

CSDP Northern Sands DMPA

Site Based Management Plan

Date	Custodian	Approved	Version
July 2018	Ports North	Alan Vico	Draft for Adequacy Check
August 2018	Ports North	Alan Vico	CRC Submission
November 2018	Ports North	David Finney	Revised Application Final
February 2019	BMT	Lisa McKinnon	TAG Review
April 2019	Ports North	Adam Fletcher	TAG Endorsement
June 2019	Ports North	Adam Fletcher	DoEE Approval

Table of Contents

Abbreviations.....	3
1 Introduction	4
1.1 OBJECTIVE	5
1.2 SCOPE	6
2 Project Description	7
2.1 NORTHERN SANDS DREDGE MATERIAL PLACEMENT AREA (NS-DMPA OR DMPA)	7
2.2 RECEIVING ENVIRONMENT.....	12
3 Legislative Requirements.....	14
4 Management Structures, Accountability and Responsibilities.....	16
4.1 PORTS NORTH ENVIRONMENTAL POLICY	17
4.2 PORTS NORTH’S ENVIRONMENTAL MANAGEMENT SYSTEM (EMS)	17
4.3 INCIDENT MANAGEMENT	17
4.4 TECHNICAL ADVISORY GROUP	18
4.5 ROLES AND RESPONSIBILITIES	19
5 Summary of Potential Impacts	20
5.1 DMPA STORMWATER AND FLOODING IMPACT MANAGEMENT	28
5.1.1 Water and Materials Balance Summary.....	28
5.1.2 Stormwater and Flooding Remediation Management Rationale.....	28
6 Environmental Management Controls	32
6.1 LAND.....	32
6.2 GROUNDWATER	33
6.3 FLOODING	36
6.4 TAILWATER MANAGEMENT.....	37
6.5 WATER QUALITY.....	40
6.6 EROSION AND SEDIMENT CONTROL	42
6.7 REHABILITATION AND FINAL LANDFORM.....	46
6.8 NOISE.....	49
6.9 AIR QUALITY	50
6.10 CULTURAL HERITAGE	51
6.11 BIODIVERSITY MANAGEMENT.....	52
7 Notification, Monitoring, and Reporting	53
7.1 CONSTRUCTION, OPERATION, AND DECOMMISSIONING PHASES	53
7.2 POST PLACEMENT HANDOVER PHASE	57
7.3 COMPLAINTS.....	58
7.4 AUDITING.....	58

7.5 RECORD KEEPING.....	58
8 Continual Improvement.....	59
9 Authorship	61
10 References	62
11 Appendices	63

Tables

Table 1 Roles and Responsibilities	19
Table 2 Actual, Potential, and Residual Adverse Impacts, and Likelihood	21
Table 3 DMPA Stormwater and Flooding Remobilisation Management Rationale.....	29
Table 4 EA End of Pipe Tailwater Release Limits	38
Table 5 Barron River REMP Water Quality Limits	38
Table 6 DMPA Notification, Monitoring, and Reporting Requirements	53
Table 7 Operation Phase Auditing Requirements.....	58
Table 8 TAG Communications.....	59
Table 9 Ports North Project Team Communications	60

Figures

Figure 1 Project Reports and Management Plans	5
Figure 2 Final Void Footprint and Storage Volumes FCG Sketch 3527- SK14G.....	8
Figure 3 General Arrangements FCG Sketch 3527-SK21D	9
Figure 4 Barron River Discharge Point FCG Drawing 3527-C368 Rev A.....	10
Figure 5 Drainage Pathways for Northern Sands DMPA Site Post-Placement and Bund Removal	11
Figure 6 Sensitive Receptors downstream of Northern Sandss Site.....	13
Figure 7 CSDP DMPA Environmental Management Reporting Responsibilities.....	16
Figure 8 Water Quality Monitoring Sites	39

Appendices

Appendix A	Relevant Project Drawings and Management Plans
------------------	--

Abbreviations

ASSMP	Acid Sulfate Soil Management Plan
CSDP	Cairns Shipping Development Project
CRC	Cairns Regional Council
DAF	Department of Agriculture and Fisheries
DES	Department of Environment and Science
DMP	Dredge Management Plan
DMPA	Dredge Material Placement Area
DoEE	Department of Environment and Energy
EA	Environmental Authority
EIS	Environmental Impact Statement
EMS	Environmental Management System
E&SC	Erosion and Sediment Controls
FNQROC	Far North Queensland Region of Councils
FRA	Flood Risk Assessment
GWA	Groundwater Assessment
PN	Ports North
NS	Northern Sands
RD-EIS	Revised Draft Environmental Impact Statement for the CSDP
SBMP	Site Based Management Plan
SWMBA	Site Water and Materials Balance Assessment
SWESCP	Storm Water and Erosion and Sediment Control Plan
TAG	Technical Advisory Group

1 Introduction

This document has been developed by Ports North and their consultant team for the construction and operation of the Northern Sands Dredge Material Placement Area (DMPA), which is a key component of the Cairns Shipping Development Project (CSDP – the project). This document is compliant with the Development Permit for Material Change of Use for Dredging (Concurrence ERA16) and Undefined Use under Cairns Plan 2016.

The DMPA is under the control of Northern Sands Pty Ltd, who currently operates the facility as a commercial landfill (outside of the DMPA footprint) and gravel supply yard under approvals from the Department of Environment and Science (DES) and Cairns Regional Council (CRC). They have mined sand material from the void in the past under these licences. Ports North will take control of the site just prior to material placement, and dredging of sand material from the void by Northern Sands Pty Ltd will cease. Ports North will remain in control of the site until all conditions of their state and council approvals are met, which includes settlement of placed material to the satisfaction of approval authorities. Once these conditions are met, Ports North will surrender their approvals, and the site will be handed back to Northern Sands Pty Ltd.

This document forms the Northern Sands Management Plan that requires approval under Condition 7 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) approval.

This plan should be read in conjunction with the Dredge Management Plan (DMP) for the project, which encompasses environmental management measures to be implemented for dredging activity and construction/demobilisation of the dredge delivery and discharge pipelines – including disposal and management of dredge spoil into the DMPA. The DMP and the Northern Sands Site Based Management Plan (SBMP – this document) are stand-alone documents, but do interact to some extent.

An overview of the various reports and management plans that will direct the environmental performance and monitoring of the capital dredging project (and their scope) are illustrated in **Figure 1**.

Note: This SBMP forms part of the contractual requirements for the dredging contractual documents and may be subject to refinements. It provides a framework that will be used to guide site establishment, construction, operation, and decommissioning stages of the Northern Sands DMPA only.

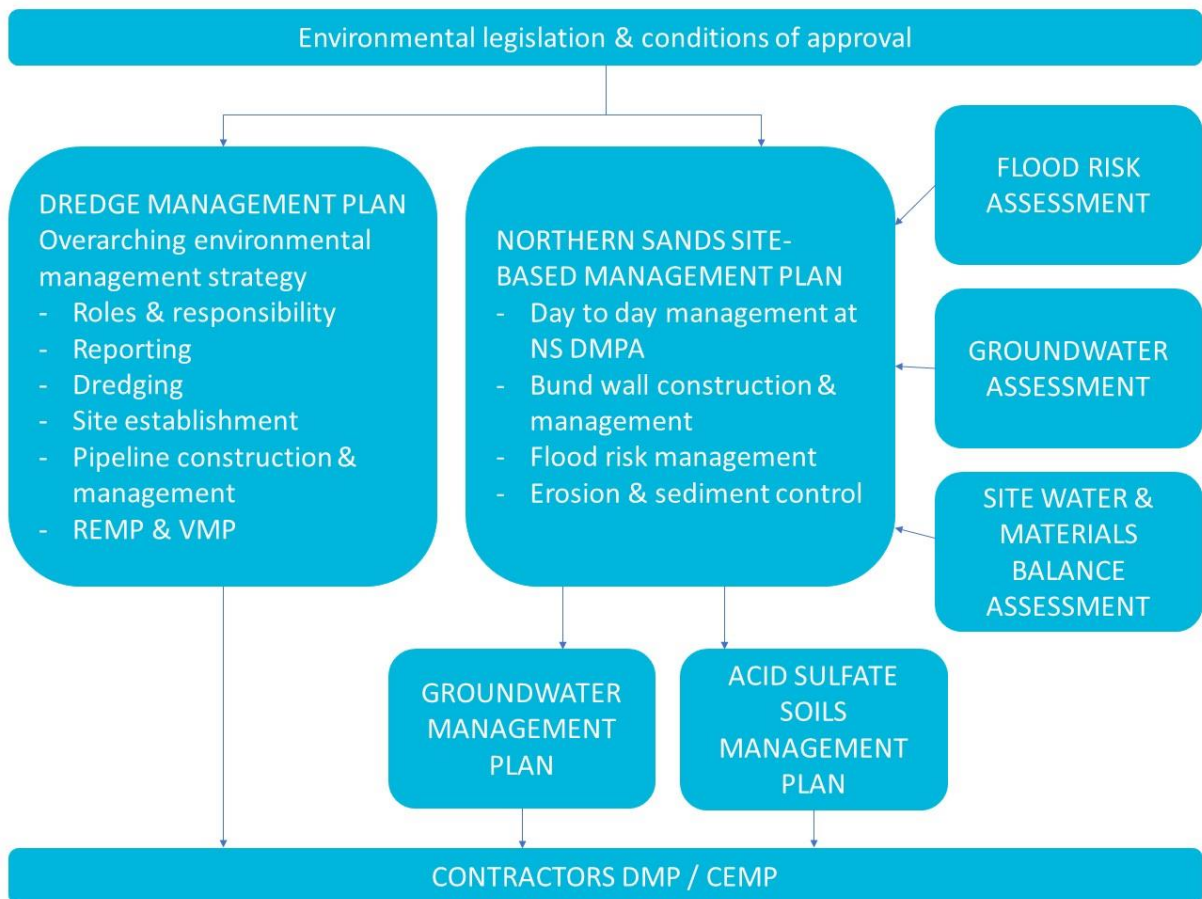


Figure 1 Project Reports and Management Plans

1.1 Objective

The objective of this SBMP is to achieve the following:

- Provide practical and achievable strategies and plans for complying with environmental requirements for the management of the Northern Sands DMPA pre, during, and post placement whilst in the control of Ports North;
- Demonstrate compliance with relevant legislative obligations related to the Northern Sands DMPA;
- Outline performance criteria to be met for the discharge of tailwater from the DMPA;
- Provide evidence to stakeholders and the community that construction and operation of the Northern Sands DMPA will be managed in an environmentally, socially and economically responsible manner; and
- Specify roles and responsibilities, monitoring regimes and corrective actions.

The document provides a basis for the Dredge Contractor to assist in the preparation of the various detailed Management Plans, for the components applicable whilst they have a role at the site.

Objectives and performance criteria for the sub-ordinate plans (e.g. GWMP) are contained within those documents, with intent reflected herein, however the relevant document should be referred to where further detail is required.

1.2 Scope

This document draws on relevant sections of the documents described below, as illustrated in **Appendix A** and outlined below;

- CSDP Revised EIS Chapter C1 Construction Environmental Management Plan (2017);
- Dredge Management Plan (BMT; March 2019);
- Conditions of approval issued under the following approvals:
 - Operational works for bulk earthworks issued by CRC (8/10/782)
 - Material Change of Use for an unconfined use issued by CRC (8/8/1511)
 - Environmental Authority for an Environmentally Relevant Activity issued by DES (EA0001463)
- Acid Sulfate Soil Management Plan (Golder Associates, 2019a) including:
 - Procedure BD-A Characterisation and Verification of Self-Neutralising PASS (SNP) Dredged Material;
 - Procedure BD-B Treatment and Verification of Dredged Potential Acid Sulfate Soil (PASS); and
 - Procedure BD-C Future Filing Over Placed Dredge material;
- Site Water and Materials Balance Assessment (Flanagan Consulting Group; November 2018)
- Flood Risk Assessment (BMT, November 2018)
- Groundwater Management Plan (Golder Associates, March 2019b)
- DMPA Geotechnical Design Input Report (Golder Associates, 2018)

This document is to be dynamic and subject to continual review, with particular hold points such as development of the Dredge Contractor Environmental Management Plan.

2 Project Description

2.1 Northern Sands Dredge Material Placement Area (NS-DMPA or DMPA)

Soft Clays materials dredged from the Trinity Inlet Shipping Channel are to be transported to a Pump-out facility located approx. 3 km offshore from the mouth of Richter's Creek and pumped via approx. 8 km of submerged, floating, and land based pipeline to the Northern Sands DMPA for placement. Northern Sands is an existing void created by current and historic sand extraction activities on the Barron Delta and the intended DMPA areas is currently being expanded by continuation of sand mining to the north of Lot 2. All activities by Northern Sands within the intended DMPA facility will cease prior to the dredged material placement.

The estimated volume of the Northern Sands void below nominal ground level (RL 3.5 m AHD) at the time for commencement of placement (June 2019) is estimated to be approx. 2,350,000 m³. The estimated volume of the "bulked up dredge material is 1,970,000 m³. An allowance for a minimum 1 m depth of water above the placed material level at completion of placement requires a volume of approx. 400,000 m³.

The void capacity will be enhanced via the construction of temporary bund walls with a crest level of RL 4.5 m AHD to provide capacity to accept the "bulked up material" and the volume of retained water required to meet WQ limits prescribed for discharge of displaced fresh water from the void, transport water and supernatant generated by the consolidation on of the placed material as well as a min 600 mm freeboard (refer **Figure 2**).

To allow for the maximum consolidation period prior to the onset of the 2020 wet season, the dredging and placement of material in the DMPA is required to be conducted in the period May (earliest start) to September (latest finish). It is anticipated that the dredging will be completed within a nominal 12-week dredging programme. Duration of the dredging campaign could however be subject to more than statistically foreseen weather delays and pond management measures.

General arrangements of the proposed DMPA infrastructure are shown in **Figure 3**.

The tailwater from the Northern Sands DMPA will be transported to the Barron River adjacent to the Captain Cook Highway Bridge (**Figure 4**) via a 550mm to 800 mm diameter pipeline placed on ground, or supported up to 500 mm above the natural ground level, where necessary. The pipeline will exit the DMPA site at the north-eastern corner and will traverse the road reserve adjacent to the Captain Cook Highway corridor through to the Barron River discharge point.

