LTR2024.10.02 CPM to DOT Stakeholder Consultation to Support SDP Application
Date:	Monday, 4 November 2024 10:53:18 AM
Attachments:	image001.jpg

Harley, thanks for this email.

DoT does not object to the sea dumping permit process being initiated with the Commonwealth and we will continue to work with the CPPC and other Cape Preston port stakeholders in regards to safe port operations, including dredging operations whenever required to maintain a desired depth.

Many thank and best regards

Steven Wenban

Capt. Steven Wenban
Director Maritime Environmental Emergencies Response (MEER) & Ports | Maritime | Department of Transport
5 Newman Court, Fremantle WA 6160
Tel: (08) 92168209 | Mob: 0457 562 622
Email: Steven.Wenban@transport.wa.gov.au | Web: www.transport.wa.gov.au

From: Harley Barron <Harley.Barron@citicpacificmining.com>
Sent: Monday, 4 November 2024 10:45 AM
To: Wenban, Steven <Steven.Wenban@transport.wa.gov.au>
Cc: HSE admin <HSEadmin@citicpacificmining.com>; Brendan White <Brendan.White@citicpacificmining.com>; Oliver Krumholz <Oliver.Krumholz@citicpacificmining.com>
Subject: RE: ENVDR-1084915769-4344 - LTR2024.10.02 CPM to DOT Stakeholder Consultation to Support SDP Application

Hi Steve,

I am writing to let you know that CITIC Pacific Mining is in the process of wrapping up the stakeholder consultation process for the Sea Dumping Permit application.

When you spoke with Brendan White on October 11 you indicated that there were no concerns provided all regulatory permitting requirements are met. CITIC Pacific Mining and Cape Preston Port Company will ensure that all the necessary permits are in place prior to undertaking any dredging activities.

I would greatly appreciate it if you could respond to this email acknowledging Department of Transport's position on CPM's Sea Dumping Permit application.

Regards,

Harley Barron
T (08) 9226 8398 | M 0409 685 147
Advanced leave notice:

From: Emma Rayson <Emma.Rayson@citicpacificmining.com> **On Behalf Of** HSE admin
Sent: Wednesday, 2 October 2024 4:00 PM
To: Steven.Wenban@transport.wa.gov.au
Cc: HSE admin <HSEadmin@citicpacificmining.com>; Harley Barron <Harley.Barron@citicpacificmining.com>
Subject: ENVDR-1084915769-4344 - LTR2024.10.02 CPM to DOT Stakeholder Consultation to Support SDP Application

Attention: Steven Wenban, Director Maritime Environmental Emergencies Response

Please find attached CPM letter (ENVDR-1084915769-4344) together with attachments, seeking feedback on CITIC Pacific Mining's proposed capital dredging programme.

Please note that feedback is required by close of business Wednesday 16th October 2024.

Kind regards,

HSE Admin | CITIC Pacific Mining | Sino Iron project
T (08) 9178 3342 **| E** HSEadmin@citicpacificmining.com

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7) DPIRD - Stakeholder Feedback Form

Attachment 2 – Stakeholder Feedback Form

Organisation:	Department of Primary Industries and Regional Development (DPIRD)	Name:	Linda Wiberg and Mark Pagano
Phone:	08 6551 4338	Email:	environment@dpird.wa.gov.au Linda.Wiberg@dpird.wa.gov.au

Do you have any comments/concerns regarding the location of the proposed Dredge Material Placement Area (DMPA)?

Thank you for the opportunity to provide comment and for extending the consultation period to 1 November 2024. DPIRD consider itself a relevant stakeholder in relation to this proposal.

DPIRD has concerns in relation to the location of the proposed DMPA as the dredging and sea dumping activities which may have substantial negative effects due to: increased turbidity, sedimentation, reduced dissolved oxygen and water quality, release of contaminants and spills, change in sediment profiles, plus an increased risk of introduced pest species or diseases associated with the increasing vessel movements. Risks to fish and fish resources include the potential alteration or loss of benthic habitat and associated nursery/recruitment areas, change of movements and migrations for marine species, loss of fisheries productivity, impact and disruption to commercial, recreational and customary fishing sectors.

The stakeholder consultation memorandum from CITIC Pacific Mining (CPM) lacks detail about the proposed activity, potential impacts and whether the currently identified DMPA site proposed by the CPM effectively mitigates and minimizes environmental impacts. DPIRD notes that whilst the location of dredge spoils is not defined under Ministerial Statement 0635 (MS), that under Attachment 1 dredging is to be "disposed offshore". The proposed DMPA appears to be in close proximity to the coast and existing Port infrastructure, based on the information provided the location appears to be located in nearshore rather than "offshore" waters.

DPIRD would like to seek clarity around the potential disturbance areas, type of material to be dumped and given the time that has lapsed since the original approval from the EPA in 2003 (which excluded details on the offshore disposal location); DPIRD requests CPM fully demonstrates consideration and application of measures to mitigate and minimize impacts on fisheries, fish resources and the aquatic environment and that these are incorporated in the proposal. This includes impacts from the activity on fishing interests that may be affected, as well as consideration to mitigating impacts on crucial nursery habitats and early life stages (i.e. fish eggs and larvae) which are essential to the sustainability of the fish resources, in line with current 2024 standards.

DPIRD notes that since the initial approval considerable additional development has been undertaken in the area, including adjacent solar salt projects, with these and additional pressures now on the environment and fauna in the area DPIRD would like the EPA to consider the cumulative impacts from the combined activities that are causing increased pressures on the aquatic environment and fish resources in the area. DPIRD also recommends that consideration be given under the relevant legislation with regards to the appropriateness of an amendment to existing approvals or whether this should fall under a new assessment given it has been more than 20 years since the original permit was granted. The scale of the project is also to be considered in the context a holistic view and cumulative impacts on the environment in the region. DPIRD notes that the proposed DMPA is relatively close to shore and would like the proponent to consider both a location that minimizes impacts on productive benthic communities and habitats, as well as a long-term solution. Whilst the currently proposed DMPA may provide a cost-effective option in the short term, due consideration should be given to finding a long-term solution that assists in ensuring that any dumped material does not reaccumulate with ongoing dredging requirements. Alternatively, DPIRD would recommend that a DMPA is located further offshore to minimize negative impacts on coastal areas and critical habitats and recruitment/nursery processes for fish resources. In addition, its noted that the memorandum fails to identify teleost fish species and other fish resources in the Table 2. Both the table and the associated maps should also be including comprehensive detail about the Benthic Communities and Habitats, such as for example macroalgal communities.

The Pilbara Demersal Scalefish Fisheries (PDSF) operate over a larger area in the offshore waters of the Pilbara region (> 30 m, see proximity to southern boundary in Fig. 2), with the nearshore habitats along the adjacent coastline representing important areas for recruitment of certain highly valued commercial and recreational species. Most notably, a sargassum macro algal complex has been identified as an exclusive habitat for the recruitment of the Bluespotted Emperor (*Lethrinus punctulatus*). The distribution and abundance of this endemic species to northwestern Australia is limited relative to the occurrence of this habitat for juvenile recruitment (Candland 2016; Taylor 2016; Moustaka et al. 2024; DPIRD unpub.), with markedly higher abundances of this species occurring in the western Pilbara, predominantly due to the relatively higher abundance of nearshore islands and essentially year-round persistence of sargassum around them and along the coastline areas (DPIRD unpub.). This species has the highest commercial catches among the suite of over 60 retained species in the PDSF. Although Cape Preston represents a localized nearshore area within this western Pilbara region, there are numerous developments along this shoreline that combined may pose a potential risk to this macro algal habitat and subsequent recruitment of this, and potentially other, demersal species, and thus should be assessed to determine the overall cumulative impacts. Current ongoing monitoring programs conducted by the DPIRD for the recruitment of Bluespotted Emperor involve two research surveys in the nearshore waters of the western Pilbara region. The longest running of these research surveys commenced in 2015 and monitors the biannual recruitment of this species at reference sites located in the Dampier Archipelago; the second survey has investigated the juvenile abundances of Bluespotted Emperor relative to sargassum habitat densities around the Mardie-Preston-Eramurra area over the last two years (see Figs 1-3).

From the information provided by O2 Marine on the potential environmental impacts (i.e., summarized in Section 2), the assessment of the Fish component of the Marine Fauna excludes any information on the teleost communities. More importantly, there is no information provided on the early life stages (i.e., eggs, larvae, juveniles) of important fisheries species that occur in this nearshore region, which is typically the period when these species are most vulnerable. Further, although the mapping of the Benthic Communities and Habitats (BCH) has identified an 'Algae/Limestone Pavement' category (Appendix A & C), which would be synonymous with the exclusive habitats identified for the recruitment of Bluespotted Emperor, this habitat has not been mentioned in the summary of the environmental impacts (i.e., Section 2). Although the location of the proposed DMPA appears to be ~400 m from the algae habitat (Appendix C), there is a considerable area of this algae habitat within the Zone of Influence (ZoI), which is suspected to be impacted by suspended sediment concentrations (SSCs) during dredging and disposal activities. SSCs have the potential to reduce light availability to algae and hence impact coverage and density of this habitat and thus reduce abundances of the associated teleost fauna that exclusively relies on it for recruitment (e.g., juvenile Bluespotted Emperor). Further, SSCs exposure at relatively low concentrations for short periods is known to have a lethal impact on fish larvae (Partridge & Michael, 2010). Based on Bluespotted Emperor recruitment surveys conducted by DPIRD, it is concerning that there are considerable numbers of juveniles that recruit to and settle within the sargassum algal habitats within the area designated as ZoI around Cape Preston (Figs 2 and 3).

References

Candland, L. 2016. Baited remote underwater stereo-video: an effective sampling tool for identifying juvenile fish-habitat and depth relationships in the Dampier Archipelago, Western Australia. [Masters Thesis] The University of Western Australia, 61 pp.

Moustaka, M., Robbins, W.D., Wilson, S.K., Wakefield, C.B., Cuttler, M.V.W., O'Leary, M.J., & Evans, R.D. 2024. Seascape effects on the nursery function of macroalgal habitats. Marine Environmental Research (202), doi.org/10.1016/j.marenvres.2024.106767

Partridge, G.J., & Michael, R.J. 2010. Direct and indirect effects of simulated caclcareous dredge material on eggs and larvae of pink snapper *Pagrus auratus*. Journal of Fish Biology (77), 227-240.

Taylor, M.D. 2016. Ontogenetic shifts in commercially important short-lived indicator species of the Pilbara, Western Australia. [Masters Thesis] The University of Western Australia, 76 pp.

Do you have any comments/concerns regarding the potential environmental impacts of using the DMPA as a spoil ground?

DPIRD recommends that full consideration of the impacts on all fisheries and fish resources are identified, so that consideration can be given in relation to the impacts and mitigation measures, should the activity be granted. Commercial fisheries in the area include: Pilbara Demersal Scalefish Resource or Pilbara Fish Trawl Interim Managed Fishery, Pilbara Trap Managed Fishery, Pilbara Line Fisheries; Marine Aquarium Fish Managed Fishery, Mackerel Managed Fishery, Pilbara Crab Managed Fishery, Hermit Crab and Specimen Shell Fishery. There may also be interest for exploratory Beach-de-Mer fishing. For the recreational sector the nearby 40 mile is a very popular location for fishing and spearfishing. Boat based recreational fishers target demersal and pelagic species (i.e., Red Emperor, Bluespotted Emperor, Blue lined Emperor and Saddletail snapper, Blackspot Tuskfish, Coral Trout, Mackerel, Trevally, Queenfish and Tuna species). Shore based recreational fishing for nearshore and estuarine species includes targeting of Goldspotted (Estuary) and Blackspotted (Malabar) Cod, Barramundi, Threadfin, Mangrove Jack, Spanish flag, Yellowfin Whiting, Black Bream, as well as cast netting for Mullet. Other popular recreational fishing activities include drop netting for Blue Swimmer crabs and hooking Mud Crabs, as well as targeting Squid and Rock Lobster. Customary fishing is undertaken by Yaburara, Mardudhunera, Ngarluma, Yindjibanri Traditional Owners including around 40 mile and Mardie area shore fishing such as for Mullet and Garfish, as well as spearfishing for demersal species.

The proposed area and area that will potentially be impacted includes a range of benthic habitats including macroalgae, corals, sponges, mangroves and mudflats. As stated above, there is a large area of sargassum macro algal habitat that occurs around Cape Preston and within the ZoI, which is utilized exclusively by juvenile Bluespotted Emperor for recruitment, which is predicted to be impacted by suspended sediment concentrations (SSCs), which is concerning. Bluespotted emperor have a protracted spawning period over ten months of the year from mid-winter to mid-autumn (i.e., July to April), with juveniles recorded in the nearshore sargassum habitat year-round for up to their first 2 years of life (DPIRD unpub.).

Do you require any additional information regarding the dredging program, or environmental studies undertaken to support approvals? If so, please list below. If a meeting is required, please advise.

DPIRD would like CPM to give further consideration of the proposed activity, including the type of material to be dredged and dumped (as for example soft sediment may move into creek systems), hydrodynamic modelling for proposal and a comprehensive consideration of the fish resources and aquatic habitats impacted. DPIRD has concerns regarding negative impacts on fisheries, environmental impacts, cumulative effects from a range of development in the areas including new challenges in the environment space since the original dredging approval was granted as well as strengthened legislation expectations that are now in effect.

DPIRD recommends that fish, fish resources and associated habitats be incorporated with relevant management plans (such as the Port Environmental Management Plan and the Marine Management Plan), including options to mitigate or minimise impacts. If a review process is not already incorporated in the Management Plans it is recommended that it is added in (five yearly reviews would be a good starting point), as well as inclusion of any changes to the environment

and emerging issues with regard to developments that may not yet be included so that the cumulative effects on the environment area considered in a holistic approach. DPIRD requires additional information and environmental studies be undertaken on the fish ecology of the area. The proposed dredging and sea dumping activities should not proceed until DPIRD's concerns have been considered and addressed in the development of action and management plans, as well as policy to mitigate and minimise risks to fish and fisheries resources. DPIRD can assist with feedback on drafts in the development phase. Prior to commencing any activity relevant approvals and permits should also be obtained from other relevant departments. In addition, DPIRD recommends that CPM undertakes consultation with peak fisheries bodies including the West Australian Fishing Industry Council (WAFIC), Recfishwest and the Aquaculture Council of WA. DPIRD would like ongoing consultation from CPM with regards to any amendments or new proposals. Further information in relation to fishing activities details can be found in the State of the Fisheries reports on this this link – https://www.fish.wa.gov.au/About-Us/Publications/Pages/State-of-the-Fisheries-report.aspx.
Do you wish to receive updates on the dredging program? (Yes/No) If yes, please provide email address.
Yes, please send updates to environment@dpird.wa.gov.au.

Stakeholder feedback forms should be completed and emailed to no later than Close of Business on Wednesday 25th October 2024.

Figure 1. Map of the Mardie-Preston-Eramurra area sampled for juvenile Bluespotted Emperor (*Lethrinus punctulatus*) showing some of the main islands of interest. Red lines denote outline of Mardie salt project.