A discharge pipeline diffuser will be suspended from two pontoon units temporarily moored with anchors in the Barron River at the discharge location upstream of the Captain Cook Bridge (-16.869°, 145.735°). The diffuser will be approximately 3 m in diameter and up to 4 m in height. The pontoon units will be approximately 6 m long by 2 m wide and 1-2 m deep.

Post-placement and discharge of tailwater, the bunds will be gradually lowered and excess water discharged via dedicated flow paths and a spillway (**Figure 5**). These will be kept in place after completion of the works to allow for ongoing site water balance management.

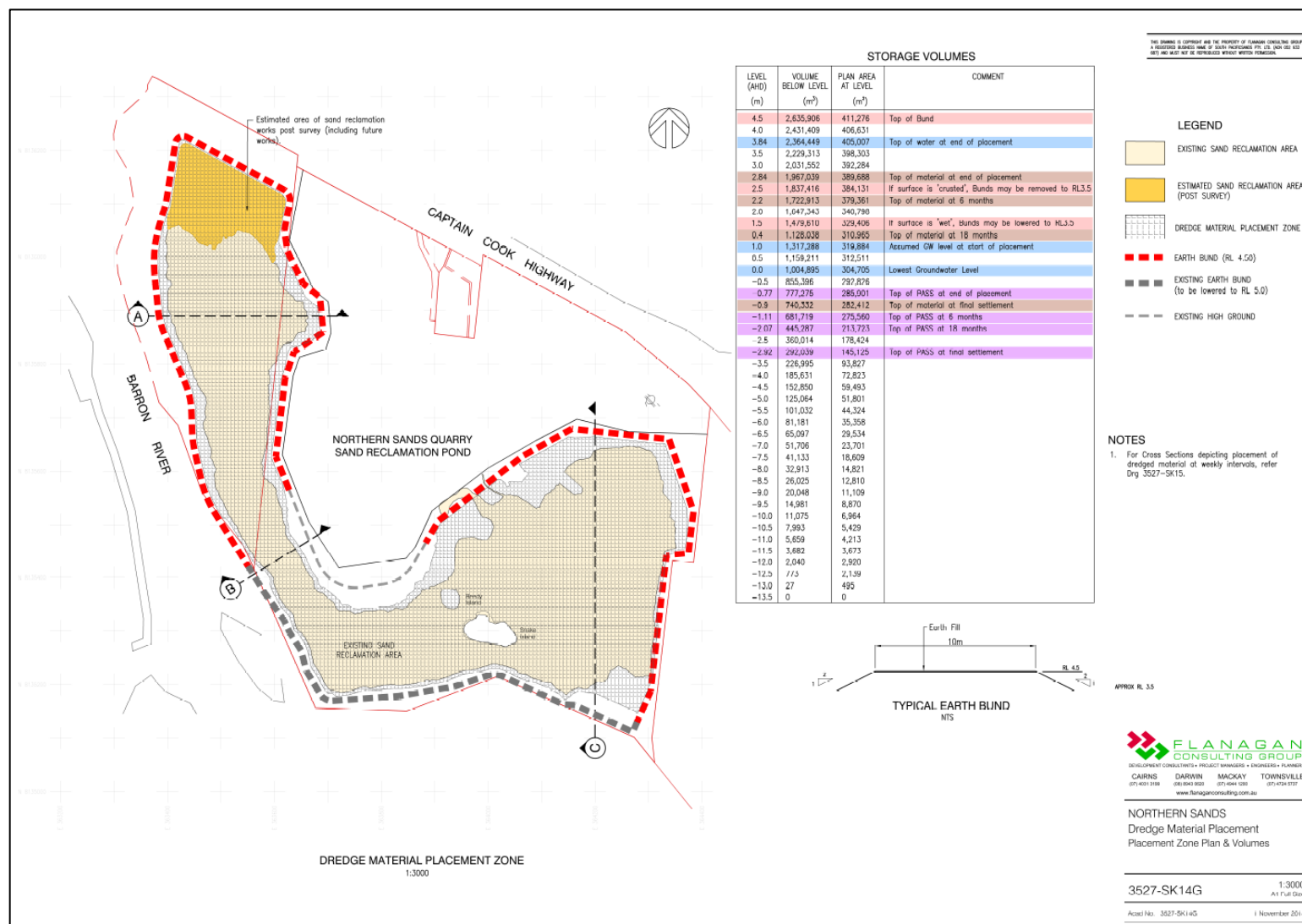


Figure 2 Final Void Footprint and Storage Volumes FCG Sketch 3527- SK14G

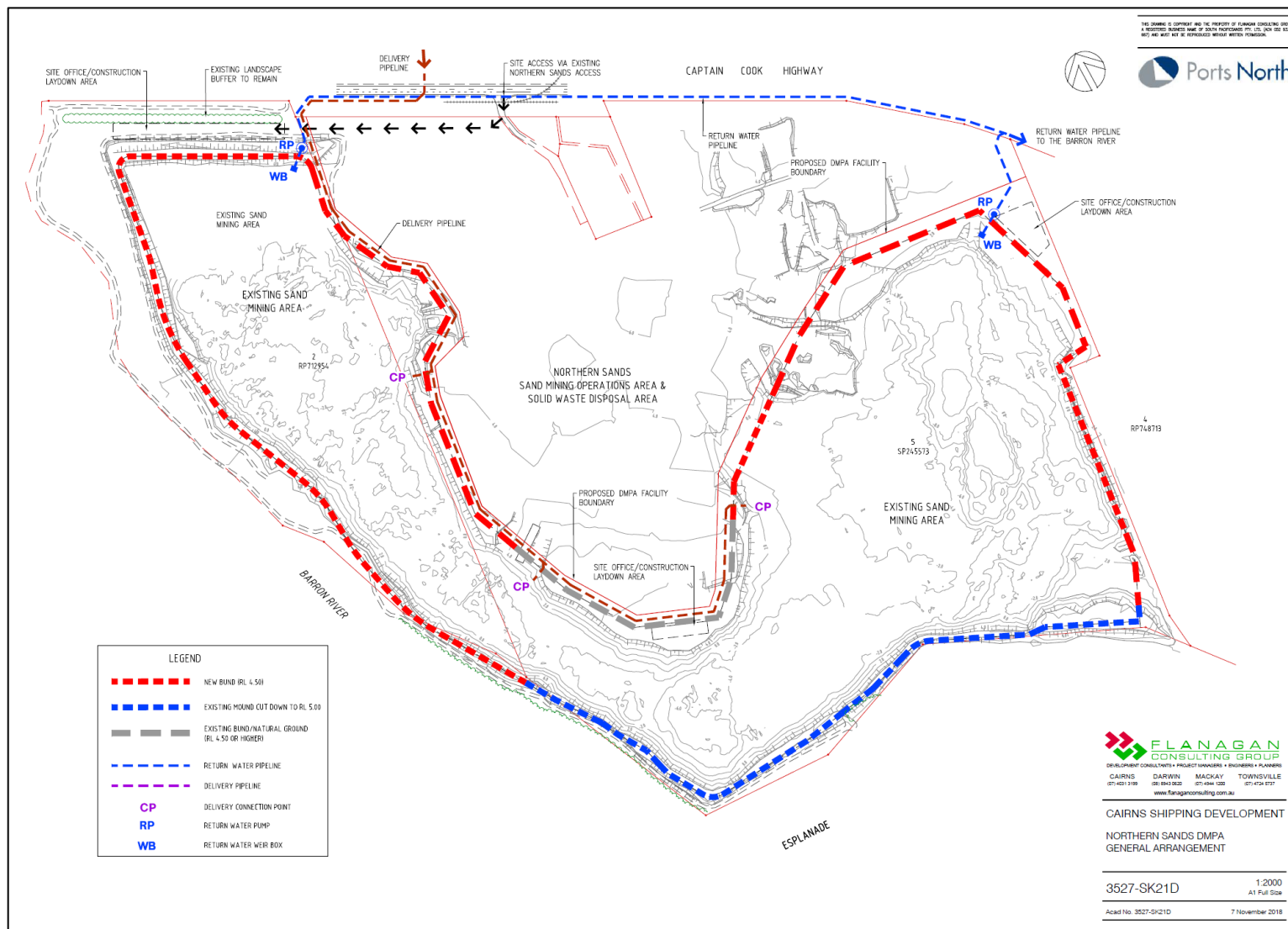


Figure 3 General Arrangements FCG Sketch 3527-SK21D

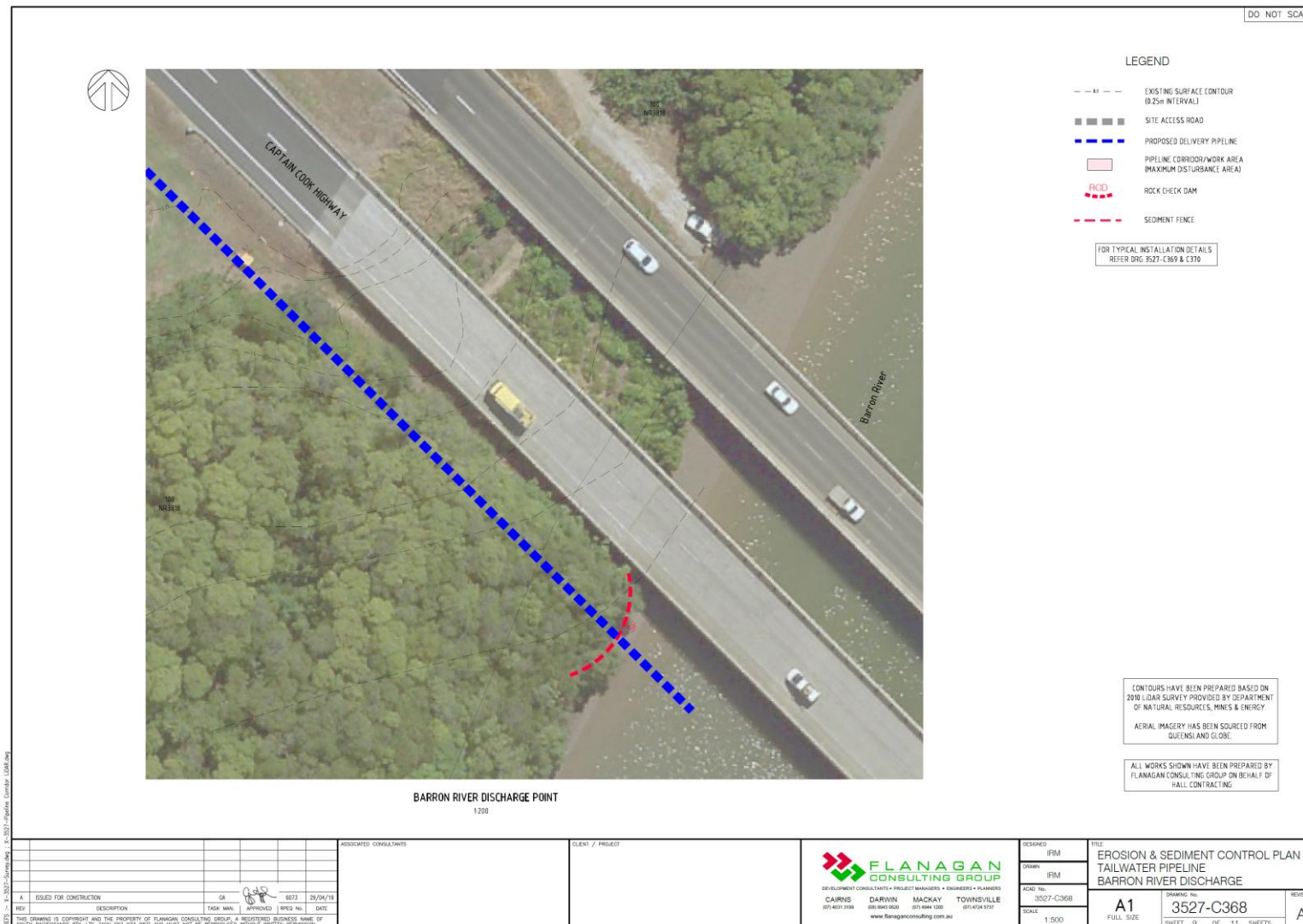


Figure 4 Barron River Discharge Point FCG Drawing 3527-C368 Rev A

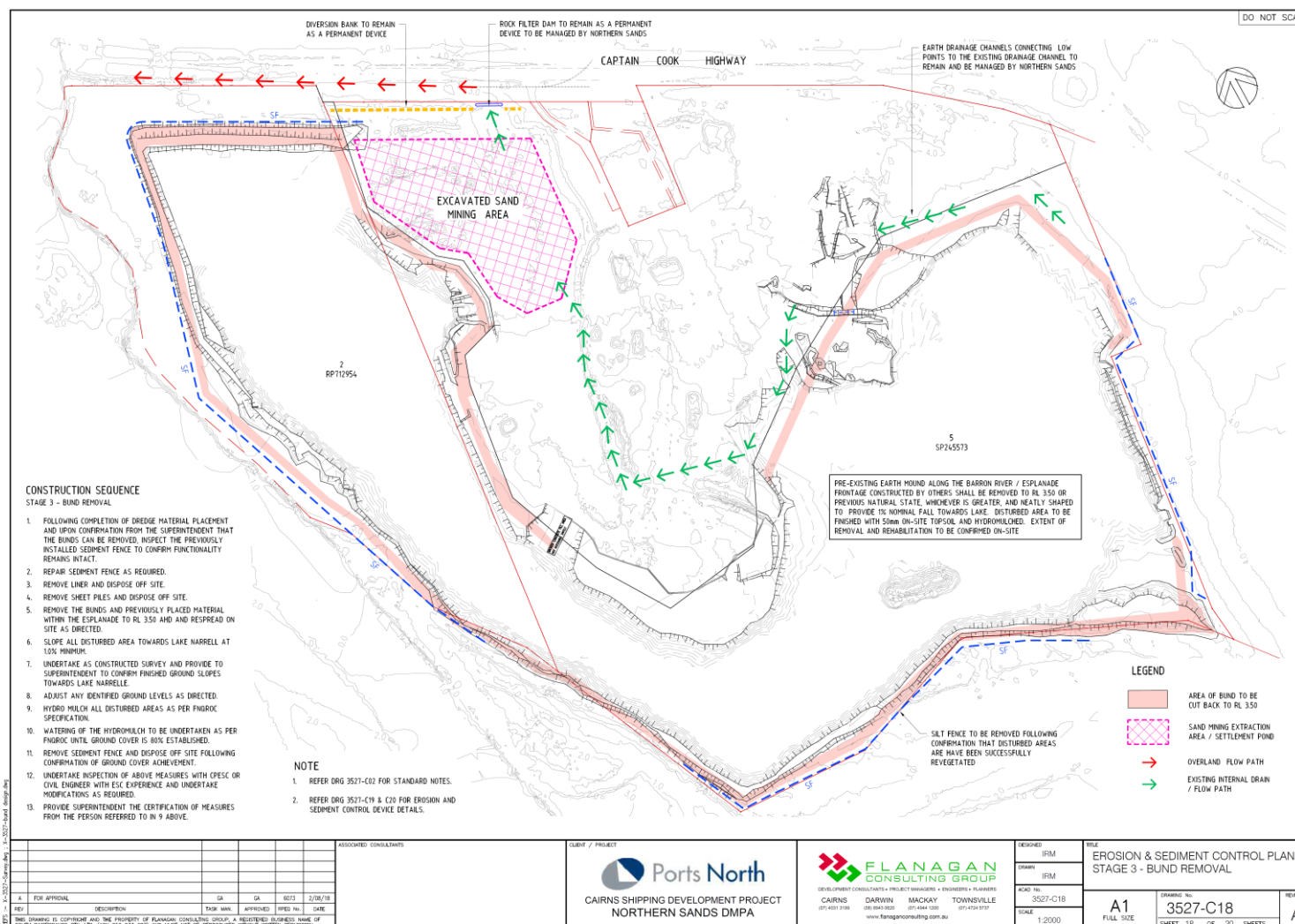


Figure 5 Drainage Pathways for Northern Sands DMPA Site Post-Placement and Bund Removal