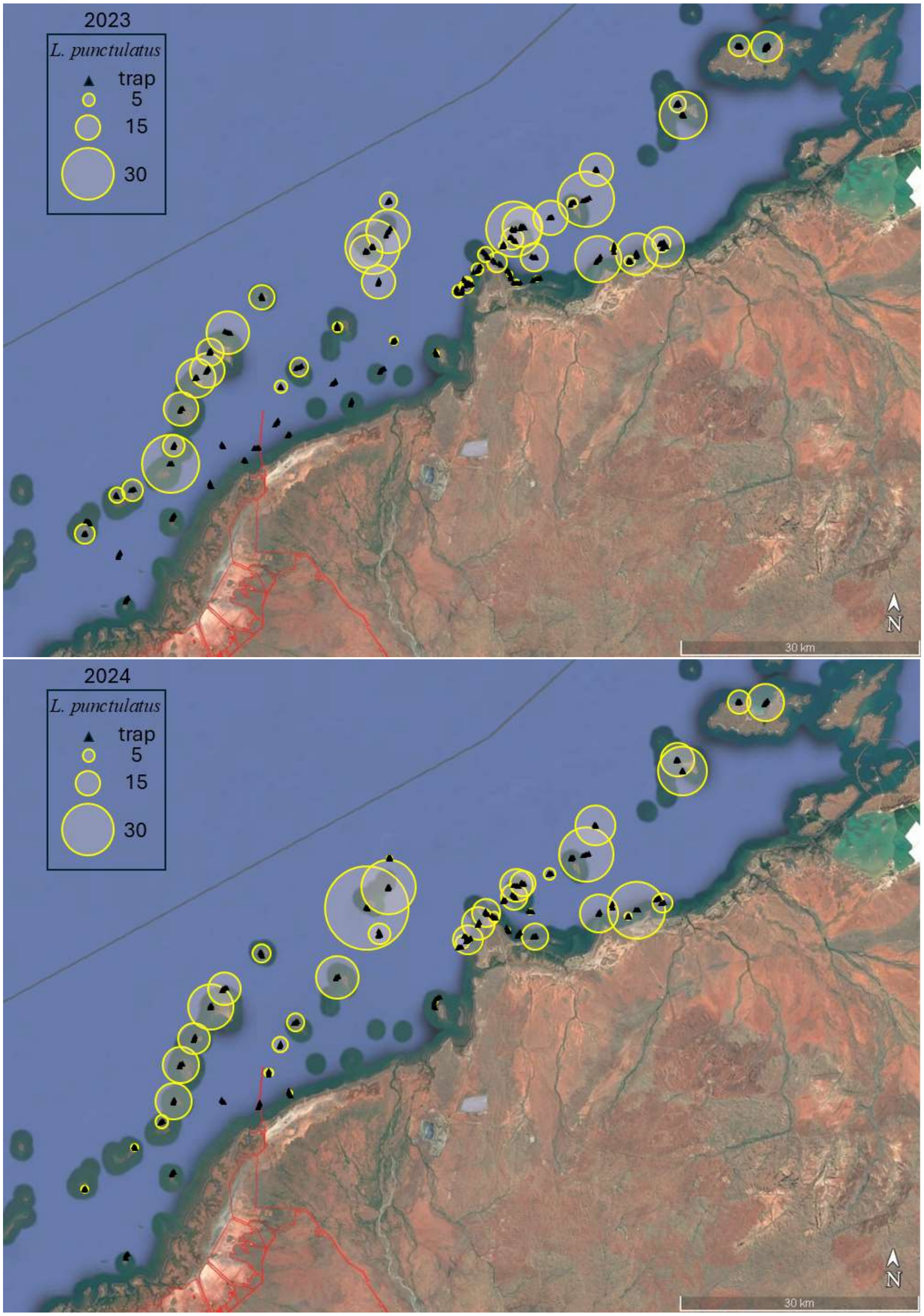

Figure 2. Average abundances of juvenile Bluespotted Emperor (*Lethrinus punctulatus*, yellow circles) per site (n = 8-10 traps per site, black triangles denote locations of each trap) in May 2023 (above, n = 647 traps) and May 2024 (below, n = 498 traps). Red lines, outline of Mardie salt project; grey line, southern boundary of commercial trap fishery.

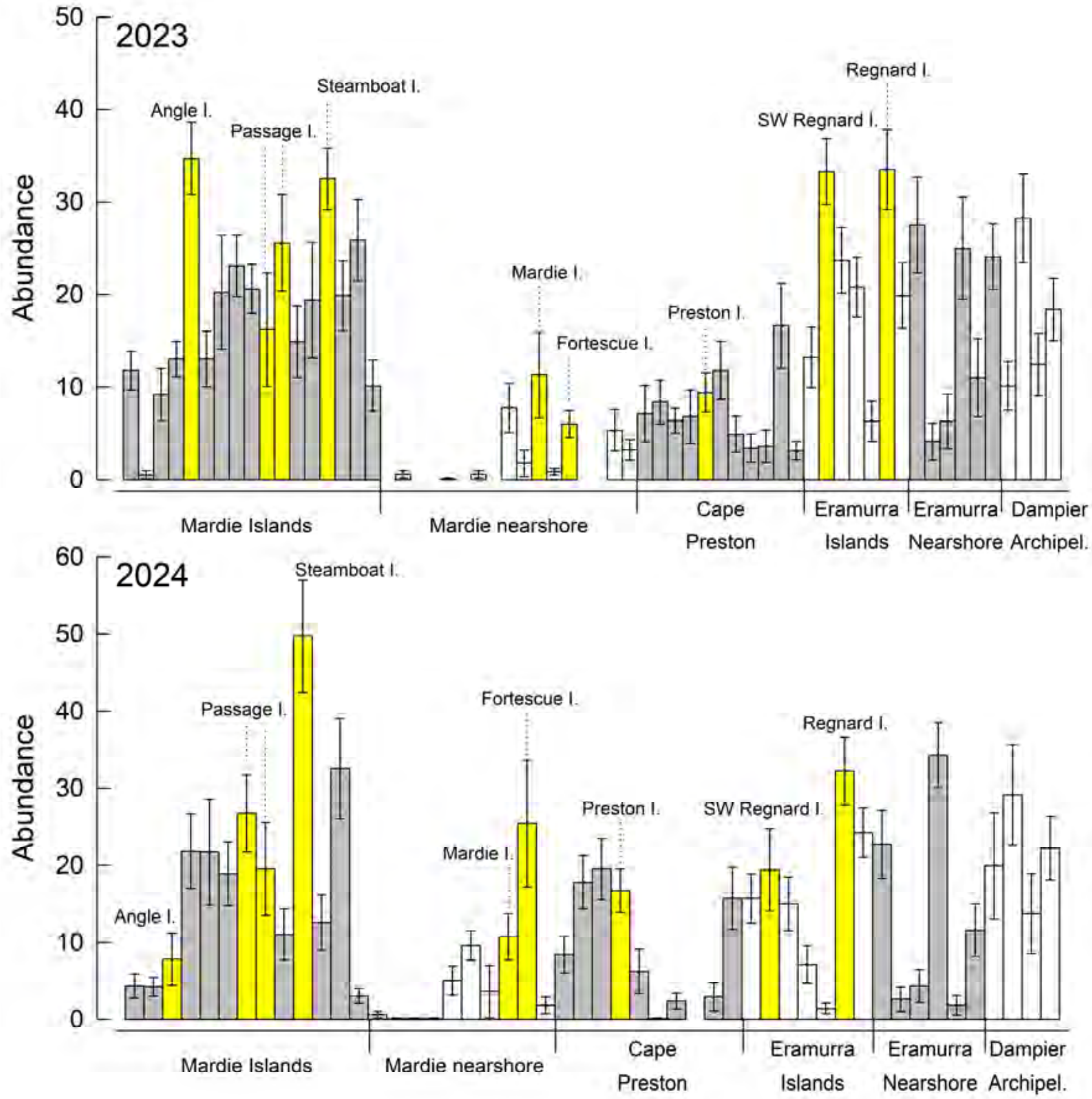

Figure 3. Average abundances of juvenile Bluespotted Emperor (*Lethrinus punctulatus*, ±1 se, bars) per site (n = 8-10 traps per site) in May 2023 (above, n = 647 traps) and May 2024 (below, n = 498 traps). Sites are in sequential order by longitude (from west to east, see Fig. 2) within each of the categorised regions (i.e., Mardie Islands, Mardie nearshore, Cape Preston, Eramurra Islands, Eramurra nearshore, Dampier Archipelago). Yellow bars denote abundances at the main islands of interest (see Fig. 1).

8) CPM response to DPIRD - Stakeholder Feedback Form

Response to DPIRD Stakeholder Feedback for Sea Dumping Permit Application

DATE:	26/11/2024	REFERENCE:	24ENV318/T240415
TO:	Linda Wiberg & Mark Pagano	EMAIL:	Linda.Wiberg@dpird.wa.gov.au
FROM:	Travis Hurley	EMAIL:	Travis.hurley@o2marine.com.au
	Harley Barron	EMAIL:	Harley.Barron@citicpacificmining.com
SUBJECT	Response to DPIRD Stakeholder Feedback for Sea Dumping Permit Application		

Thank you for taking the time to provide feedback on the request from Citic Pacific Mining (CPM) to comment on the proposal for a Dredge Material Placement Area (DMPA) to support a Sea Dumping Permit Application. The feedback obviously identifies concerns raised by the Department of Primary Industries and Regional Development (DPIRD) and provides a good platform for justifying the need to work through these concerns with stakeholders before undertaking actions. Comments provided by DPIRD have been itemised in the tables below relevant to each section of the feedback form. A response is offered for DPIRD consideration. The Department of Climate Change, Energy, the Environment and Water (DCCEEW) will seek verification from CPM that DPIRD's concerns have been resolved to grant approval for a Sea Dumping Permit. CPM requests that DPIRD please provide a response indicating whether the comments suitably address the concerns raised or whether further action will be required.

1. The Proposed Location of the DMPA

The environmental impact assessment (EIA) process performed for this dredging application aligns with the Technical Guidance – Environmental impact assessment of marine dredging proposals 2021 (Technical Guidance) from the Environmental Protection Authority (EPA 2021). The outcomes of which were provided as a summary in the Stakeholder Consultation memo. The Dredge Management Plan (DMP) (as submitted to DWER) is appended to this email for your information. This dredging project is 36,000 m^3 and involves only six weeks of work. Small dredging projects are defined in the National Assessment Guidelines for Dredging (2009) as <50,000 m^3. The risks associated with these small dredging programs are substantially lower than those presented for medium (50,000 m^3 – 500,000 m^3) or large projects (>500,000 m^3), which require larger dredge equipment over longer durations.

Within the appended DMP are details of the following:

- Sediment plume modelling
- Zonation scheme set out in the Technical Guidance identifying the Zone of High Impact (ZoHI) and Zone of Influence (ZoI)[1].

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[1] Note: that the Zone of Moderate Impact (ZoMI) is entirely contained within the ZoHI.