2.2 Receiving Environment

The Northern Sands DMPA site and the tailwater discharge point occur within the lower reaches of the Barron River. This area was surveyed in 2016 as part of the EIS, which found the following:

- The mouth of the Barron River had large amounts of accreted and re-worked sand, with sections showing obvious accretion while others appeared to be actively eroding. Erosions were evident particularly along the southern shore of the Barron near the mouth, and frequently along the outside meanders of each river bend.
- In the lower estuary (upstream of the river mouth), the mangroves *Bruguiera* and *Rhizophora* dominated on the outside of eroding meander bends, whereas *Avicennia* and *Sonneratia* dominated on the inside accreting meanders and straight sections of the river. There were several sections of bank showing major disturbances to riparian vegetation, along the downstream left bank in particular.
- Near the airport, the downstream right bank (on the airport side) had series of major bank stabilisations in the form of rock armour at the base of the mangroves on the outside meander. Recruiting mangroves were observed growing in gaps in the armour.
- The riparian zone was in relatively good condition throughout the lower and mid-sections of the Barron River. Occasional dead and fallen trees were present along the actively eroding outside meanders of the Barron River, but no areas of dieback were observed.
- At the first bend upstream of the Bruce Highway Bridge, pockets of non-mangrove riparian habitat begin to become more prevalent in the riparian fringe. At this bend, the downstream right bank has a large number of *Melaleuca* and other less marine tolerant species growing down towards the high water mark.
- From the Bruce Highway Bridge to Northern Sands the proportion of mangroves in the riparian fringe becomes progressively less, to the point where mangroves are no longer present upstream of the Northern Sands site.

Mangroves downstream of the DMPA site and tailwater discharge point are shown in **Figure 6**. This is based on State Government regional ecosystem mapping and therefore provides the indicative presence of these mangroves. It is noted that baseline studies during the EIS identified the extent is known to include fringing mangroves along most of the lower Barron River upstream and downstream of the discharge point.

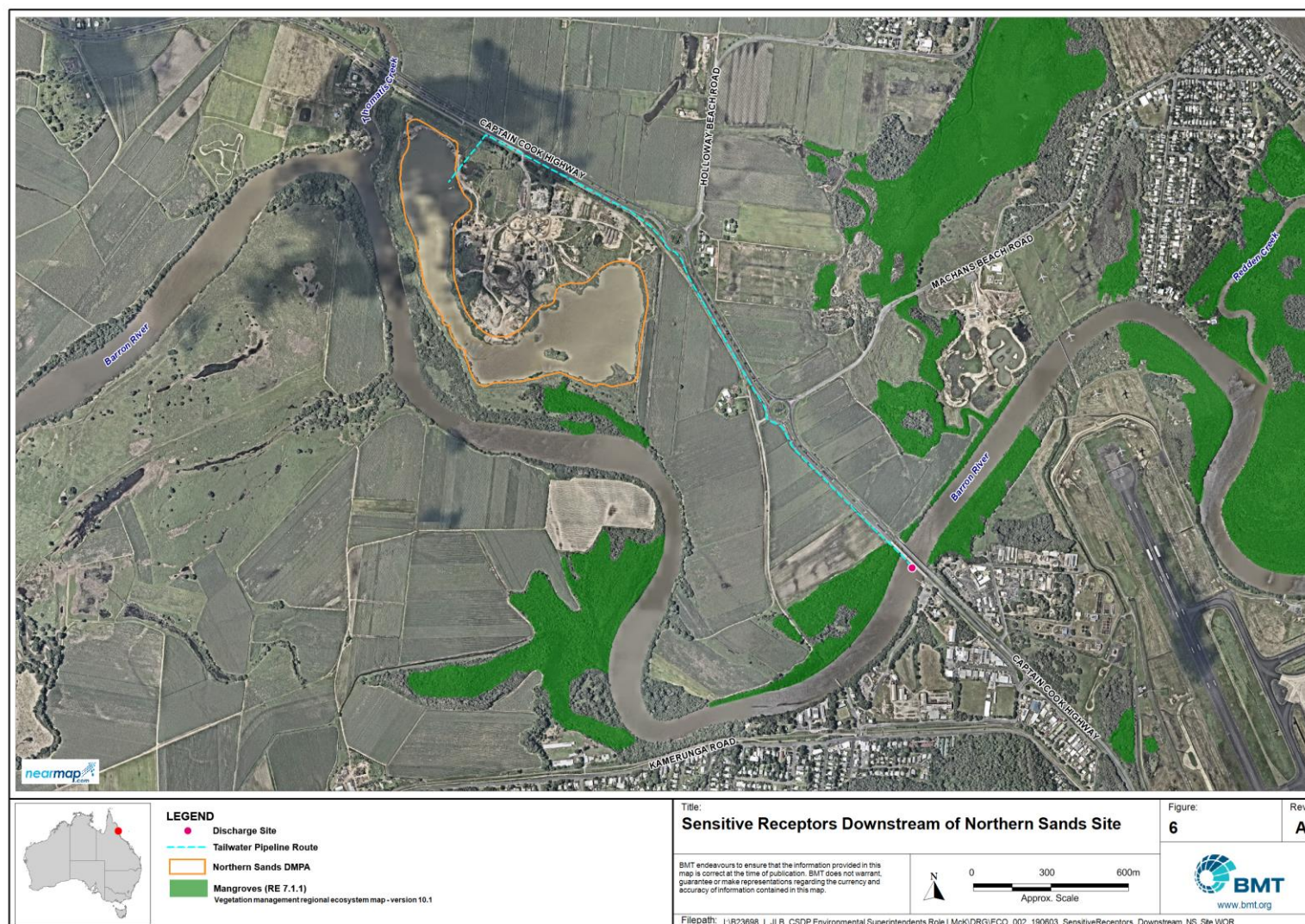


Figure 6 Sensitive Receptors downstream of Northern Sandss Site

3 Legislative Requirements

The SBMP has been developed in accordance with and considering legislative requirements set out in Acts and Regulations at Commonwealth and State level that are listed below. Further, while all consents and approvals have not yet been issued for the Project, the SBMP has been developed to include measures that Ports North believes are necessary for protection of sensitive environments that could be affected by the dredging and land based placement activity.

Commonwealth legislation considered in development of this DMP (including Acts implementing relevant international conventions) includes:

- *Environment Protection and Biodiversity Conservation Act 1999.*
- *Great Barrier Reef Marine Parks Act (1975) and regulations*
- *Great Barrier Reef Marine Park Amendment (Capital Dredge Spoil Dumping) Regulation 2015*

The following State legislation is relevant to the proposed dredging:

- *Aboriginal Cultural Heritage Act, 2003;*
- *Biosecurity Act 2014 and Regulation, 2016;*
- *Coastal Protection and Management Act 1995 and Coastal Management Plan;*
- *Environmental Offsets Act 2014;*
- *Environmental Protection and Biodiversity Conservation Act, Environmental Offsets Policy 2013;*
- *Environmental Protection Act 1994, and Environmental Protection Regulation 2014;*
- *Fisheries Act 1994 and Regulations;*
- *Nature Conservation Act 1992 and Conservation Plans;*
- *Land Act 1994*
- *Native Title (Queensland) Act 1993*
- *Nature Conservation Act 1992;*
- *Planning Act 2016, and Planning Regulation 2017;*
- *Soil Conservation Act 1996;*
- *Sustainable Ports Development Act 2015;*
- *Transport Infrastructure Act 1994;*
- *Transport Operations (Marine Pollution) Regulation 2008;*
- *Water Act 2000;*
- *Vegetation Management Act 1999;*
- *Waste Reduction and Recycling Act 2011.*

Relevant national, state, regional, and local plans and policies include:

- Australian Maritime Safety Authority Marine Orders;
- Cairns Plan 2016;
- Ports North (Cairns Port Authority) Land Use Plan (LUP);
- Environmental Protection Policies (EPP), (Air, Noise, Water);
- Environmentally Relevant Activities (ERA);

- Great Barrier Reef Marine Park - Draft Policy - Cruise Ship Operations within the Great Barrier Reef, (2018);
- Maritime Safety Queensland Regulation (2002);
- National Assessment Guidelines for Dredging (2009);
- National Strategy for Ecologically Sustainable Development (1992);
- Queensland Biosecurity Strategy (2018-2023);
- Queensland Coastal Plan (2011);
- Queensland Coastal Contingency Action Plan (QCCAP 2018);
- Queensland Ports Strategy (2014);
- Reef 2050 Long Term Sustainability Plan (2015);
- Standards for Hydrographic Surveys within Queensland Waters;
- State Development Assessment Provisions (SDAP);
- State Planning Policy (2017); and
- State Planning Regulatory Provisions (SPRP).

4 Management Structures, Accountability and Responsibilities

The dredging and placement works associated with the CSD project will be undertaken in accordance with Port North's overarching environmental management framework outlined below; incorporating the reporting responsibility structure identified in **Figure 7**.

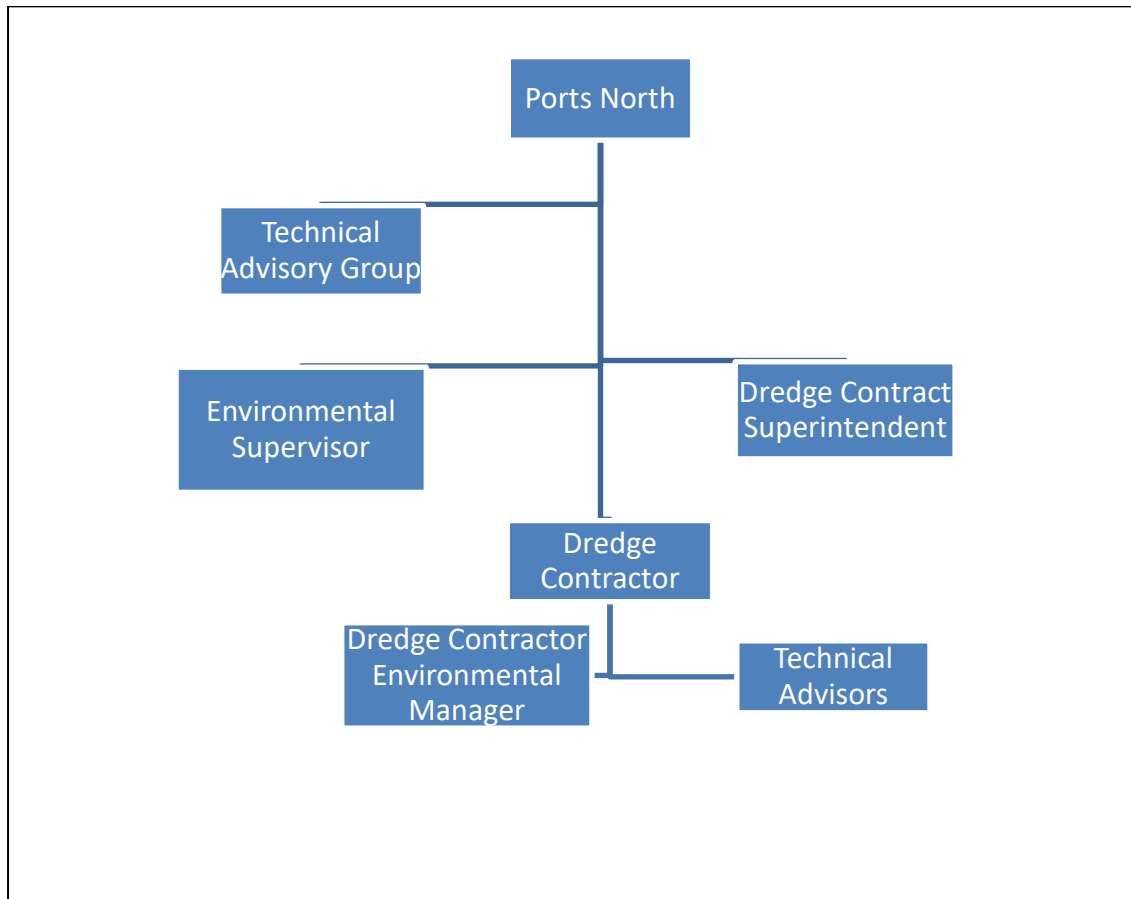


Figure 7 CSDP DMPA Environmental Management Reporting Responsibilities

4.1 Ports North Environmental Policy

The Ports North Environmental Policy has the following commitments to demonstrate environmental leadership:

- Implement and maintain an environmental management system to meet the standard set by AS/NZ ISO14001:2004, as a tool for continual improvement in environmental performance;
- Comply with relevant environmental laws, regulations, policies, procedures, and standards;
- Identify, assess, and minimise environmental risk and impacts of port activities;
- Integrate environmental considerations and principles of sustainable development into management processes and decision making;
- Maintain emergency, fire protection, security systems and infrastructure to protect the environment;
- Strive to use resources efficiently, minimise waste and prevent pollution;
- Apply sufficient and appropriate people and resources to achieve this Environmental Policy;
- Define, measure and report regularly against objectives and targets and review the effectiveness of performance;
- Communicate this policy to staff and stakeholders to build collaborative relationships to promote superior environmental outcomes; and
- All construction contractors should be familiar with this policy and actively promote achievement of these commitments in consultation with Ports North.