- Monitoring, mitigation and management of Marine Environmental Quality (MEQ)
- Sediment geotechnical assessment
- Assessment, mitigation and management of introduced marine pests (IMP)

Item	DPIRD Comment	CPM Response	Further Action Required (Yes/No)
1.1	DPIRD has concerns in relation to the location of the proposed DMPA as the dredging and sea dumping activities which may have substantial negative effects due to: • Increased turbidity • Sedimentation	Plume dispersion modelling was undertaken for turbidity (suspended sediment) during dredging and disposal activities. The possible and probable effects threshold guideline values for corals were applied to model outputs. These threshold guideline values are presented in Appendix A of the Technical Guidance (EPA 2021)and were derived by the Dredging Science Node of the Western Australian Marine Science Institution (WAMSI DSN) research. It is worth noting thresholds for corals are more sensitive than seagrass and sponge communities (also provided in EPA 2021). While thresholds are not provided for macroalgae in EPA (2021), it is generally understood that macroalgae are less sensitive to turbidity and sedimentation than hard corals, particularly *Sargassum* and other habitat-forming species which are thought to have an advantage in higher sediment environments (Fraser et al. 2017). A zonation scheme set out in the Technical Guidance is applied to the predicted modelling outcomes. To summarise, the Technical Guidance defined these zones as: • The ZoHI is where predicted impacts are considered irreversible (serious damage to benthic communities is predicted). • The ZoMI is where predicted impacts are sub-lethal, and/or where impacts are recoverable within a period of five years following completion of activities. • The ZoI is where there are predicted changes to environment quality, but where these changes would not result in detectible impacts on benthic biota (e.g. a reduction in biomass). It is described as the area surrounding proposed activities where the aesthetic water quality may be impacted. No biota is predicted to be impacted in this zone. For the proposed dredging/disposal activities: • The ZoHI is the direct disturbance footprint (dredge footprint, DMPA footprint) with a 50 m buffer applied. • The ZoMI is wholly contained within the ZoHI.	

		Therefore there are no indirect impacts to benthic communities expected beyond the direct dredge footprint and DMPA footprint (ZoHI). On further note, the large size of the ZoI is to be expected as the ZoI is where turbidity may be above the natural background turbidity at some point during the six weeks of dredging or disposal activities. However, no impacts to hard coral are predicted (i.e. turbidity remains below thresholds). This ZoI was modelled as anywhere >1 NTU above natural background concentrations in surface waters, which describes conditions well within the natural fluctuation of background turbidity levels for this area. Mapping the ZoI in this way indicates that increased turbidity could possibly be visually observed at surface waters beyond the ZoHI. However, scientific evidence indicates that the predicted concentrations will have no detrimental effects on the most sensitive of marine organisms. The only areas represented as having turbidity generated which is likely to impact on the marine environment are limited to the ZoHI within the existing harbour, and the 10.2 ha at the DMPA. So, the results conclude the dredging and sea dumping activities will not have substantial negative effects beyond 50 m from the direct disturbance footprint as a result of slightly increased turbidity or sedimentation.	
1.2	DPIRD has concerns in relation to the location of the proposed DMPA as the dredging and sea dumping activities which may have substantial negative effects due to: • Reduced oxygen and water quality • Release of contaminants and spills • Change in sediment profiles	Sediment profiles and contaminant testing Sediments to be dredged have been tested in accordance with NAGD (2009) and results indicate sediments are clean (uncontaminated, as described by the NAGD 2009) and do not have high nutrient or chlorophyll concentrations which may influence phytoplankton productivity resulting in changes to dissolved oxygen in the water column. There is also minimal risk of acid sulphate soils when disposed back into the ocean. Results indicate dredging and sea dumping activities will not have substantial negative effects due to reduced dissolved oxygen and water quality or release of contaminants. The particle size distribution (PSD) of sediments to be dredged is also similar to sediments in the DMPA, so no changes to the sediment profile other than increased unconsolidated material on the surface layer. Standard mitigation and spill response practices are detailed in the DMP to prevent and manage the potential impacts for chemical/fuel spills.	

1.3	DPIRD has concerns in relation to the location of the proposed DMPA as the dredging and sea dumping activities which may have substantial negative effects due to: • Increased risk of introduced pest species or diseases associated with increasing vessel movements	Due to the small scale of dredging. CPM intend to use a dredge which is already working in the area. The cost of mobilising a dredge for this small program would be significantly higher than the work required. A locally present vessel minimises the risk of introduced marine pests. CPM has been working with DPIRD to help identify introduced marine species (IMP) using the State Wide Array Surveillance Program which has identified one record of an IMP: *Didemnum perlucidum*. This species has been reported across Ports and harbours in WA, including Exmouth Gulf, Ashburton Dampier, Barrow Island and Montebello Islands. More details can be found on the NIMPIS website: https://nimpis.marinepests.gov.au/species/species/149 CPM will continue to utilise DPIRD's expertise in the area of IMP management in addition to the DPIRD Vessel Check management tool as per standard protocols for the Port.	
1.4	DPIRD has concerns in relation to the location of the proposed DMPA as the dredging and sea dumping activities may present substantial risks to fish and fish resources: • Potential alteration or loss of benthic habitat and associated nursery/recruitment areas • Change of movements and migrations for marine species • Loss of fisheries productivity • Impact and disruption to commercial, recreational and customary sections	In terms of risks to fish and fish resources, there is predicted to be no loss of benthic habitat except in the area of direct disturbance in the Port and the DMPA. Therefore, there are no predicted impacts to benthic habitats, or any biota, outside the area of direct impact. Due to dredging activities occurring within an already working Port harbour, and predicted impacts of this activity being limited to within the Port area, the potential for this area to represent an important area for nursery/recruitment, movement and migration or fisheries productivity is highly unlikely. Commercial, recreational and customary fishing does not occur within the working harbour. Benthic habitat at the 10.2 ha of the DMPA is predominantly comprised of bare sand with occasional filter feeder communities (i.e. sponges, octocoral) at between 12-14 m depth. This habitat is broadly spread surrounding the Project area (i.e. not limited to the 10.2 ha). The known important nursery areas occur adjacent to the DMPA in shallower waters, including hard coral and macroalgae communities which are not predicted to be impacted. Assessment of fisheries, fish resources is not required within the application form for which the current approval requires. However, O2 Marine can advise that the DMPA overlaps with the following State managed fisheries: • Pilbara Trap Managed Fishery: Pilbara Inshore Closed Waters • Onslow Prawn Managed Fishery	

		• Pilbara Crab Managed Fishery • Mackerel Managed Fishery • Sea Cucumber Fishery • Marine Aquarium Fish Managed Fishery • Hermit Crab Fishery • Pearl Oyster Wildstock Fishery • Specimen Shell Managed Fishery The small scale of the DMPA is not likely to represent substantial risk to migratory species or fisheries productivity. For any fishery context, areas fished are typically very large (e.g. trap fishery = 24,520 nm^2). The 10.2 ha of the ZoHI is indistinguishable on the scale of an 8.5-million-hectare fishing zone of the trap fishery (e.g. <0.0000012% of the fishing area), for which access would be limited only for six weeks. Further, recent catch effort indicates limited fishing activities within the vicinity of the DMPA, potentially with the exception of the Mackerel Managed Fishery or Marine Aquarium Fish Managed Fishery. On this scale, it is presumed the proposed activities will not result in any measurable impact on any commercial, recreational or customary fisheries.	
1.5	The Memo lacks detail about: • The proposed activity, • Potential impacts • Whether DMPA site effectively mitigates and minimizes environmental impacts. The location of DMPA is not defined under MS635. The proposed DMPA appears to be in close proximity to the coast and existing Port infrastructure rather than "offshore" waters described in MS635.	The dredging proposed is capital dredging to deepen the Berth Pocket and Inner Harbour at the Sino Iron Terminal (SIT) to a target depth of -12 m (-12.5 m Over Dredge) in the Berth Pocket and -9.5 m (-10 m Over Dredge) in the Inner Harbour / Channel to accommodate new vessels with an increased draft, improve port efficiency and reduce risk for harbour vessels. The dredging activity has been approved under MS635. The sea dumping permit application is for disposal of the specified volume only at the proposed site. This dredging project is 36,000 m^3 and involves only six weeks of work. Small dredging projects are defined in the National Assessment Guidelines for Dredging (2009) as <50,000 m^3. The risks associated with these small dredging programs are substantially lower than those presented for medium (50,000 m^3 – 500,000 m^3) or large projects (>500,000 m^3), which require larger dredge equipment over longer durations. While many of the concerns raised in the response are valid issues for larger dredging programs, the scale of this Proposal and information collected to support the Permit application and Dredge Management Plan	

		identifies the potential risks to the environment for this Proposal are minimal. Additional details describing the activities on the dredging works in particular can be found in the appended DMP. CPM acknowledges that MS635 identifies a large area for dredged material placement, however this was in the context of a 4.5 Million m^3 dredging programme and the map clearly states that the spoil disposal area was subject to further studies. The location of the DMPA for this proposal was chosen as it exists within the boundary of General Purpose Lease G08/52, within which mining or promoting the activity of mining has been approved and is also within the boundaries of the *Iron Ore Processing (Mineralogy) Agreement Act 2002*. There were two site options assessed within the lease boundary as part of the preliminary modelling undertaken, with the option selected providing favourable environmental outcomes. If modelling outputs indicated a significant risk to benthic communities adjacent to the DMPA, then additional options for the DMPA location would be explored further prior to seeking Stakeholder Consultation. However, the current proposal does not predict disturbance to adjacent benthic habitats beyond 50 m from the DMPA. 'Offshore disposal' is used to define disposal of dredged or excavated material at sea, as regulated under the *Environment Protection (Sea Dumping) Act 1981*, which applies in all Australian waters (i.e. also within nearshore state waters). 'Onshore disposal' requires reference to state guidelines for the assessment and management of contaminated sites which is regulated under the *Contaminated Sites Act 2003*. The term nearshore is not applied in this context.	

1.6	DPIRD would like to seek clarity around:
	• The potential disturbance areas
	• Type of material to be dumped
	• CPM demonstrates measures to mitigate and minimize impacts on fisheries, fish resources and the aquatic environment, including:
	  • Fishing areas, &
	  • Crucial nursery habitats, in particular *Sargassum* macroalgae complex for the recruitment of the Bluespotted Emperor (*Lethrinus punctulatus*).
		Further information, including the DMP, will be submitted with this response for clarity.
		The areas of direct disturbance are shown in Figure 1, Appendix A and Appendix C. There is a buffer allowed of 50 m around the disturbance footprint shown in Appendix B (i.e. ZoHI) from which within all indirect impacts on benthic habitats are limited to. An area of slightly increased turbidity that is not predicted to cause disturbance to benthic habitats (ZoI) is also shown in Appendix B.
		The material to be dumped is typically described as 'clean' uncontaminated unconsolidated sand.
		As identified in Item 1.4, impacts to the spatial area available for fishing over a six week period of dredging and disposal activity is minimal.
		Impacts to adjacent benthic habitats are not predicted, including the *Sargassum* macroalgae complex. As stated in Item 1.1, the ZoI is where there are predicted changes to environment quality, but where these	

		changes **would not result in a detectible impact on benthic biota (e.g. a reduction in biomass)**. It is described as the area surrounding proposed activities where the aesthetic water quality may be impacted. No biota is predicted to be impacted in this zone. Therefore, there is no predicted impact on the habitat used by juvenile Bluespotted Emperor. Mitigations have been prepared in the DMP to reactively manage dredging and disposal activities if they exceed the impacts that have been predicted. Water quality will be monitored in real-time during dredging and disposal activities. In the event of an exceedance in water quality, this will trigger a post-dredging survey of adjacent benthic coral communities, as well as modification of activities including, but not necessarily limited to: • Reduce the dredging rate (i.e. longer time intervals between disposal events) • Moving dredging activities to a different area of the planned footprint • Dredging activities with no-overflow of the hopper (i.e. smaller volumes for disposal) • Cease dredging/disposal Normal dredging operations would resume once water quality is no longer exceeding.	
1.7	DPIRD would like the EPA to consider the cumulative impacts from the combined activities that are causing increased pressures on the aquatic environment and fish resources in the area. DPIRD also recommends that consideration be given under the relevant legislation with regards to the appropriateness of an amendment to existing approvals or whether this should fall under a new assessment given it has been more than 20 years since the original permit was granted. The scale of the project is also to be considered in the context a holistic view and cumulative impacts on the environment in the region.	The Sino Iron Project was approved by the EPA in 2003, the Cape Preston Port is an operational Port facility and proposed dredging activities have already been granted as part of that approval. CPM are committed to implement conditions relevant to the approvals under MS635 for the life of the Project. CPM acknowledges that MS635 identifies a large area for dredged material placement, however, this was in the context of a 4.5 Mm^3 dredging programme and the map clearly states that the spoil disposal area was subject to further studies. Under conditional approval of MS635, the DWER Marine Branch has been provided opportunity to comment on planned dredging and disposal activities as part of an approval process for the Dredge Management Plan. DWER has responded with a request for further information on minor queries, although has not queried the relevance of existing approvals nor the currency of the approvals. The scale of the Project has been considered. **Assessment of cumulative impacts** is typically undertaken for an EPA referral for new large development proposals predicted to have significant ongoing impacts on the environment. Assessment of cumulative impacts are not typically applied to minor works such as small six	

		week dredging programs within existing coastal facilities (e.g. maintenance dredging in marinas). These activities occur, and predicted impacts remain, within the Cape Preston Marine Management Unit for an estimated period of six weeks (see insert in Figure in Appendix A). Also note that the nearby project, Mardie Salt, has not undertaken any dredging. There is potential for Mardie Salt to conduct dredging in the future. This project is 32 km away from the Port of Cape Preston and is unlikely to have plumes which overlap the CPM dredge programme. Approval to dispose of 36,000 m^3 of material at the DMPA is regulated by DCCEEW under the Sea Dumping Act. Stakeholder consultation is required by DCCEEW for the Sea Dumping Permit application and has since also been requested by DWER. Concerns raised by DPIRD will be considered by DWER within the DMP approval process.	
1.8	Consider both a DMPA location that minimizes impacts on productive benthic communities and habitats, as well as a long-term solution. Due consideration should be given to finding a long-term solution that assists in ensuring that any dumped material does not reaccumulate with ongoing dredging requirements. DPIRD recommends the DMPA is located further offshore to minimize negative impacts on coastal areas and critical habitats and recruitment/nursery processes for fish resources.	It is acknowledged that DPIRD's concern is in regard "*to minimising negative impacts on coastal areas and critical habitats and recruitment/nursery processes for fish resources*." <u>There are no predicted direct or indirect impacts to benthic communities expected 50 m beyond the direct dredge footprint and DMPA footprint.</u> Please see response 1.1 and 1.4 above for further details on the interpretation of zones of impact and influence in relation to EPA dredging guidance and the risks to fish and fish resources, respectively. This is a minor works program. Note: the proposal is required for capital dredging for new transhipment vessels with a deeper draft. There has been some minor accumulation of sediment within the harbour which has occurred since Port construction began in 2009 that will be removed as part of the dredging process. However, historical evidence indicates that any requirement for maintenance dredging at the Port of Cape Preston is relatively infrequent (> 10 years). The report from the Department of Transport on sediment cells for the Pilbara Coast (DoT 2014) indicates the ancient rocky headland forms a barrier to sediment transport along the shore, minimising the accumulation of sediment. If the DMPA is proposed to be used again in the future (i.e. 10 years) for disposal of minor maintenance dredging, presumably the volumes would be relatively small and the following environmental testing would be required as a minimum: • geophysical, sediment and benthic video surveys of the DMPA,	

		• sediment quality of dredge material to be disposed at the DMPA, and • review of the historical use of the site will be evaluated as part of a new Sea Dumping Permit application. Presumably, necessity for further capital dredging for a deep water harbour and channel as initially approved will require dredging activities and disposal volumes that would not propose to use the existing DMPA (e.g. 4.5 Mm^3). However, this is not currently planned with CPM committing to new transhipment vessels, which do not require the same magnitude of dredging to access the loading berth compared with direct loading of ocean going vessels. In this context, the proposed dredging does minimise impacts on productive benthic communities and habitats.	
1.9	Teleost fish species and other fish resources are not identified. The table and the associated maps should include comprehensive detail about the Benthic Communities and Habitats, such as for example macroalgal communities.	In accordance with the Department of Climate Change, Energy, the Environment and Water's (DCCEEW) Sea Dumping Permit application, the focus of the marine fauna assessment was on threatened species listed under the *Environment Protection and Biodiversity Conservation Act* 1999. Teleost species were considered, as Table 2 identifies the southern bluefin tuna which was listed as Conservation Dependant up until July 2024. As the marine fauna search via the Protected Matters Search Tool was used before this update, this species was considered to be likely present and therefore is indicated as a key species in the DMP. The map provided in Appendix A of the Stakeholder Consultation Information Memo presents details about the distribution of Benthic Communities and Habitats in the area, including macroalgal communities which are listed as Algae/Limestone Pavement. A survey was undertaken in the vicinity of the DMPA in December 2023 using multibeam and ROV to collect bathymetry and video transects of benthic communities. A macroalgae community, described as >10% cover, was not recorded at any sites in the area. Sparse unidentified 20 cm macroalgae was recorded in four from 21 survey transects, all located beyond 50 m from the DMPA. Macroalgae communities are mapped in Appendix A as occurring on the shallow reef south of the DMPA and east of the Port breakwater. As DPIRD identify, this is likely to be the habitat targeted during research surveys for juvenile Bluespotted Emperor. Modelling predicts this macroalgae habitat will not be effected by proposed disposal activities. As identified previously, the ZoI represents the spatial extent where surface turbidity may be above background at some time during the six week period of dredging or disposal activities, but no impacts to BCH are predicted (i.e.	

		remain below coral effect thresholds). The considerable numbers of juveniles that recruit to and settle within the algal communities will not be impacted by ZoI suspended sediments or sedimentation which are within the natural variability of background.	

References:

EPA 2021. Technical Guidance: Environmental impact assessment of marine dredging proposals. Environmental Protection Authority, September 2021.