4.2 Ports North's Environmental Management System (EMS)

Ports North maintains an Environmental Management System (EMS) that is consistent with international standard ISO14001:2004. This EMS identifies all risks including safety, business and environment as well as management controls or actions to prevent or minimise impacts. A register of risks and treatment plans is maintained for all significant risks. A key element of the EMS is the commitment to conducting environmental audits of all construction activities so that risks associated with these are identified so that Ports North can verify that relevant permits, licences, and project objectives are being achieved.

The Construction Contractor(s) will be required, as a condition of the works contract, to establish and implement relevant management plans, procedures and reporting to enable Ports North to ensure project permit and approvals requirements are met. Ports North will inform the appointed contractor of requirements to ensure the project objectives are being achieved consistent with the EMS framework.

4.3 Incident Management

Ports North has a system in place for recording, reporting and investigating incidents that result in, or have the potential to result in, adverse environmental impacts. This ensures that all environmental incidents and near miss events are investigated in an effective and timely manner to ensure the cause is identified and corrective actions completed.

The dredging contractors will have an obligation to report events that have or may cause environmental harm to Ports North and to respective agencies as required under applicable laws and conditions.

4.4 Technical Advisory Group

To assist in finalisation of the document, the SBMP is to be subject of review by an advisory panel of experts (TAG) reporting to Ports North, and then submitted to the administering authority at least 50 business days prior to the commencement of dredging. The TAG members have been appointed by by Ports North and include:

- Independent Chair;
- Experts in the field of:
 - Coral biology;
 - Seagrass biology;
 - Marine megafauna biology (turtles, dugongs and cetaceans);
 - Dredging operations;
 - Groundwater and Acid Sulfate Soils;
 - Coastal hydrodynamics and sediment transport; and
 - Water quality.

The TAG has been established as a requirement of approvals issued under the Queensland State approvals, to meet conditions thereof. The Group functions as a consultative mechanism for the capital dredging and will assist Ports North and regulators to access technical and local knowledge to ensure compliance with monitoring and approval conditions. The advice to be provided by the TAG will assist Ports North in reconciling technical outputs of the monitoring with any responses to various stakeholder interests. The primary objective of the Group is the review of the Dredge Management Plan, (and the sub-ordinate plans), monitoring designs, and to provide advice to Ports North and regulators on the management response to the outcomes of the monitoring results, to ensure consistency with the DMP and project approval conditions.

The purpose of the TAG is to undertake the following, where it relates to management of the Northern Sands DMPA:

- Provide technical advice to Ports North and regulatory agencies on risk management techniques to minimise the impacts of dredging and marine construction works associated with the CSD Project on the marine ecology of Trinity Inlet/Bay and surrounds.
- Provide independent, expert based input on the scientific basis underlying contingency measures.
- Provide advice and endorsement of the proposed management and monitoring strategies associated with the dredging and marine construction works to address conditions associated with regulatory agency marine environmental permits and approvals.
- Provide advice, review, and endorsement of the Reactive Monitoring Programs (RMPs) and Validation Monitoring Programs (VMPs) including those related to tailwater released from the DMPA to the Barron River.
- Provide input on the effectiveness of implementation of the environmental management plans associated with the dredging and marine construction works including this plan and provide input where corrective actions may need to be implemented.

4.5 Roles and Responsibilities

All parties involved with the project are required to undertake work in accordance with all relevant Acts, Policies, and Regulations. **Table 1** outlines the roles and responsibilities for each party taking part in management of the Northern Sands DMPA.

Table 1 Roles and Responsibilities

Role	Responsibility
The Proponent (Ports North)	• Ensure all necessary environmental approvals are secured prior to commencement of work • Minimise the potential environmental impacts associated with the placement of material at the DMPA • Address issues raised by the community • Ensure that the Dredge Contractors have appropriate and approved environmental controls and systems in place and have constructed the facilities in accordance with the design • Facilitate RPEQ certification of all construction works • Environmental manager to review monthly monitoring reports from dredge contractors and assist with any corrective actions and/or review of this SBMP and subordinate management plans • Oversee environmental management actions as directed by regulatory agencies and/or CRC • Ensure this SBMP is regularly reviewed and updated • Oversee monitoring programs and prepare monthly reports • Liaise with CRC, TAG and other stakeholders • Implementation of cultural heritage agreements • Ensure project compliance with monitoring and reporting requirements • Engage and facilitate Third Party Auditors • Ensure regular audits are undertaken • Monitor SBMP compliance regularly and update if required • Notify any legislative breaches or environmental incidents to authorities • Coordinate completion testing and project closure requirements for handover back to Northern Sands
Dredge Contractor	• Compliance with all relevant legislation and approvals during dredging and placement of options • Plan work in a way that avoids or minimises the impact on the environment • Ensure all site personnel, including sub-contractors, are aware of their environmental responsibilities • Detailed design, including associated engineering drawings certified by an RPEQ • Pre-construction surveys (including bathymetry) • Provide construction supervision testing, as built drawings and certification of construction in accordance with the design and contract requirements • Conduct activities in accordance with this SBMP, ASSMP, GWMP, SWMBA and Construction Environmental Management Plans (CEMPs), and the Ports North applicable Management Plans • Managing dredging, delivery of material and tailwater discharge from the Northern Sands DMPA such that water quality limits/objectives are met • Ensure all necessary environmental management procedures are in place • Ensure environmental risks are identified and appropriate measures are put in place • Assisting the Dredging Superintendent, PN and Environmental Supervisor with reporting where required • Respond to any complaints received • Conduct environmental monitoring in accordance with SBMP and subordinate management plans, including end-of-pipe monitoring of tailwater discharges • Undertake environmental management actions as directed by Ports North • Notify PN immediately in the event of an environmental incident or exceedance of performance objectives, including water quality triggers.

5 Summary of Potential Impacts

A summary of all broad potential environmental impacts identified by the CSDP Revised EIS (where relevant to works at the NS-DMPA) following adoption of impact mitigation by design and standard industry mitigation measures that may result from the construction, operation and decommissioning of the Barron Delta DMPA is provided in **Table 2**. Note that tailwater plume modelling undertaken in the EIS did not predict any impacts to sensitive receptors in the Barron River or downstream as a result of the detectable tailwater plume, as defined under the *EPBC Act*. Detailed management controls for these impacts are presented in **Section 6**.

Table 2 Actual, Potential, and Residual Adverse Impacts, and Likelihood

Element	Potential and Actual Impact	Phase	Potential Cumulative Impact	Impact Mitigation <i>(Includes some mitigation due to the actual operations)</i>	Characterisation of Residual Impacts Requiring Management						
					Likelihood	Short Term	Long Term	Reversible	Irreversible	Predictable	Unpredictable
Land	Dredge material may not achieve suitable strength gain precluding or significantly delaying removal of flood bunding, and final landform works	Operation	Nil	Design allows for enhanced material consolidation through tailwater and stormwater management. Preferential flow paths designed to allow management of flood inflow as well as rainfall outflow. Material consolidation to be maximized by: 1) Draw off, and evaporation in dry season to be supplemented by pump installation to draw off water and enhance material surface drying and hardening.(Refer to Site Water and Materials Balance Assessment (SWMBA)) 2) Maintenance of minimal tailwater depth from the stage when natural pond level is increased (maintain a maximum water depth over the placed material of 1m during remaining material placement)	Unlikely	x		x		x	

Table 2 cont.

Element	Potential and Actual Impact	Phase	Potential Cumulative Impact	Impact Mitigation (Includes some mitigation due to the actual operations)	Characterisation of Residual Impacts Requiring Management						
					Likelihood	Short Term	Long Term	Reversible	Irreversible	Predictable	Unpredictable
Land <i>cont.;</i>	Disturbance of Barron River bank and esplanade area from construction of tailwater outlet structure	Construction, Operation,	Nil	Outlet location selected at highly disturbed and cleared bridge abutment. Minimise clearing envelope by using existing clearing. Use of geotextile layer under outlet structure fill materials. Utilise existing maintenance access tracks for construction and decommissioning and long reach cranes to minimize bank disturbance.	Likely	x		x		x	
		Decommissioning	Nil	Any unavoidable marine plant or mangrove clearing will be undertaken and rehabilitated in accordance with Department of Agriculture and Fisheries approvals, including the Marine Plant Permit. Replanting is required under the marine plant permit. Combined with natural recruitment in a tropical environment, the impact is reversible, as mangroves will be able to grow back once pipeline is removed. Operational impacts to be minimized by use of floating dispenser outlet as per EA approval.	Likely	X		X		X	

Table 2 cont.

Element	Potential and Actual Impact	Phase	Potential Cumulative Impact	Impact Mitigation (Includes some mitigation due to the actual operations)	Characterisation of Residual Impacts Requiring Management						
					Likelihood	Short Term	Long Term	Reversible	Irreversible	Predictable	Unpredictable
Groundwater	Preferential shallow groundwater flow channels could be present under the containment bund footprints which could create localized saturated high salinity seepages to adjacent areas and lead to cane crop mortality or yield depression.	Operation	Nil	Geotechnical assessment of bund footprint undertaken to inform Bund Design (Golder Associates, 2018c)	Unlikely	x		x		x	
	Groundwater salinity seepage plumes may extend from edge of void which could lead to cane crop mortality or crop yield depression on adjacent properties	Operation	Nil	Filling design in accordance with Groundwater Assessment (Golder Associates, 2018b)	Unlikely, based on modelling undertaken (see Groundwater Assessment Report)	x		x		x	
	Placed PASS/ASS dredged materials could be displaced by self-neutralising PASS (SNP) material placement resulting in the oxidation of PASS and release of acidic and metalliferous waters to groundwater	Operation	Nil	Filling design in accordance with ASS Management Plan (Golder Associates, 2019a) and Groundwater Assessment (Golder Associates, 2018b)	Possible	x		x		x	
	Finer particles may be segregated from coarser particles during pumping and placement of SNP. This may result in placed SNP having neutralising capacities which vary from that indicated from offshore sampling and create the potential to produce “pockets” of PASS that may generate future unbuffered acidity when dried.	Operation	Nil	Filling design in accordance with ASS Management Plan (Golder Associates, 2019a) and Groundwater Assessment (Golder Associates, 2018a)	Unlikely		x	x		x	

Table 2 *cont.*

Element	Potential and Actual Impact	Phase	Potential Cumulative Impact	Impact Mitigation <i>(Includes some mitigation due to the actual operations)</i>	Characterisation of Residual Impacts Requiring Management						
					Likelihood	Short Term	Long Term	Reversible	Irreversible	Predictable	Unpredictable
Groundwater <i>cont.</i> ;	Placed PASS/ASS dredged materials could be displaced by placement of construction and demolition waste following site hand over to Northern Sands resulting in release of acidic and metalliferous waters to groundwater	Decommissioned DMPA	Nil (likelihood outlined here assumes management in accordance with ASSMP, therefore likelihood is reduced below that in the plan, where low-moderate was noted).	Construction and Demolition material placement in accordance with ASS Management Plan (Golder Associates, 2019a)	Unlikely		x	x		x	
	Flooding afflux impacts to adjacent cane fields, residences and other buildings	Operation	Potential minor increase in flood damage to adjacent cane crops, residences and other buildings during flood events.	Bund design as per Flood Risk Assessment (BMT, 2018) and specified in the DMP (PN, 2019) Four Stage Rainfall and Flood Management Rules to be adopted as per Table 3 below. Design of Rainfall and Flood management devices (preferential flow paths) designed as passive to eliminate dependence on access and response time. Stage 2 (Dredge Material Placement and Dewatering) Pond Water Management Rules to be adopted as per Table 3 below.	Unlikely	x		x		x	

Table 2 *cont.*

Element	Potential and Actual Impact	Phase	Potential Cumulative Impact	Impact Mitigation <i>(Includes some mitigation due to the actual operations)</i>	Characterisation of Residual Impacts Requiring Management						
					Likelihood	Short Term	Long Term	Reversible	Irreversible	Predictable	Unpredictable
Water Quality	Breach of perimeter bunds could result in discharge of sediments and water to the adjacent mangrove areas and surrounding agricultural land, and irreversible impact.	Operation	Nil	The maximum level of the top of the placed dredged material is not expected to exceed 2.9 m or natural surrounding ground level. However bund construction will be undertaken in accordance with Geotechnical specifications (Golder, 2018c) and Flood Risk Assessment (BMT, 2018) outputs. Water Management Rules to be achieved in accordance with SWMBA and Dredging Contract via control of dredge sequence and timing, weir box draw off level control and timing of discharge pump operation in conjunction with water level monitoring.	Unlikely	x		x		x	
	Release of sediment due to disturbance of Barron River bank or esplanade area from bank erosion due to construction of tailwater outlet structure or tailwater scour.	Construction	Nil	Outlet structure design in accordance with Far North Queensland Regional Organization of Councils (FNQROC) and Department of Agriculture and Fisheries (DAF) guidelines.	Unlikely	x		x		x	
	Release of poor quality surface storm water resulting from erosion and sedimentation from bund and access track construction and decommissioning.	Construction Operation Decommissioning	Minor increase in flood sediment loads	Stormwater and erosion and sediment control as per SWMBA (Flanagan Consulting, 2018)	Unlikely	x		x		x	
	Flood overtopping of the DMPA bund resulting in discharge of remobilised sediment into flood waters and downstream environments.	Operation Decommissioning	Minor increase in flood sediment loads	Implementation of Flood Risk Assessment (BMT, 2018) outputs and SWMBA (Flanagan Consulting, 2018) recommended water management strategies as per Table 4 .	Unlikely	x			x	x	
	Release of tailwater that exceeds EA limits.	During and after placement	Minor	Reactive monitoring program (refer to DMP) and mitigation measures in the DMP/SWMBA	Possible						

Table 2 cont.