DoT 2014. Coastal Sediment Cells for the Pilbara Region between Giralia and Beebingarra Creek, Western Australia. Report prepared by Seashore Engineering Pty Ltd and Geological Survey of Western Australia for the Western Australian Department of Transport, Fremantle.

NAGD 2009. National Assessment Guidelines for Dredging. Department of the Environment, Water, Heritage and the Arts.

2. Potential Environmental Impacts from Disposal Activities

Item	DPIRD Comment	CPM Response	Further Action Required (Yes/No)
2.1	DPIRD recommends full consideration of the impacts on fisheries and fish resources are identified for consideration of impacts and mitigation measures.	Please refer to response 1.4 in the table above.	
2.2	For the recreational sector the nearby 40 mile is a very popular location for fishing and spearfishing. Customary fishing is undertaken by Yaburara, Mardudhunera, Ngarluma, Yindjibanri Traditional Owners including around 40 mile and Mardie area shore fishing such as for Mullet and Garfish, as well as spearfishing for demersal species.	Note, the Port has an exclusion zone in place where recreational, commercial and customary fishing is not allowable (see Figure below). CPM plan to provide notification of activities through Department of Transport Notice to Mariners for public to be aware of proposed dredging and disposal activities. The DMPA represents a small area (10.2 ha) of the broader region available for recreational and customary fishing during a six week period. This represents minimal impacts on these activities. The City of Karratha and Mardudhunera people have both been approached as part of the Stakeholder Consultation. City of Karratha have noted no concerns with the proposed dredge programme. Consultation with the Mardudhunera people is ongoing.	

			
2.3	Potential impacts on benthic habitats: macroalgae, corals, sponges, mangroves and mudflats. In particular, large area of *Sargassum* macro algal habitat that occurs around Cape Preston and within the ZoI which represents juvenile nursery habitat for Bluespotted Emperor which is predicted to be impacted by suspended sediment concentrations (SSCs). Bluespotted emperor have a protracted spawning period over ten months of the year from mid-winter to mid-autumn (i.e., July to April), with juveniles recorded in the nearshore sargassum habitat year-round for up to their first 2 years of life (DPIRD unpub.).	As identified in Item 1.1, the most sensitive environmental receptor to the effects of SSC (coral) are not predicted to be impacted. As part of the review of information, DPIRD may have mistaken the ZoI for marine environmental quality conditions that represent potential impacts on benthic habitats. However, in accordance with EPA guidance, this is the area where turbidity conditions may be visually above the background in surface waters for the protection of aesthetic values, but impacts to benthic habitats are not predicted. Juvenile Bluespotted emperor recorded in the nearshore sargassum habitat year-round for up to their first two years of life will also not be impacted by low levels of turbidity above natural background concentrations generated over the six weeks of proposed dredging and disposal activities.	

3. Additional Information, Further Environmental Studies

Item	DPIRD Comment	CPM Response	Further Action Required (Yes/No)
3.1	DPIRD would like CPM to give further consideration of the proposed activity, including: • the type of material to be dredged and dumped (as for example, soft sediment may move into creek systems) • hydrodynamic modelling for proposal • a comprehensive consideration of the fish resources and aquatic habitats impacted DPIRD has concerns regarding negative impacts on fisheries, environmental impacts, cumulative effects from a range of development in the area including new challenges in the environment space since the original dredging approval was granted, as well as strengthened legislation expectations that are now in effect.	CPM has given due consideration to the proposed activity, including the type of material to be dredged and dumped and undertaken hydrodynamic modelling for the proposal. These assessments will be provided. This work has established there is negligible risk of negative impacts on fisheries, environmental impacts or cumulative effects. There is little risk (both spatially and temporally) that cumulative impacts could occur. The small volume of material aligns to offshore disposal and any impacts are predicted to be limited to 10.2 ha at the DMPA. The type of dredging equipment and associated production rate of activities, the characteristics of sediment being dredged, as well as the duration of six weeks required to dredge the small volume, result in negligible predicted impacts to sensitive environmental receptors. As highlighted, fish, fish resources and associated habitats are less sensitive than thresholds for coral communities assessed in the DMP. Further, cumulative effects from a range of developments would be required if this were a new Project, although the Port of Cape Preston is an operational Port and the proposed dredging activities have already been approved. While many concerns DPIRD raise would be valid for larger dredging Projects, the details of each Proposal need to be evaluated individually. In this case, the environmental impact assessment work undertaken in accordance with appropriate guidance indicates risks for the proposed activities can be managed to mitigate significant impacts to the marine environment.	

		The port development is approved under Ministerial Statement 635 pursuant to the provisions of the *Environmental Protection Act 1986*. The Port has a Low Ecological Protection Area within 70 metres of the desalination wastewater outfall diffuser, which is to be located in the port area. A moderate level of ecological protection would apply within 250 meters of the port infrastructure and a high level of ecological protection beyond that. In areas assigned a moderate level of ecological protection, moderate changes in environmental quality may be acceptable provided there are only small changes in abundance and biomass of marine life and in the rates, but not types, of ecosystem processes. There is no reason to suspect that fish, fish resources and associated habitats are being unduly affected by the Port Operations.	
3.2	DPIRD recommends that fish, fish resources and associated habitats be incorporated with relevant management plans (such as the Port Environmental Management Plan and the Marine Management Plan), including options to mitigate or minimise impacts.	This comment is beyond the scope of the request for feedback on the proposed activities. Amendment of Environmental Management Plans is typically for new referral's under Part IV of the Environmental Protection Act, this submission is to gain approval for a Management Plan. The Port Environmental Management Plan and the Marine Management Plan were prepared to the requirements of Ministerial Statement 635 and subsequently approved. The Marine Management Plan is related primarily to potential impacts relating to the construction of the Port structure, The Port Environmental Management Plan relates to the management of port operations to maintain adequate water quality, mitigate the risk of invasive marine pests, mitigate impacts to turtles and incorporate an oil spill contingency plan. These plans incorporate monitoring programmes to ensure the management outcomes are achieved and the monitoring reports are provided to the DWER annually along with an Annual Compliance Assessment Report. The implemented monitoring programmes include: • Coral health monitoring • Invasive Marine Pest monitoring (by DPIRD - Aquatic Pest Biosecurity) • Port Sediment and visual amenity monitoring	

		• Coastal Stability monitoring If monitoring indicates management measures are ineffective and management outcomes are not being achieved, then adaptive management is adopted. It must be noted to date there has been no indication management outcomes are not being achieved and the plans are performing as intended, with environmental quality and benthic habitats being appropriately maintained. The DMP has been prepared to adopt standard mitigation and management operational practices for the Cape Preston Port detailed within these plans where relevant, including but not necessarily limited to, introduced marine pests and prevention and management of oil/chemical spills.	
3.3	If a review process is not already incorporated in the Management Plans it is recommended that it is added in (five yearly reviews would be a good starting point), as well as inclusion of any changes to the environment and emerging issues with regard to developments that may not yet be included so that the cumulative effects on the environment area considered in a holistic approach. DPIRD requires additional information and environmental studies be undertaken on the fish ecology of the area. The proposed dredging and sea dumping activities should not proceed until DPIRD's concerns have been considered and addressed in the development of action and management plans, as well as policy to mitigate and minimise risks to fish and fisheries resources. DPIRD can assist with feedback on drafts in the development phase. Prior to commencing any activity relevant approvals and permits should also be obtained from other relevant departments. In addition, DPIRD recommends that CPM undertakes consultation with peak fisheries bodies including the West Australian Fishing Industry Council (WAFIC),	The Dredge Management Plan developed for the proposed dredging and disposal activities has been prepared for the scope outlined in the information provided. It would not be relevant to review the plan in five years as the activities are planned to be completed well within this timeframe. Fish and fisheries resources are protected within the DMP through minimising impacts on the most sensitive receptor to the activities, hard corals. The DMP identifies minimal impacts on these receptors from the proposed dredging and disposal activities for a period of six weeks. Monitoring will be undertaken during the proposed activities for management actions to be implemented in the event the risk to hard coral communities is greater than predicted, in turn protecting other marine biota including fish and fisheries resources. Updating operational management plans for the Cape Preston Port is beyond the scope of the request for comment on proposed activities. Approval of the DMP and the Sea Dumping Permit application will determine acceptance to proceed with proposed activities. CPM are committed to implement conditions relevant to the approvals under MS635 for the life of the Project. Further, MS1066 which was issued for approving an expansion of the project required to accommodate continued operations, which includes Condition 17 to:	

	Recfishwest and the Aquaculture Council of WA. DPIRD would like ongoing consultation from CPM with regards to any amendments or new proposals. Further information in relation to fishing activities details can be found in the State of the Fisheries reports on this this link – https://www.fish.wa.gov.au/About-Us/Publications/Pages/State-of-the-Fisheries-report.aspx.	*Revise and implement plans, reports, systems or programs required under the Ministerial Statement 635 to be consistent with contemporary standards, policies, guidelines and procedures.* CPM are not in a position to consolidate recommendations on compliance matters that are not formally received from the relevant regulatory authority. Further, the approval process for proposed activities should not be postponed due to requirements to update plans that are not related to these activities, as this has no net environmental benefits for implementing the works. DWER and DCCEEW will have opportunity to review and consider DPIRD recommendations provided for ongoing environmental compliance for the Port operations. CPM has undertaken consultation with peak fisheries bodies including the West Australian Fishing Industry Council (WAFIC), Recfishwest and the Aquaculture Council of WA. The outcome of the consultation will support the Dredge Management Plan and Sea Dumping Permit Submissions. CPM will undertake ongoing consultation with DPIRD with regard to any amendments or new proposals. CPM can provide some further documents as requested, including: • Sediment sampling analysis plan implementation report • Benthic Habitat Characterisation Report • Dredge plume modelling report • Dredge Management Plan	

Project Updates

Item	DPIRD Comment	CPM Response
1	Please send updates to environment@dpird.wa.gov.au.	CPM will provide Project Updates by sending relevant information to the email address supplied.

9) PPA response to CPM

From:	Dan Pedersen
To:	Brendan White
Cc:	Harley Barron; Mike Minogue; Alexander Cullen; David Pozzari; Shannon Browne; Richard King
Subject:	Re: ENVDR-1084915769-4346 LTR2024.10.02 CPM to Pilbara Ports Stakeholder Consultation to Support SDP Application
Date:	Friday, 11 October 2024 3:01:39 PM
Attachments:	LTR2024.10.02 CPM to Pilbara Ports Stakeholder Consultation to Support SDP Application.pdf

Hi Brendan,

Thanks for your time on the phone this afternoon. As discussed, Pilbara Ports has reviewed the information provided (attached) and has no comment in relation to the proposed dredging, establishment of a spoil ground or sea dumping. We note the activity will occur entirely within the seabed lease held by CPM.

Kind regards

Dan

Get Outlook for iOS

From: Brendan White <Brendan.White@citicpacificmining.com>
Sent: Friday, October 11, 2024 1:42 PM
To: Dan Pedersen <Dan.Pedersen@pilbaraports.com.au>
Cc: Harley Barron <Harley.Barron@citicpacificmining.com>
Subject: FW: ENVDR-1084915769-4346 LTR2024.10.02 CPM to Pilbara Ports Stakeholder Consultation to Support SDP Application

Hi Dan,

Sorry to bother you on a Friday afternoon.

I'm a colleague of Harley Barron and am I following up on the below correspondence to confirm that it has been received and see if there were any matters you'd like to discuss in relation to the proposed dredging activity.

Please don't hesitate to on 92268039 if you have any queries.

As noted in the correspondence it would be greatly appreciated if feedback can be supplied by Wednesday 16th October 2024 confirming receipt and identifying if the PPA has any feedback.

Thanks,
Brendan White

Superintendent - Environment

From: Emma Rayson <Emma.Rayson@citicpacificmining.com> **On Behalf Of** HSE admin
Sent: Wednesday, October 2, 2024 4:02 PM
To: Dan.Pedersen@pilbaraports.com.au
Cc: HSE admin <HSEadmin@citicpacificmining.com>; Harley Barron <Harley.Barron@citicpacificmining.com>
Subject: ENVDR-1084915769-4346 LTR2024.10.02 CPM to Pilbara Ports Stakeholder Consultation to Support SDP Application

Attention: Dan Pedersen, Environment & Heritage Director

Please find attached CPM letter (ENVDR-1084915769-4346) together with attachments, seeking feedback on CITIC Pacific Mining's proposed capital dredging programme.

Please note that feedback is required by close of business Wednesday 16th October 2024.

Kind regards,

HSE Admin | CITIC Pacific Mining | Sino Iron project
T (08) 9178 3342 **| E** HSEadmin@citicpacificmining.com

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10) WAFIC response to CPM

From:	Olivia Mickle
To:	Harley Barron
Cc:	Brendan White
Subject:	RE: Contact details for Industry Stakeholder Consultation
Date:	Thursday, 17 October 2024 2:19:49 PM
Attachments:	image001.png image002.png

Hi Harley,

Thanks for providing a response to my questions.

At this stage WAFIC has not further comments/questions regarding this dredging program, however I would suggest contacting DPIRD (if haven't done so already), as this program may be of interest to their Environmental Impact Assessment team.

Kind regards,

Commercial Fishers…we're fishing for everybody

LIV MICKLE
Industry Liaison Officer

L1, 5A/166 Stirling Hwy
NEDLANDS WA 6009

wafic.org.au

From: Harley Barron <Harley.Barron@citicpacificmining.com>
Sent: Wednesday, 16 October 2024 12:06 PM
To: Olivia Mickle <olivia.mickle@wafic.org.au>
Cc: Brendan White <Brendan.White@citicpacificmining.com>
Subject: RE: Contact details for Industry Stakeholder Consultation

Hi Liv,

Thank you for your email, please find answers to your queries below.

Regards,

Harley Barron
T (08) 9226 8398 | M 0409 685 147
Advanced leave notice:

From: Olivia Mickle <olivia.mickle@wafic.org.au>
Sent: Friday, October 11, 2024 3:32 PM
To: Harley Barron <Harley.Barron@citicpacificmining.com>
Cc: Brendan White <Brendan.White@citicpacificmining.com>
Subject: RE: Contact details for Industry Stakeholder Consultation

Hi Harley,

Thank you for reattaching the document.

After reviewing it, I have the following questions:

- Has CMP identified any fisheries that will potentially be impacted by the activity?

  After having undertaken modelling of dredge plumes and evaluation of potential environmental impacts to marine and benthic organisms to support this Sea Dumping Permit Application, we do not believe there are potential impacts to commercial fisheries in the area. Our consultant advises that the Dredge Material Placement Area (DMPA) overlaps with the following State managed fisheries:
    - Pilbara Trap Managed Fishery: Pilbara Inshore Closed Waters
    - Onslow Prawn Managed Fishery
    - Pilbara Crab Managed Fishery
    - Mackerel Managed Fishery
    - Sea Cucumber Fishery
    - Marine Aquarium Fish Managed Fishery
    - Hermit Crab Fishery
    - Pearl Oyster Wildstock Fishery
    - Specimen Shell Managed Fishery

  The areas fished are typically very large (i.e. trap fishery = 24,520 nm^2). The proposed activities are of small scale and duration where any impacts to the environment are not considered significant. For example, plumes generated during the six-week of dredging and disposal activity are not predicted to impact benthic habitat outside of the direct disturbance footprint (i.e. only impact directly where dredging and/or disposal will be undertaken). To place this into context, the 5 ha of the Dredge Material Placement Area (DMPA) is indistinguishable on the 8.5-Million-hectare fishing zone of the trap fishery (<0.0000006% of fishing area for a period of six weeks). Further, recent catch effort indicates almost all fisheries do not fish within the vicinity of the DMPA, potentially with exception to the Mackerel Managed Fishery or Marine Aquarium Fish Managed Fishery. On this scale, it is presumed the proposed activities will not result in any measurable quantitative impact on any commercial fisheries. It is noted that the DMPA occurs within the boundary of the existing mining tenement General Purpose Lease G08/52.

  Please note that CITIC Pacific Mining has already received approval through the Environmental Protection Authority to undertake dredging and is authorised to approximately 4.5 million cubic metres of dredged material (please refer to

Ministerial Statement 635 on the EPA website). This Sea Dumping Permit Application form is for the federal Department of Climate Change, Energy, the Environment and Water.

- How has CPM addressed cumulative impacts on the commercial fishing?

  As above, there is not predicted to be any impact to commercial fishing from proposed small-scale dredging and disposal activities. Therefore, no contribution to broader cumulative impacts.

- Has the project considered sensitive environment windows, such as spawning for key commercial species (excluding coral)?

  Modelling results predict no impacts to phototrophic sensitive coral outside the dredging or disposal areas from generated suspended sediments. This describes that the scale of the activity is sufficiently small so that the maximum turbidity generated immediately next to dredging or disposal activities will still provide enough light through the water column to not even stress coral reefs. Therefore, it is unlikely that any non-photosynthetic organisms would be disturbed by the turbidity generated by proposed activities, even during the most sensitive life-history stage, as it would be difficult to distinguish this turbidity concentration from background natural variability. The only other species considered for environmental windows are threatened turtle and humpback whales which may be disturbed by noise or light generated during construction. Consideration of environmental windows for commercial species is considered overly precautionary for the scale of the activities.

- Is dredge spoil frequently placed in this location? If so, how has CMP addressed the cumulative impact of ongoing contaminant loading?