Element	Potential and Actual Impact	Phase	Potential Cumulative Impact	Impact Mitigation <i>(Includes some mitigation due to the actual operations)</i>	Characterisation of Residual Impacts Requiring Management						
					Likelihood	Short Term	Long Term	Reversible	Irreversible	Predictable	Unpredictable
Flooding and Water Management	Release of poor quality storm water resulting from erosion and sedimentation from site earthworks	Operation	Minor increase in flood sediment loads	Stormwater and erosion and sediment control as per drawings in Appendix A .	Unlikely	x		x		x	
Noise	Tailwater pumps may result in noise nuisance at sensitive receptors.	Operation	Nil	Mitigation as per noise modelling assessment (RD-EIS, Appendix AU), 2018, informed by the specification or data known for each pump, to inform the assessment to be undertaken by the Dredge Contractor Pumps enclosed or located away from, or shielded to deflect influence away from sensitive receptors where practical.	Possible	x		x		x	
Air Quality	Tailwater pumps may result in air quality impacts on sensitive receptors under light westerly wind conditions.	Operation	Nil	Pump emission specifications to be assessed and need for enclosures or screening to be evaluated by the Dredge Contractor, or pumps positioned away from, or shielded to deflect influence from sensitive receptors where practical.	Unlikely	x		x		x	
Cultural Heritage	Disturbance to cultural heritage sites	Construction, and Operation	Nil	Cultural heritage survey with Traditional Owners conducted and Cultural Heritage Agreement has been developed and registered,	Unlikely	x	x	x	x		x
Biodiversity	Loss of biodiversity on and off site	Construction and Operation	minor	Erect fencing/flagging tape around vegetation to be remain.	Unlikely	x		x		x	

Table 2 cont.

Element	Potential and Actual Impact	Phase	Potential Cumulative Impact	Impact Mitigation (Includes some mitigation due to the actual operations)	Characterisation of Residual Impacts Requiring Management						
					Likelihood	Short Term	Long Term	Reversible	Irreversible	Predictable	Unpredictable
Emergency Management	Bund failure and contaminant discharge	Operation Decommissioning	Flooding- Minor increase in flood sediment loads	Bund construction in accordance with Geotechnical specifications (Golder Associates, 2018c) and Flood Risk Assessment (BMT, 2018) outputs	Unlikely	x		x			x
	Inlet or outlet pipe failure (DMPA Area)	Operation	Minor	Regular pipeline integrity checks	Unlikely	x		x			x
	Cyclone and flooding Containment capacity exceedance	Operation	Unlikely	Implementation of SWMBA (Flanagan Consulting, 2018) and Flood Risk Assessment (BMT, 2018) outputs	Unlikely	x			x	x	
	Major refuelling spills(>20lt)	Construction, and Operation	Minor to Major	Fuel stored in correctly-sized bunding and refueling within bunded area only.	Unlikely	x		x			x
	Crocodile void entry	Construction, and Operation	Nil	Include “crocodile” awareness in induction for relevant project staff. Observation and awareness by staff as applicable to all works on or over tropical waterways. Erect crocodile warning signs at bund/tailwater outfall area. Use of spotters for essential pond/tailwater outlet access tasks Call DES and organise removal trapping if needed.	Possible	x		x			x

5.1 DMPA Stormwater and Flooding Impact Management

5.1.1 *Water and Materials Balance Summary*

Details of the placement arrangement, and status of filling and water coverage over time are provided in SWMBA (Flanagan Consulting Group November 2018). The management regime involves pumping out of displaced fresh water immediately after the placement starts (Volume of water and material in, equals volume of water out, (provided EA discharge limits are adhered to (i.e. maximum of 87ML per day))), to maintain the lake water level as long as possible to minimise potential for a driving head from the DMPA to the groundwater. The anticipated starting level of the groundwater (immediately post 2019 wet season) is RL 1.0 m AHD. The Water and Materials Balance Assessment indicates that the operating water level will start increasing from day 38 and will rise above RL 3.5 (such that the bunds start to function as a containment structure) at about day 72 and will reach a maximum level of RL 3.84 m AHD on Day 84. Based on the top of Bund at RL 4.5m AHD the mandated minimum freeboard of 600 mm is not compromised during placement.

Post placement, the depth of water over the top of the placed material will be maintained to allow clearance testing, as well as any potential treatment (re-dredging and dosing) for a period of 4-6 weeks (August to mid-September based on earliest start/finish, or mid-November based on latest start/finish). There will be evaporation losses and rainfall input during this period.

The SWMBA (Flanagan Consulting Group, 2018) predicts that the placed material level will reduce to RL 2.2 m within 6 months of the commencement of placement.

The water level is to be maintained at 1 m above placed material level for 4 weeks and then dewatered over two weeks.

The bunds will function as a containment structure from week 9, until dewatered, and as the placed material surface level drops below RL 3.5m.

Relative to the start date, and assuming the dredging (and spoil deposition into the DMPA) is completed during the dry season, the DMPA will then be dewatered such that the surface of the placed material is exposed to evaporation and drying during consolidation.

Following the dewatering, the material will continue to consolidate such that it is predicted to reach a level of RL 0.4 within 18 months of commencement of placement.

5.1.2 *Stormwater and Flooding Remobilisation Management Rationale*

The proposed staged rationale for design and management of DMPA stormwater and material flood remobilisation risk is provided in **Table 3**. (Refer to the SWMBA for further details of the stages referred to below).

Table 3 DMPA Stormwater and Flooding Remobilisation Management Rationale

Stage (Refer to Stages in the SWMBA)	Management Responsibility	Timing	Design	Event Management	
				Rainfall	Barron River Flood
1 Pre-placement Bunds Constructed	Dredge Contractor	April 2019 (1st Wet Season)	Bunds to R4.5m. Create preferential flows paths by not building the bund (ch 3010 to 3100 invert at RL 2.8m) along southern boundary of Lot 2 to allow inflow and out flow.	Void is permeable to ground water. Air space available to crest level is 3.5 m. The SWMBA takes into account the lowest and highest recorded groundwater levels, which influence air space capacity, which has been evaluated to accommodate the highest cumulative wet season rainfall (3110 mm) recorded in the 77 year history of rainfall records at Cairns Aero Station No 31011. The void has the capacity to accommodate the cumulative rainfall in a 1% AEP season. Preferential flow paths will outlet to Barron River when water level reaches RL 2.8 mm. The DMA will spill through the preferential flow path in the event of greater than 1.8 m of cumulative rainfall. This depth exceeds the maximum rainfall ever recorded in individual months from November to April. No active intervention required to management rainfall events.	Possible flood will commence to inundate the void when flood stage height reaches >RL 2.8m through preferential flow paths for drainage. Scour protection to be constructed at preferential flow path entry and exit.

Stage (Refer to Stages in the SWMBA)	Management Responsibility	Timing	Design	Event Management	
				Rainfall	Barron River Flood
2 During Placement until Dewatering	Dredge Contractor	July 2019 - October 2019 (Dry season)	Bunds to be completed to RL 4.5 m. Tailwater weir boxes in place to allow decanting of tailwater. Weir boards max level @ TOL RL 3.9m	Air space available to crest level reduces from 3.5 m to 600 mm by end of placement and maintained till dewatering when discharge pipeline is decommissioned. In the anticipated period when the void airspace is at its lowest early placement period, the void has the capacity to accommodate the highest ever-recorded rainfall in each month. Air space has capacity to accommodate the highest cumulative dry season rainfall (644 mm) recorded in the 77 year history of rainfall records at Cairns Aero Station No 31011. The void has the capacity to accommodate the cumulative rainfall in a 1% AEP dry season taking into account evaporation losses at 5 mm /day. Overtopping of the bund crest has a very low probability	Barron River flood event unlikely
3 Post Placement	Ports North	November 2019 - October 2020 (2nd wet season & 2020 dry season)	Provide preferential inflow/outflow paths to Barron River by cutting bund down to RL 3.5 m along southern boundary of Lot 2 (ch 3010 - 3100)	Air space increases to >1.6 m following dewatering. The capacity of the air space will progressively increase as the material settles. The air space has the capacity to accommodate in excess of the 1% AEP event for each month from November to April. Preferential flow paths to BR are provided by cutting bund down to RL 3.5 m along southern boundary of Lot 2 (ch 3010 -3100). Provide pump capacity post wet season to progressively reduce water level in void to expose placed material surface to encourage crusting. Maintain pumping capacity and dewatered surface until placed material settles below dry season groundwater level.	Allow wet season rainfall to accumulate up to RL 3.5 mm to reduce differential levels between flood stage height and void lake level. Flood will inundate the void when flood stage height reaches >RL 3.5 m (50 % AEP Flood) through preferential flow paths for drainage. Preferential flow path to be baffled/ dissipated to prevent jetting and disturbance of placed material in the event that flood occurs early in wet season when lake levels are low.

Stage (Refer to Stages in the SWMBA)	Management Responsibility	Timing	Design	Event Management	
				Rainfall	Barron River Flood
4 Final Land Form	NS	November 2020 - April 2021 (2nd wet season post placement) and onwards for subsequent dry and wet seasons.	Once material has settled below 1.5 m AHD (if not surface dried and hardened) or below RL 2.5 m AHD (if surface has dried and hardened) remove bund to natural surface or RL 3.5 m or approved land form level RL 5.0 mm (southern boundary of Lot 5) whichever is the highest. Preferential drainage paths to Barron River to be provided along southern boundary of Lot 2 (ch 3010 - 3100 invert at RL 2.8m).	Lake Level will rise with accumulated rainfall and drain to Barron River through preferential flow paths along southern boundary of Lot 2 (ch 3010 -3100 invert at RL 2.8 mm). Lake level will eventually fall to groundwater level through evaporation.	Allow wet season rainfall to accumulate up to RL 3.5 mm to reduce differential levels between flood stage height and void lake level. Flood will inundate the void when flood stage height reaches >RL 3.5 m through preferential flow paths for drainage. Preferential flow path to be baffled/ dissipated to prevent jetting and disturbance of placed material in the event that flood occurs early in wet season.

6 Environmental Management Controls

6.1 Land

Objective	To minimise the impacts of soil disturbance during Northern Sands DMPA bund construction, operation and decommissioning			
Performance Criteria	Compliance with design and management specifications identified in Golder Associates Acid Sulfate Soil Management Plan Procedure BD-C (Golder Associates, 2019a), Geotechnical Specifications (Golder Associates, 2018c) and FNQROC erosion and sediment control guidelines.			
Monitoring & Reporting	Refer Section 7			
Potential Impacts	Proposed Management Procedures	Responsibility	Timing	Corrective Action
Erosion and sedimentation of disturbed areas.	Rehabilitation of all areas of natural vegetation and landforms that are to be cleared for the construction of the Northern Sands DMPA in accordance with Rehabilitation and Final Landform Plan (RFLUP) (Appendix A)	Ports North	As part of demobilization works (i.e. removal of bunds, delivery and discharge pipelines)	Review and revise Rehabilitation and Final Landform Plan (RFLUP) (Appendix A) in accordance with CRC and DES requirements.
	Delivery and Discharge pipelines across Northern Sands land outside the DMPA facility area to be positioned in consultation with Northern Sands to minimize potential for erosion by accommodating site drainage, utilizing existing hardstand surfaces and access tracks, and placing the pipes on sand bags or earth plinths.	Dredging Contractor	Construction, Operation and Decommissioning	Establish Erosion and Sediment (E&S) controls for construction and operational stages, as per the Stormwater Management, Erosion and Sediment Control Plan (SWESCP).
	Site rectification, re-profiling works at completion of bund removal.	Ports North's appointed earthworks Contractor for end of use demobilization/bund removal	Decommissioning	Re-establish or install sufficient E&S controls to enable return of site to operator for continuation of waste management operations and reflect those changes in update of the operators SBMP.
Dredge material may not meet the target for suitable strength gain precluding or significantly delaying decommissioning of flood bunding, and final landform works	Manage DMPA in accordance with Dredge Management Plan and SWMBA (Flanagan Consulting, 2018)	Dredge Contractor(at final placement) Ports North thereafter	As part of de-demobilization works	Implement corrective actions, for example additional de-watering, enhancement of consolidation informed by geotechnical expert review of the progressive monitoring of consolidation during the placement period

6.2 Groundwater

Objective	To minimise the impacts on groundwater during Northern Sands DMPA bund construction and operation			
Performance Criteria	• Compliance with the Department of Science Information Technology and Innovation Acid Sulfate Soil Management Guidelines (Dear et al. 2014). • Compliance with design and management specifications identified in Acid Sulfate Soil Management Plan, Golder Associates Procedures BD-A, BD-B and BD-C (Golder Associates, 2019a). • Compliance with Dredging Management Plan (PN, 2019). • Compliance with groundwater limits; and the release of dredge tailwater limits from the Northern Sand DMPA (Lot 2 on RP712954, Lot 5 on SP245573) under Environmental Authority EA 0001463			
Monitoring & Reporting	• Refer Section 7			
Potential Impacts	Proposed Management Procedures	Responsibility	Timing	Corrective Action
DMPA Operation				
SNP, once placed in the DMPA is no longer self-neutralising	• Undertaking testing of the dredge hopper, daily verification sample and lime treatment if performance limit not met, as per the ASSMP (Golder Associates, 2019a)	• Dredge Contractor	• During placement	• Further testing and lime treatment if not successful
Placed PASS dredged materials could be displaced by SNP placement resulting in release of acidic and metalliferous waters to groundwater	• Development of groundwater trigger water quality objectives through pre operation groundwater monitoring (refer to GWMP (Golder Associates, 2019b); regular monitoring of groundwater levels and quality to inform selection of remediation controls • Management of dredge material in accordance with DMP, ASSMP (Golder Associates, 2019a) and GWMP (Golder Associates, 2019b)	• Ports North and Groundwater Consultant • Dredging Contractor and then Ports North	• Operation • Operation and then after Dredging Contractor demobilisation	• In the event of observed off site crop stress and/or exceedance of groundwater triggers at sentinel wells and off site monitoring wells, implement measures such as groundwater interception and pump back strategies detailed in the GWMP (Golder Associates, 2019b)

Section 6.2 cont.

Potential Impacts	Proposed Management Procedures	Responsibility	Timing	Corrective Action
Preferential shallow groundwater flow channels could be present under the containment bund footprints which could create localised saturated high salinity seepages to adjacent areas and lead to cane crop mortality or yield depression	- Monitoring of groundwater as per GWMP (Golder Associates, 2019b) - Manage DMPA operation in accordance with the GWMP (Golder Associates, 2019b) - Geotechnical investigation along the alignment of the wall to identify unsuitable foundation materials for the wall, engineering design to consider foundation materials, and oversight of construction to ensure that the construction is adapted where necessary to ground conditions encountered on site. - Limit the water level in the lake until sufficient dredged material has been placed in the lake to create a low permeability barrier between the saline water in the lake, and the surrounding aquifer.	- Ports North - Ports North - Ports North - Dredging Contractor	- Operation - Post-Dredge Contractor demobilisation	In the event of observed off site crop stress and/or exceedance of groundwater triggers at sentinel wells and off site monitoring wells implement measures such as groundwater interception and pump back strategies detailed in the Groundwater Management Report
Groundwater salinity seepage plumes which may extend beyond the bund perimeter could lead to cane crop mortality or crop yield depression.	- Limit the water level in the lake until sufficient dredged material has been placed in the lake to create a low permeability barrier between the saline water in the lake, and the surrounding aquifer. - From the stage when natural pond level is increased, maintain a maximum water depth of 1 m over the placed material during remaining material placement - Manage DMPA operation in accordance with the GWMP (Golder Associates, 2019b)	Dredging Contractor	- Operation - Post dredge contractor demobilisation	In the event of observed off site crop stress and/or exceedance of groundwater triggers at sentinel wells and off site monitoring wells implement measures such as groundwater interception and pump back strategies detailed in the Groundwater Management Report

Section 6.2 *cont.*

Potential Impacts	Proposed Management Procedures	Responsibility	Timing	Corrective Action
Placed ASS dredged materials could be displaced by further filling of soil, or construction and demolition waste following site hand-over to Northern Sands, resulting in release of acidic and metalliferous waters to groundwater.	• Manage DMPA operation in accordance with the ASS Management Plan (Golder Associates (2019a) Procedure BD-C including certification by the appropriate CSDP consultants, prior to project completion and handover of the DMPA site to Northern Sands that: • The designated PASS material has been certified to have settled 1 m below the lowest permanent water table; • Procedures for the controlled placement of soil fill and Construction and Demolition material over the dredged material have been developed, based on appropriate strength testing. The procedures should include monitoring and review recommendations for Northern Sands ongoing operations.	• Dredge Contractor • Ports North	• Operation • (post DMPA decommissioning)	• Testing, treatment and management of dredge material as per the ASSMP, Golder Associates Procedure BC-D (2019a)

6.3 Flooding

Objective	To minimise the flooding impact of the Northern Sands DMPA on neighboring farming lands and residences, and discharge of remobilized sediments			
Performance Criteria	- Minimal increase in flooding afflux impacts (<20 mm) on surrounding properties, residences and other buildings greater than 20 mm in accordance with Cairns Plan's Flood Management Code and Excavation and Filling Code. - Bund lowering through achievement of target sediment resuspension freeboard as per Flood Risk Assessment BMT 2018 and Site Water and Materials Balance Assessment (SWMBA)			
Monitoring & Reporting	Refer Section 7			
Potential Impacts	Proposed Management Procedures	Responsibility	Timing	Corrective Action
Flooding afflux impacts to adjacent cane fields, residences and other buildings resulting from bund construction	- Minimisation of afflux risk by lowering of bund heights as soon as possible in response to continual monitoring of settled dredge material levels and strength - Bunds to be lowered only when freeboard targets identified in the SWMBA have been achieved	- Ports North - Dredging Contractor	Operation	active management of water balance with void consistent with the SWMBA (Flanagan Consulting Group, 2018)
Remobilisation of dredge sediment during flood inundation of bund	Bund construction and management in accordance with procedures nominated in Table 3.	Dredging Contractor	Construction and Operation	Implement measures, consistent with the SWMBA (Flanagan Consulting Group, 2018), inclusive of maintaining sufficient water cover over material to minimise remobilisation during an event
Fuel and Chemical Storage flooding immunity	- Fuel and chemical containers placed above or bundled from 1 % AEP flood level - Tailwater pumps (and fuel tanks) which will only be in place during the 2019 dry season and 2019/2020 wet season will be bundled to 6 m AHD (ARI 100 flood immunity) level	Dredging Contractor	During operations and till handover	- Create raised platforms or bunds, or - demobilize from site in advance of flood event.

6.4 Tailwater Management

The EA for placement of dredge material at Northern Sands sets surface water release limits for the release of tailwater in the Barron River. Limits have been set for tailwater discharge quality at the 'end of pipe', as described in **Table 4** below. Note that the EA sets a volumetric release limit of 87 Megalitres (ML) per day. The SWMBA (Flanagan Consulting, 2018) has detailed the timing and volume of dredge material to be delivered to the DMPA, and the subsequent discharges to the Barron River; the modelling undertaken demonstrates that the performance limits outlined below can be met for the duration of placement activity. The Dredge contractor is to detail how tailwater will be monitored to meet the EA requirements in their Construction EMP.

In addition, water quality will be monitored at locations upstream and downstream of the release point in the Barron River and Thomatis/Richters Creek as part of the Barron River Receiving Environment Monitoring Program (REMP). While limits for the Barron River REMP have not been specified in the EA conditions, limits have been developed (for the DMP, 2019), using a similar methodology to EA limits using baseline data collected at a number of sites in the Barron River and Thomatis/Richters Creek between 2014 and 2018. These limits are provided in **Table 4**. The location of Barron River tailwater monitoring sites is provided in **Table 5**. Refer to the DMP for further detail on Barron River monitoring.

Trigger levels of 20 and 10 % below the upper release limits will be set for the end-of-pipe tailwater limits, upon which management actions will be implemented BEFORE the EA release limit is reached.

To inform the placement process and assist prediction of possible tailwater exceedances, full surveys of placed material level in the DMPA will be conducted at ~3 weekly intervals, along with weekly monitoring of fill level and profile in the areas of placement, with detailed tailwater draw-off level monitoring daily during last 2 weeks of dredging campaign.

The EA includes a requirement that within 30 days of commencement, the suitability of the current tailwater release limits will be reviewed and reported to DES, including a comparison of the in-situ measurements with the tailwater plume modelled in the EIS. That process will inform the Ports North, Dredging Contractor, and DES of any need for amendment, or re-confirm suitability of the limits for the balance of the placement and discharge activity.

In the event that an exceedance of trigger levels and/or water quality release limits occurs (including a single exceedance), the following management actions will be implemented, in order of preference:

- Management of material delivery rates and tailwater retention duration (adjustment of weir box invert levels) to avoid discharge;
- Continual monitoring of DMPA water level to ensure volumes are meeting predicted levels and licensed discharge volumes;
- Review of dredge volumes and delivery timing will be undertaken If water levels are exceeding the modelled performance;
- Temporary cessation of tailwater discharge if minimum freeboard of 600mm is threatened or if tailwater performance requirements are not being met at either the end of pipe or Barron River monitoring sites;
- Investigation of the exceedance (or near exceedance) and a review of the success of the response measures undertaken;

Any exceedance of limits will be reported to DoEE and DES within 24 hours. Further, the cause of the exceedance will be investigated and a report provided to both agencies detailing the cause of the exceedance, the response measures taken, the relative success of the response measures and actions taken to prevent further exceedances.

Table 4 EA End of Pipe Tailwater Release Limits

Monitoring Location Name	Release Points (GDA94 Decimal Degrees)		Quality characteristic (units)	Limit	Limit Type	Minimum Monitoring Frequency
	Latitude	Longitude				
End of Pipe	-16.869°	145.735°	pH	6.5-8.5	Range	Continuous data logging during releases
			Dissolved Oxygen	60-105%	Range	Continuous data logging during releases
			Turbidity	50 nephelometric turbidity units (NTU)	Maximum	Continuous data logging during releases
			Total Suspended Solids	mg/L monitor only	N/A	Weekly during releases
			Ammonia N	460 µg/L	Maximum	Weekly during releases
			Electrical conductivity or salinity	µS/cm or mg/L monitor only	N/A	Continuous data logging during releases
			Temperature	Monitor Only	N/A	Continuous data logging during releases

Table 5 Barron River REMP Water Quality Limits

Monitoring Location Name	Coordinates (GDA94 decimal degrees)		Quality Characteristics (units)	Limit	Limit Type	Minimum Monitoring Frequency
	Latitude	Longitude				
WQ1 (Upper Barron River)	-16.85902	145.70975	Turbidity (NTU)	11	15-day rolling median	Continuous data logging (at least every 10 minutes) during tailwater discharge and for two weeks after tailwater discharge ceases)
				23	6-day rolling median	
			Salinity (ppt)	19	15-day rolling median	
				23	6-day rolling median	
WQ2 (Thomatis/ Richters Creek)	-16.85106	145.71736	Turbidity (NTU)	35	15-day rolling median	
				89	6-day rolling median	
			Salinity (ppt)	29	15-day rolling median	
				32	6-day rolling median	
WQ3 (Mid-Barron River)	-16.87118	145.72631	Turbidity (NTU)	40	15-day rolling median	
				105	6-day rolling median	
			Salinity (ppt)	25	15-day rolling median	
				30	6-day rolling median	
WQ4 (Lower Barron River)	-16.86028	145.74483	Turbidity (NTU)	42	15-day rolling median	
				94	6-day rolling median	
			Salinity (ppt)	31	15-day rolling median	
				32	6-day rolling median	

Limits derived from the 80th and 95th percentile of site-specific baseline dry season water quality data.

From the definition provided in the EA, the 15 and six (6) day daily rolling median is calculated using the median of the daily median over the previous 15 or six (6) days.

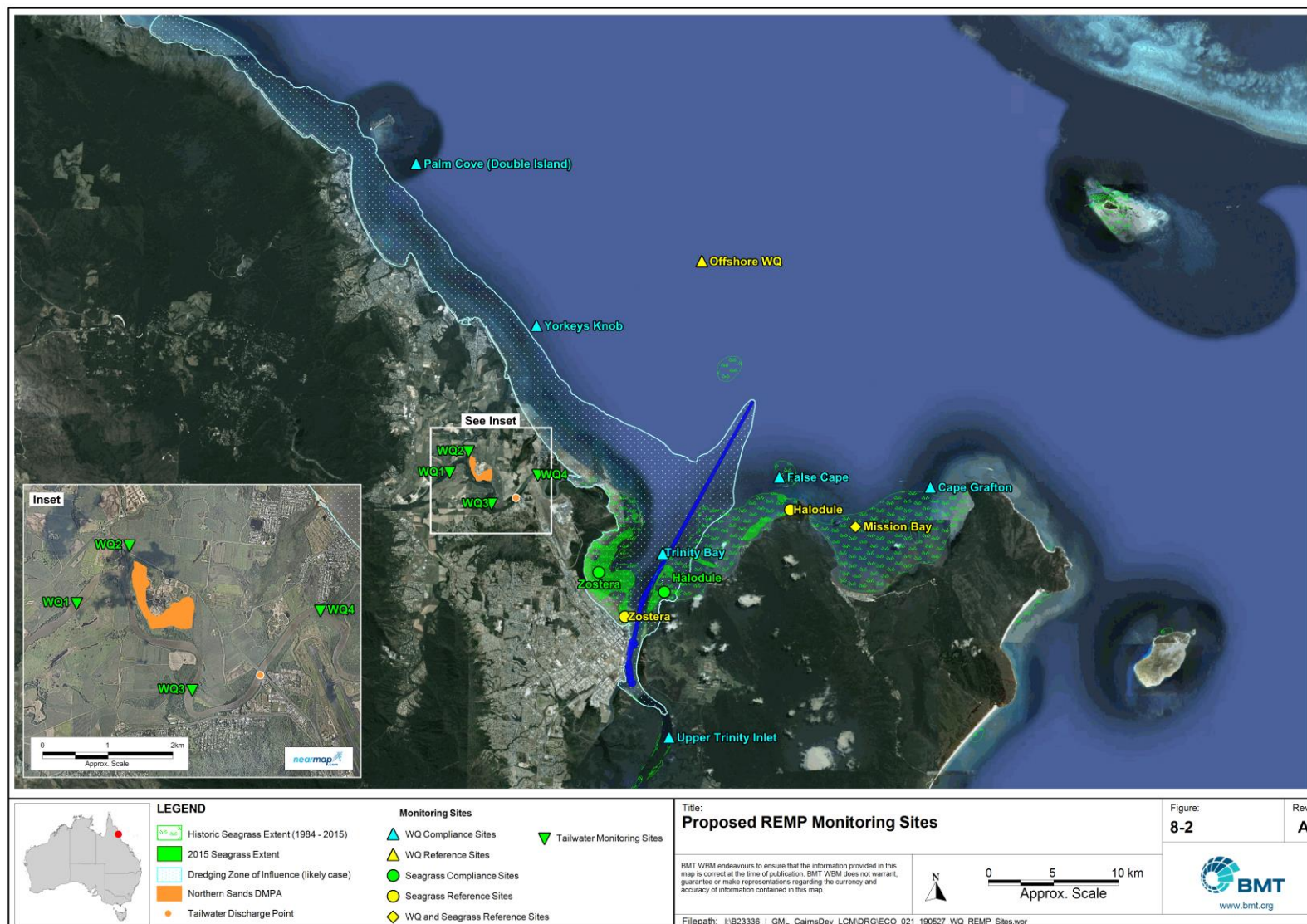


Figure 8 Water Quality Monitoring Sites

6.5 Water Quality

Objective	To minimise and manage the impact of the DMPA construction and operation on Barron River water quality			
Performance Criteria	- Water Quality end-of-pipe limits identified in the DMP (PN, 2019) and Environmental Authority EA 0001463 (dredging) onshore placement of dredged material at the Northern Sands DMPA; and the release of dredge tailwater from the Northern Sand DMPA (Lot 2 on RP712954, Lot 5 on SP245573). - Bund lowering through achievement of target sediment resuspension freeboard as per Flood Risk Assessment (FRA) (BMT, 2018) and SWMBA (Flanagan Consulting, 2018)			
Monitoring & Reporting	Refer Section 7			
Potential Impacts	Proposed Management Procedures	Responsibility	Timing	Corrective Action
Release of poor quality stormwater resulting from erosion and sedimentation from site earthworks	Manage the DMPA in accordance with Section 6.4 and Stormwater Management and Erosion and Sediment Control Plan (SWESCP) (Appendix A)	- Ports North - Dredging Contractor	- Construction-and pre handover to Northern Sands - Operation	Revision of SWESCP in response to site observations and monitoring
Breach of perimeter bunds could result in discharge of water to the adjacent mangrove areas, cane lands and isolated surrounding residences	- Use of suitable borrow material for bund construction through preconstruction geotechnical testing of material and construction supervision and materials testing - Bund geotechnical designs incorporate adequate safety factors	Dredging Contractor	Construction and Operation	- Post event repair of bund failure and placement of additional scour protection on bund crest - Notify regulatory authorities
Flood overtopping of the DMPA bund resulting in discharge of remobilized sediment into flood waters and downstream environments	- Lowering of bunds guided by maintenance of target material freeboard targets to minimize remobilisation of dredge material as per Flood Risk Assessment (FRA), BMT (2018), SWMBA (Flanagan Consulting, 2018) and DMP (PN, 2019). - Refer to Flooding Section 6.3 of this SBMP in relation to flooding impact management strategies.	Ports North	Post tailwater dewatering prior to Northern Sands handover	Implement measures, consistent within Site Water and Materials Balance Assessment and Flood Risk Assessment, BMT (2018) inclusive of maintaining sufficient water cover over material to minimize remobilisation of placed material during an event.

Section 6.5 *cont.*

Potential Impacts	Proposed Management Procedures	Responsibility	Timing	Corrective Action
Release of tailwater exceeding release and receiving water limits	- Continuous monitoring of tailwater quality to be undertaken at both the end-of-pipe and Barron River approved monitoring locations (refer to DMP for further detail of monitoring in the Barron River) - Tailwater end-of-pipe discharge compliance to be achieved by a range of management measures outlined in the introduction to this section including: - Management of material delivery rates and tailwater retention duration (adjustment of weir box invert levels) - Undertake full survey of placed material level in the DMPA at 3 weekly intervals and weekly monitoring of fill level and profile in the area of placement (tailwater levels monitored daily during last 2 weeks of dredging campaign) - Rotation of discharge dispenser locations within the DMPA - Temporary cessation of tailwater discharge if minimum freeboard of 600 mm is threatened	Dredging Contractor	Operation	- Implement measures identified in the DMP (to be revised by appointed dredge contractor) which may include: - Board up weirbox (reduce or halt discharge) - Continue turbidity monitoring at approved locations - Review intermediate alert levels (10 or 20% below trigger levels) in the event that tailwater discharges exceed triggers or licence limits - Delaying material inputs - Cessation of dredging and tailwater discharge - Deployment of floating baffles in DMPA

6.6 Erosion and Sediment Control

Objective	To minimize impact of erosion and sedimentation on the environment through effective storm water drainage and discharge quality management			
Performance Criteria	- Erosion and sedimentation to be managed in accordance with Stormwater Management and Erosion and Sediment Control Plan (SWESCP) (Appendix A) incorporating Best Practice Erosion and Sediment Control Guidelines for Australia (IECA) on the basis of a low to moderate site erosion risk (site soils typically non dispersive, flat landform < 2 %, fine texture), and the FNROC Guidelines for Stormwater Management. - SWESCP design (Sediment basin type 1/F structures) in accordance with 24 hour storm event with an average recurrence interval of 1 in 10 years must be retained on site or managed to remove contaminants before release (including Northern Sands precinct storm water) - Discharge water quality to comply with EA 0001463 - CSDP precinct SWESCP decommissioning works to comply with Rehabilitation and Final Landform Plan (Appendix A)			
Monitoring & Reporting	Refer Section 7			
Element	Proposed Management Procedures	Responsibility	Timing	Corrective Action
Stormwater Management Strategy	- Northern Sands precinct storm water to be directed to the existing void (via pipe) only until commencement of Ports Norths exclusive use of the DMPA Facility at which time it must be redirected to the future sand mine expansion void - Northern Sands Precinct drainage will largely pond against DMPA northern wall once piped drainage to Lake Narelle is blocked. Northern Sands storm water drainage to be partially redirected to existing stormwater outlet to Captain Cook Highway via diversion drains (Appendix A); - Construct diversion channels connecting Catchments 1, 2 and 3 as per Appendix A. - Construct rock and geotextile filter weir at future sand mining void sediment basin outlet to Captain Cook Hwy as per Drawings in Appendix A; - Northern Sands precinct stormwater drainage to Lake Narelle to be re-established post bund removal	- Ports North - Northern Sands	- Construction and operation - Post hand over from Ports North	install additional E&S controls for each affected sub-catchment commensurate with scale of discharge

Section 6.6 *cont.*

Element	Proposed Management Procedures	Responsibility	Timing	Corrective Action
Best Practice SWESCP Management Controls	Construction of the following BMPs: Temporary Controls • Sediment fencing around temporary soil stockpiles and toe of new embankments • Grass lined water diversion drains/bunds (refer Appendix A); • Rock check dams in diversion drains as required • Soil stabilization by hydromulching of external DMPA bund batters and decommissioned bund and pad areas within 5 days of final trim earthworks. • Maintenance of effective grass stabilization by irrigation as required • Rock armoring on high velocity drainage (e.g. drains inlets and outlets) Type 1 Controls • Type F wet basins • Sediment basins: • 1 in 10 year, 24 hr. storm event design capacity (DMPA disturbance) • Maintenance of minimum 70 % sediment basin capacity where practical	• Dredge Contractor	• Construction	• Revision of CEMP as required

Section 6.6 *cont.*

Element	Proposed Management Procedures	Responsibility	Timing	Corrective Action
Bund Construction	- Borrow areas to be internally draining (i.e. into void) or contingency pumping to main void via internal sump - Grass stabilisation of diversion drains (reinforced turf where velocities >2 m/s) - Rock check dams and level spreaders on diversion channels as required - Installation of diversion banks/channel to direct disturbed area storm water to Lake Narelle - Bund crests to be internal draining - Bund batter configuration in accordance with geotechnical specifications - External bund batters to be hydromulched within 5 days of completion - Watering of batter grass (min 40 mm/wk. during establishment) - Weed monitoring and control of any declared weeds Refer detailed specifications on SWESCP drawings (Appendix A)	Dredging Contractor	Construction	- Repair earthworks, fertiliser application, reseeding, maintenance, watering as required. - Additional rock armouring of drains as required - Install additional structures as required- sediment fences, rock check dams, drain stabilization - Repair drains as required - Bund repair and stabilisation as required - Flocculation of disturbed area storm water discharge in response to noncompliance with water quality limits as required - Replace sediment basin outlet rock filter material as required
Operation	- Monitoring and maintenance including event based storm water monitoring - Maintain grass stabilisation of access tracks (e.g. pipeline access), stabilized drain crossings, track gravel sheeting where necessary	- Dredging Contractor - Ports North until handover to Northern Sands	Operation up to final placement and tailwater removal	As above

Section 6.6 *cont*

Element	Proposed Management Procedures	Responsibility	Timing	Corrective Action
Decommissioning	- Storm water diversions to be maintained until bunds are fully removed and completion of final landform rehabilitation prior to handover of CSDP precinct to Northern Sands - Crest internal drainage maintained during staged bund removal - Revegetation of disturbed area footprints (excluding dredge material surface) with bird discouraging grasses only i.e. no roosting tree species) - Seeding of final bund footprint within 5 days of achievement of decommissioned final levels - Achievement of target groundcover prior to site hand over to Northern Sands - Revegetation of tailwater outlet and discharge structures footprint in accordance with Rehabilitation and Final Landform Plan - Weed monitoring and control of any declared weeds - Retention of SWESCP measures until achievement of storm water discharge criteria and groundcover target - Retention of storm water diversions until achievement of final stabilized landform (i.e. pre DMPA landform) - Refer detailed specifications on SWESCP drawings (Appendix A)	Ports North Northern Sands after handover	- Pre-Decommissioning - After final placement and tailwater removal - Until NS handover - Post decommissioning - After Handover from PN until EA relinquishment	- As above - Monitoring, maintenance and repair of landforms - Addition seeding, fertiliser, establishment watering as required

6.7 Rehabilitation and Final Landform

Objective	To ensure that the NS DMPA is returned to a safe, stable and nonpolluting landform capable of supporting pre-placement land use on site and adjacent areas.			
Performance Criteria	- Erosion and sedimentation to be managed in accordance with Stormwater Management and Erosion and Sediment Control Plan (SWESCP) (Appendix A) incorporating Best Practice Erosion and Sediment Control Guidelines for Australia (IECA). - Landform rehabilitation to be constructed in accordance with the Rehabilitation and Final Landform Plan (Appendix A) - No ongoing ASS impacts- managed in accordance with ASSMP (Golder Associates, 2019a) - Decommissioning of the bunds surrounding the Northern Sands DMPA must not occur until water in the placement area is maintained at a level that is at least 600 millimeters (mm) below final ground level. - Final Landform conditions of approval (Environmental Authority EA0001463) - Nil off-site dust complaints			
Monitoring & Reporting	Refer Section 7			
Element	Proposed Management Procedures	Responsibility	Timing	Corrective Action
Bund Removal Staging	- Bund wall removal staging as per Four Stage Rainfall and Flood Management Rules to be adopted as per Appendix A (SWMBA, 2018). - Lowering of CSDP bunds to 3.5 m AHD once material has settled below 1.5 m AHD if not surface dried and hardened, or below RL 2.5 m AHD if surface has dried and hardened - Re-establish internal crest drainage - Re-compaction of crest - Repair of batter as required - Retention of SWESCP controls until the bund is removed - Reprofiling earthworks to pre-disturbance levels and seeding (grasses)	Ports North	Prior to CSDP site hand over to Northern Sands	Weekly monitoring of material levels and water quality and lowering of tailwater levels as soon as possible
Bund, pad and track stabilisation	- Stabilize and maintain site in accordance with SWESCP (Appendix A) - Hydromulching of batters and pads within 10 days of completion of final trim - Revegetation of Barron River outlet and discharge pipeline access tracks within 10 days of removal and rehabilitation of discharge structure	Ports North	- Bund construction phase - Post Dredge Contractor demobilization and prior to CSDP site hand over to Northern Sands	Repair and maintenance works as required

Section 6.7 cont

Element	Proposed Management Procedures	Responsibility	Timing	Corrective Action
Tailwater Outlet and Pipeline	- Repair and reinstate Barron River bank profile in accordance with Operational Works – Tidal works approval - Marine plant species selection in accordance with Operational Works – Tidal works approval and consultation with DAF	Ports North	Prior to CSDP site hand over to Northern Sands	Repair and maintenance works as required
Revegetation	- Revegetation of disturbed area footprints(excluding material surface) - Weed monitoring and control of any declared weeds	Ports North	Prior to CSDP site hand over to Northern Sands	Repair and maintenance works as required
Dredge material spills	- Excavate and place any spilled dredge materials in bund within 72 hrs. - Field peroxide testing of spill cleanup area, lime treatment (at contingency rates) in accordance with ASS Management Plan - Seeding (grasses) of clean up area within 5 days - If replacement within bund > 72 hrs liming of spill materials prior to replacement at contingency rates	Dredging Contractor	Prior to demobilisation	Addition seeding, fertiliser, establishment watering as required
Final Void Management	The deposition of fill materials over placed dredged spoil within the DMPA shall be in accordance with controlled fill procedures prescribed by the CSDP geotechnical engineers.	Northern Sands	During placement	Monitoring of material strength and placement of waste materials in accordance with Geotechnical engineering specifications (Golder Associates, 2018c)
Stormwater Water Management	- Retention of SWESCP measures until achievement of groundcover target as per SWESCP - Retention of storm water diversions until achievement of final stabilized landform criteria	- Dredging Contractor - Ports North - Northern Sands	- After final placement and tailwater removal - Until NS handover - After Handover from PN until EA relinquishment	- Monitoring, maintenance and repair of landforms - Additional seeding, fertiliser, establishment watering as required

Section 6.7 cont

Element	Proposed Management Procedures	Responsibility	Timing	Corrective Action
Final Landform	- Achieve safe, stable and non-polluting landform generally in accordance with Appendix A (note existing bunding on southern boundary of Lot 5 to be lowered to a maximum height of 5 m AHD) - Final approved capped landform	- Ports North - Northern Sands	- Prior to NS Handover - Prior to EA relinquishment	Post placement survey (DTM) and reshaping earthworks and stabilization as required
Final Land Use	- Compliance with surface water and groundwater monitoring targets - Reinstate site access - Measures to be implemented to prevent and control the spread of weeds (e.g. <i>Hymenachne</i>) as a result of the project such as vehicle washdown facilities - Maintain security fencing to Captain Cook highway - Appropriate danger signage at entry - Construction of boat ramp within void for material monitoring craft and rescue craft entry	Ports North	Prior to CSDP site hand over to Northern Sands	Repair and maintenance works as required

6.8 Noise

Objective	To minimize noise nuisance at sensitive receptors			
Performance Criteria	- Compliance with the Environmental Protection Policy (Noise) - Compliance with Environmental Authority 16 (1) (d) (dredging) onshore placement of dredged material at the Northern Sands DMPA			
Monitoring & Reporting	Monitor noise in response to complaints and respond to complainant with 24hrs in consultation with DES			
Potential Impacts	Proposed Management Procedures	Responsibility	Timing	Corrective Action
Tailwater pumps could exceed performance criteria at adjacent residences	- Reassess noise outputs after Dredge contractor has confirmed pump location and specification. - Respond to complaints within 24 hrs.	Dredge Contractor	Operation	In the event of complaints, action options include: - Enclosing the pump with an acoustically robust enclosure including internal acoustic absorption. - Installation of temporary noise barriers or earth bunding. - Locating the pump further away from receptors. - Using smaller pumps in series. - Selection of alternative (quieter) or over-specified equipment (allowing lower operating speeds for the same throughput) plant. Dredge contractor to select low noise pumps and or install acoustic shielding around pumps

6.9 Air Quality

Objective	To minimize air quality nuisance at sensitive receptors			
Performance Criteria	- Compliance with the Environmental Protection Policy (Air) - Compliance with Environmental Authority 16 (1) (d) (dredging) onshore placement of dredged material at the Northern Sands DMPA			
Monitoring & Reporting	Refer Section 7			
Potential Impacts	Proposed Management Procedures	Responsibility	Timing	Corrective Action
Tailwater pumps emissions could exceed performance criteria at adjacent residences (set by the EA)	- Tailwater pumps to employ SCR exhaust technology - Respond to complaints within 24 hrs.	Dredging Contractor	Operation	In the event of complaints action options include: - Install additional enclosure of pumps - Relocate pumps

6.10 Cultural Heritage

Objective	• To avoid and minimize impacts on Indigenous Cultural Heritage Sites			
Performance Criteria	• Compliance with the <i>Aboriginal Cultural Heritage Act 2003</i> (including Duty of Care Requirements) • Compliance with Yirrganydji and Cultural Heritage Management Agreement			
Monitoring & Reporting	• Refer Section 7			
Potential Impacts	Proposed Management Procedures	Responsibility	Timing	Corrective Action
Disturbance to a Cultural Heritage site (significant Aboriginal object or site)	• Bund and Dredging Contractors CEMPs to include: ○ incorporation of cultural heritage awareness training in site inductions ○ observance of the Cultural Heritage Protection Area (No Go cultural heritage buffer area -Yirrganydji camp) between the DMPA and Thomatis Creek (refer Figure 2) ○ procedures for management of any items suspected of being a significant aboriginal site in accordance with CHMP (including CH inspections, monitoring, major, minor find procedures, temporary area avoidance, reporting) • No new access tracks are to be constructed in the No Go Area • Location of tailwater discharge pipeline to be micro located to minimize disturbance to Barron River banks • Installation of temporary fencing along the edge of the Cultural Heritage Protection Area (No Go area) • Monitoring of construction phase by Yirrganydji Cultural Heritage monitors • If necessary, use of an independent CH expert to resolve any CH find management dispute with the proponent	• Dredging Contractor	• Construction Phase	• Conduct operations in accordance with the project CHMP

6.11 Biodiversity Management

Objective	• To avoid and minimize on and off site impacts on Biodiversity			
Performance Criteria	• Compliance with the <i>Biosecurity Act 2014</i>			
Monitoring & Reporting	• Refer Section 7			
Potential Impacts	Proposed Management Procedures	Responsibility	Timing	Corrective Action
Spread of soil-borne pathogens, weeds and pest ants	• All machinery must be clean and free of soil and organic material prior to entering site	• Dredging contractor	• Construction and operation phase	• Review and revise procedures as required
Disturbance to remnant vegetation adjacent to the southern bund areas	• Edge of remnant vegetation to be clearly flagged prior to construction • All operators to be trained and advised in relation to preservation of remnant vegetation	• Dredging Contractor	• Construction Phase	• Review and revise procedures as required

7 Notification, Monitoring, and Reporting

7.1 Construction, Operation, and Decommissioning Phases

Proposed monitoring, notification and reporting requirements are provided in **Table 6**.

The Table also sets out the target milestones and limits for the definition of site hand over, and final landform/rehabilitation milestones that are explained in **Section 7.2**.

Table 6 DMPA Notification, Monitoring, and Reporting Requirements

Element	Monitoring Requirement	Timing	Responsibility	Reporting/Approval Requirements
Land				
Containment Bund	Bund design	Prior to construction	Ports North	Bund construction – MCU/Operational Works application to CRC
	Provide target final placed material level of settled dredge material at decommissioning	<10 days prior to dredging commencement	Ports North	Report to CRC
	Visual inspection for geotechnical failure during construction and operation	Construction Operation	Dredging Contractor	Weekly report to Ports North Monthly PN report to CRC Regulatory reporting (e.g. bund failure causing uncontrolled discharge)
	Testing and reporting of specified material properties and construction standards in accordance with the Construction Contract Specification.	Construction Operation	Ports North	Weekly report to Ports North Regulatory reporting (e.g. bund failure causing uncontrolled discharge)
	Survey of as-constructed earthworks	Within 2 weeks of completion of construction	Dredging Contractor	CRC- as constructed survey
During Material Placement	Testing and reporting of initial validation testing of PASS placement below lowest groundwater level -1 m	Immediately following completion of PASS material placement	Dredging Contractor	Included within monthly PN report to CRC

Table 6 cont.

Element	Monitoring Requirement	Timing	Responsibility	Reporting/Approval Requirements
Bund decommissioning	Certification that; (a) The PASS material has been certified to have settled 1m below the lowest permanent water table; (b) The dredge material has been certified to have settled to a level where remobilisation of the material is judged unlikely to occur; and (c) Procedures for the controlled placement of soil fill and Construction and Demolition material over the dredged material have been developed, based on appropriate strength testing. The procedures should include monitoring and review recommendations for Northern Sands ongoing operations	Prior to decommissioning and NS handover	Ports North	CRC- DMPA Decommissioning Certification
Groundwater				
Geotechnical stability	Visual inspection for geotechnical failure during construction and operation	Daily	Dredging Contractor	Contractor checklists
Water contamination	Visual inspection of any bund discharge or contamination of waters, particularly after rain events	Cairns Regional Council (CRC) <24 hrs.	Dredging Contractor	Incident report to CRC
	Groundwater contamination monitoring as per Groundwater Assessment and Management Report	CRC <24 hrs. (non-compliances)	Dredging Contractor (up to final placement) Ports North thereafter	Incident report to CRC CRC- monthly report As per EA0001463 conditions GW8 and GW9
Flooding				
Remobilisation of dredge material	Ongoing material placement level monitoring and recording in accordance with DMP	In accordance with DMP	Dredging contractor	CRC- monthly report

Table 6 *cont.*

Element	Monitoring Requirement	Timing	Responsibility	Reporting/Approval Requirements
Surface Water Management and Quality				
Stormwater	Stormwater discharge event monitoring (pH, turbidity, TSS) in accordance with EA 0001463	Event based monitoring	Ports North (or their representative)	CRC, DES noncompliance notification <24 hrs. post event CRC- monthly report
End of Pipe tailwater quality	Compliance with EA 0001463	Monitoring as per DMP	Dredging Contractor	CRC- monthly report TAG (fortnightly update, monthly report)
Tailwater Discharge Impacts	Tailwater impact on receiving water environmental values	Within 30BD of commencing tailwater discharge	Ports North	DES TAG DoEE
Erosion and Sediment Control				
Stormwater Quality	Refer surface water Quality (Section 6.4)	Refer surface water Quality (Section 6.4)	Refer surface water Quality (Section 6.4)	Refer surface water Quality (Section 6.4)
Bund Construction Phase	Discharge water quality Ground cover %	Event based	Dredging Contractor	Monthly report to Ports North
Operation Phase (up to completion of placement)	Discharge water quality Ground cover % Structural integrity	Event based Monthly Weekly	Dredging Contractor (up to placement completion)	Monthly CRC DMPA report
Material Consolidation Phase (post contractor demobilization) up to and including bund removal	Discharge water quality Ground cover % Structural integrity	Event based Monthly Weekly	Ports North	Monthly CRC DMPA report
Post Northern Sands Site Handover	As per NS EA Water disposal conditions	As per waste disposal EA	Northern Sands	As per waste disposal EA

Table 6 cont.

Element	Monitoring Requirement	Timing	Responsibility	Reporting/Approval Requirements
Rehabilitation and Final Landform				
Operation Phase	Monitoring of dredge material depth to certify that: the PASS material has been certified to have settled 1m below the lowest permanent water table;	Immediately post placement of PASS material with follow up confirmation survey/s at 2 weekly intervals until such time a surface level stabilises	Dredging Contractor	Quarterly report to Ports North post placement
Material consolidation Phase	- The dredge material has been certified to have settled to a level where remobilisation of the material is judged unlikely to occur; and - appropriate strength testing of the top 3m of placed dredged material in order to develop and certify controlled fill procedures for the resumption of Northern Sands filling activities.	Quarterly postplacement until targets achieved Quarterly once target settlement levels are achieved	Ports North	Included in monthly report to CRC Prior to handover of DMPA facility back to Northern Sands
Bund Decommissioning (once target settlement levels are achieved)	Compliance with Rehabilitation and Final Landform Plan (RFLP) - Levels - Ground cover % - Erosion control - Weeds	- once off - weekly - weekly - weekly	Ports North (pre-NS handover)	Monthly CRC DMPA report Preparation of a Final Rehabilitation Report in support of an application to DES for EA0001463 surrender.
After Northern Sands Site Handover(after completion of void filling to pre development levels)	As per Operators SBMP	As per Operators SBMP	Northern Sands	Preparation of a Final Rehabilitation Report in support of an application to DES for surrender of the Northern Sands EA.

Table 6 cont.

Element	Monitoring Requirement	Timing	Responsibility	Reporting/Approval Requirements
Noise Nuisance				
All phases	Monitor noise in response to complaints	Respond to complainant within 24hrs in consultation with DES	Dredging Contractor Ports North	Monitoring report to DES within three (3) days following any notification in accordance with Conditions MCU10 and MMCU11 Monthly CRC report
Air Quality				
All phases	Monitor air quality in response to complaints	Respond to complainant with 24hrs in consultation with DES	Dredging Contractor Ports North	Monitoring report to DES within three (3) days following any notification in accordance with Conditions MCU10 and MMCU11 Monthly CRC report
Emergency Management				
Emergency Discharges	Barron River water quality monitoring of material, tailwater, spills (if discharged to Barron River) emergency discharges	Within 24hrs	Dredging Contractor Ports North	reporting in monthly CRC report TAG- Fortnightly updates TAG- reporting in monthly CRC report
Flooding	Barron Delta impacted landowners liaison- in the event of confirmed 1 in 5 year or more extreme flood event	Within 5 days post event	Ports North	Confirmation of event AEP with CRC- Liaison with impacted landowners in accordance with landowner agreement
Mitigation and management	Contractor checklists(incidents, structure integrity monitoring, water quality, flood levels)	Default weekly (as per Contractor EMP)	Dredging Contractor Ports North	Reporting in monthly CRC report Reports to Ports North (as per Contractor EMP)

7.2 Post Placement Handover Phase

Ports North will assume post placement responsibility for environmental management of the Northern Sands DMPA following short term settlement and supernatant removal and demobilization by the Dredge Contractor.

After sufficient consolidation and surface hardening of the dredge material, anticipated to be before the 2020/2021 wet season, environmental management of the DMPA will revert to Northern Sands Pty Ltd, who will recommence waste disposal activities in accordance with an amended EA, incorporating long-term management of the DMPA and achievement of final landform.

Site handover to Northern Sands will not occur until the site has met the target limits and status identified in **Table 6**.

7.3 Complaints

The following details of all environmental complaints received must be recorded:

- (a) date and time the complaint was received;
- (b) name and contact details of the complainant when provided and authorised by the complainant;
- (c) nature of the complaint;
- (d) investigation undertaken;
- (e) conclusions formed;
- (f) actions taken.

Ports North and the Dredging Contractor will also have respective systems and protocols for recording and responding to complaints for the NS-DMP and also other project components, as outlined in the associated management plans.

7.4 Auditing

Operation phase auditing, reporting, and notification requirements are identified in **Table 7**.

Table 7 Operation Phase Auditing Requirements

Type	Responsibility	Frequency	Reporting To	Auditing Scope
Internal Auditing	Dredging Contractor	Daily	Ports North	As per CEMP, DMP and dredging contract
Third Party Audit of Contractor Performance	Ports North Environmental Manager	Monthly	Ports North	Compliance with NS-SBMP and subordinate management plans and Development permit for Material Change of Use for Dredging (Concurrence ERA 16) and Undefined Use
Regulatory Authority	Ports North Environmental Manager	Within 28 days of activity commencement, then annually	CRC	Compliance with NS-SBMP and subordinate management plans and Development permit for Material Change of Use for Dredging (Concurrence ERA 16) and Undefined Use

7.5 Record Keeping

All relevant project personnel involved in the project environmental management regime identified in **Table 7** will be expected to maintain a record control system including the following data:

- Environmental Incidents;
- Environmental monitoring data and reports (as per **Section 7**);
- Complaints;
- Environmental Management Plan updates;
- Internal and external audit reports; and
- Contractor daily, weekly checklists.

Records must be kept in a secure location and be available for inspection by regulatory agencies and Ports North for a period of up to 5 years post project completion.

8 Continual Improvement

This plan, including subordinate management plans, will be regularly reviewed and improved in response to the following triggers:

- 1) CRC assessment and approvals (this SBMP, Operational Works);
- 2) Procurement of Dredge Contractor;
- 3) TAG meeting to include review of the Dredging and Barron River RMPs, VMPs;
- 4) Pre-construction groundwater monitoring outcomes; and
- 5) Operation phase monitoring trends.

Proposed project communications details, including review meetings and general communications with the TAG and PN project team are provided in **Table 8** and **Table 9** respectively.

Table 8 TAG Communications

Phase	Type	Frequency	Attendee/Contact
Approvals	Set up, protocols, work program	2-3 months (12 months prior to dredging)	- PN Environmental Manager - Environmental Advisor
Detailed Design/ Bund Construction	- Review and approve DMP - Confirmation of monitoring programs	As required	- PN Environmental Manager - Dredge Contractor
Operation	- Review monitoring data (including predredge information) - DMP implementation	Weekly communication (tbc)	PN Environmental Manager
	Monitoring update	As required	- PN Environmental Manager - Dredge Contractor - Environmental Officer
	- Monitoring update (meeting) - Update DMP as required	Fortnightly	- BMT Technical Advisor - PN Environmental Manager
	Real time advice	As required	PN Environmental Manager
Post Dredging	Impact validation monitoring review	Monthly	- BMT Technical Advisor - PN Environmental Manager

Table 9 Ports North Project Team Communications

Element	Type	Frequency	Attendee/Contact
Approvals/Detailed Design reviews	Project Progress Meeting	Monthly	- PN Approvals Manager - PN Environmental Manager - FGC Project Manager - Consultants as required
	Communications	As required	- PN Approvals Manager - FGC Project Manager - Consultants as required
Operation (up to dredging contractor demobilisation)	- Monitoring and management review - Communications - Stakeholders and public	- Weekly - As required - refer Community Stakeholder Engagement Plan (CSEP)	- PN Project