  Dredge spoil is not frequently placed in this location. This is the first Sea Dumping Permit Application prepared by CITIC Pacific Mining for the Sino Iron Project since the Port commenced construction in 2009. If approved, the existing application will only be relevant to a volume of 35,649 m^3. While a small volume of maintenance dredging will occur as part of the Project, most of the material will be dredged to deepen the natural depths of the Port to enable new transshipment vessels with a larger draft. The Project strategy to load transhipment vessels within the Port has minimised the requirement for maintenance dredging compared to the typical deep-water ports. Here, Ocean Going Vessels are loaded offshore in naturally deeper waters. It is possible further dredging may be required, although any ongoing requirement is not a component of the current application for disposal at the proposed DMPA and would be subject to further approvals.

WAFIC requests to be included in updates on the dredging program and any temporary marine notices to mariners prior to dredging and disposal commencing.

Noted, CITIC Pacific Mining will include WAFIC in updates on the dredging program and marine notices to mariners.

Kind regards,

Commercial Fishers…we're fishing for everybody

LIV MICKLE
Industry Liaison Officer

L1, 5A/166 Stirling Hwy
NEDLANDS WA 6009

wafic.org.au

From: Harley Barron <Harley.Barron@citicpacificmining.com>
Sent: Friday, 11 October 2024 12:29 PM
To: Olivia Mickle <olivia.mickle@wafic.org.au>
Cc: Brendan White <Brendan.White@citicpacificmining.com>
Subject: RE: Contact details for Industry Stakeholder Consultation

Hi Liv,

Thanks for your email. I can confirm that the dredge spoil will be placed offshore.

You can see the exact location of the dredged material placement area in Figure 1 (page 4 of 18) represented as a small pale pink box within the larger blue polygon, it is labelled as DMPA in the legend, I have reattached the document again for your convenience.

Table 2 is found on pages 5 – 11 within Section 2. Summary of potential environmental impacts.

Please let me know if the document is corrupt and we will try send again.

If you would like to discuss the programme please feel free to call. I will be in meeting this afternoon however Brendan White will be available to discuss on 9226 8039.

Regards,

Harley Barron
T (08) 9226 8398 | M 0409 685 147
Advanced leave notice:

From: Olivia Mickle <olivia.mickle@wafic.org.au>
Sent: Friday, October 11, 2024 11:52 AM
To: Harley Barron <Harley.Barron@citicpacificmining.com>
Subject: RE: Contact details for Industry Stakeholder Consultation

Hi Harley,

WAFIC has significant concerns on the potential impacts of dredging on our industry and the broader marine environment.

Since CPM dredging is occurring within the Port of Cape Preston and not within fishing grounds, our primary concern is the offshore release of dredge spoil. Could you confirm if the dredge spoil will be released offshore, and if so, could you provide the specific location? This information will help us assess the potential impact on our industry.

Additionally, I noticed that Table 2 was not included. Could WAFIC please receive further details on the management measures and monitoring efforts that will be implemented to minimise impacts?

Thank you.

Regards,

Commercial Fishers…we're fishing for everybody

LIV MICKLE
Industry Liaison Officer

L1, 5A/166 Stirling Hwy
NEDLANDS WA 6009

wafic.org.au

From: Harley Barron <Harley.Barron@citicpacificmining.com>
Sent: Tuesday, 8 October 2024 11:12 AM
To: Olivia Mickle <olivia.mickle@wafic.org.au>
Subject: RE: Contact details for Industry Stakeholder Consultation

Hi Liv,

Thanks for getting in touch.

CITIC Pacific Mining (CPM) plans to undertake a small capital dredging programme at the Port of Cape Preston, located in the west Pilbara region. This will return the harbour to natural depth and enable our contractors to utilise vessels with a deeper draft and larger capacity. CPM is seeking approval from the Environmental Protection Authority (WA) and the Department of Climate Change, Energy, the Environment and Water (Cth) to undertake these works. We have reached out to WAFIC (and a number of other stakeholders) to understand whether there are any comments from either WAFIC or WAFIC members with regard to this programme.

In brief:

- CPM already has approval to dredge 4.5 Mm^3 in accordance with Ministerial

- Statement 635, however is required to submit an additional management plan for approval.
- This dredging programme is significantly smaller than the approved dredge amount, approximately 36,000m^3 and will be completed within 6 weeks.
- Modelling and assessment of potential impacts has been undertaken by specialist consultants and found to meet the Environmental Protection Authority objectives for the relevant environmental factors.
- Management measures and monitoring of impacts will be undertaken to minimise impacts. Table 2 of the previously supplied information contains this information.

Please feel free to contact me if you'd like to discuss further.

Regards,

Harley Barron | Manager – Environment
CITIC Pacific Mining | Sino Iron project | Cape Preston
PO Box 2732 Perth WA 6000
T (08) 9226 8398 | M 0409 685 147| E
mailto:harley.barron@citicpacificmining.com

Advanced leave notice:

From: Olivia Mickle <olivia.mickle@wafic.org.au>
Sent: Tuesday, October 8, 2024 10:04 AM
To: Harley Barron <Harley.Barron@citicpacificmining.com>
Subject: RE: Contact details for Industry Stakeholder Consultation

Hi Harley,

Thanks for reaching out, and apologies for my delayed response.

I am the point of contact at WAFIC to discuss a dredging programme at the Port of Cape Preston in the Pilbara. If you could provide some context on this project and your reason for reaching out, I'd greatly appreciate it.

Regards,

Commercial Fishers…we're fishing for everybody

LIV MICKLE
Industry Liaison Officer
L1, 5A/166 Stirling Hwy

NEDLANDS WA 6009

wafic.org.au

From: Harley Barron <Harley.Barron@citicpacificmining.com>
Sent: Friday, 27 September 2024 1:39 PM
To: WAFIC Administration Officer <admin@wafic.org.au>
Subject: Contact details for Industry Stakeholder Consultation

> You don't often get email from harley.barron@citicpacificmining.com. Learn why this is important

Hi,

Can you please advise who I can contact to discuss a dredging programme CITIC Pacific Mining intend to undertake in the near future at the Port of Cape Preston in the Pilbara?

Regards,

Harley Barron | Manager – Environment
CITIC Pacific Mining | Sino Iron project | Cape Preston
PO Box 2732 Perth WA 6000
T (08) 9226 8398 | M 0409 685 147| E
mailto:harley.barron@citicpacificmining.com

Advanced leave notice:

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11) Recfish West response to CPM

From:	Emma Rayson
To:	Harley Barron; Brendan White
Cc:	Oliver Krumholz
Subject:	FW: ENVDR-1084915869-4351 LTR2024.10.11 CPM to Recfishwest Stakeholder Consultation to Support SDP Application
Date:	Monday, 21 October 2024 3:52:30 PM
Attachments:	image001.png

FYA

Regards,

Emma Rayson | Senior Administrator HSE | 08 9226 8722

From: Danielle Hartshorn <danielle@recfishwest.org.au>
Sent: Monday, 21 October 2024 3:51 PM
To: Emma Rayson <Emma.Rayson@citicpacificmining.com>
Cc: Matt Gillett <matt@recfishwest.org.au>; James Florisson <james@recfishwest.org.au>
Subject: RE: ENVDR-1084915869-4351 LTR2024.10.11 CPM to Recfishwest Stakeholder Consultation to Support SDP Application

Good afternoon Emma

Thank you for your email in relation to CITIC Pacific Mining's (CPM's) proposal to implement a dredging program within the Cape Preston Port.

It is noted that activities will include dredging approximately 36,000 m^3 of material and disposing it within a proposed spoil ground located about 500 m NE of the Port infrastructure, within tenement G08/52.

Given that the surrounding area, including Gnoorea and 40 Mile Beach, is popular among recreational fishers, it is recommended that CPM makes contact with fishing clubs in Dampier and Karratha to inform them of this project. Relevant clubs include:

- King Bay Game Fishing Club (presidentkbgfc@gmail.com); and
- Nickol Bay Sportfishing Club (nbsfc@hhbsc.com.au).

Please feel free to reach out if you have any questions.

Kind regards
Danielle

Danielle Hartshorn
Policy and Approvals Lead MEnvLaw

recfishwest
Suite 3, 45 Northside Drive, Hillarys WA 6025
Tel: (08) 9246 3366
Mob: 0431 343 981
Web: recfishwest.org.au
facebook.com/recfishwest

From: Emma Rayson <Emma.Rayson@citicpacificmining.com> **On Behalf Of** HSE admin
Sent: Friday, October 11, 2024 12:04 PM
To: Info <info@recfishwest.org.au>
Cc: HSE admin <HSEadmin@citicpacificmining.com>; Harley Barron <Harley.Barron@citicpacificmining.com>
Subject: ENVDR-1084915869-4351 LTR2024.10.11 CPM to Recfishwest Stakeholder Consultation to Support SDP Application

Attention: Recfishwest

Please find attached CPM letter (ENVDR-1084915769-4351) together with attachments, seeking feedback on CITIC Pacific Mining's proposed capital dredging programme.

Please note that feedback is required by close of business Friday 25th October 2024.

Kind regards,

HSE Admin | CITIC Pacific Mining | Sino Iron project
T (08) 9178 3342 **| E** HSEadmin@citicpacificmining.com
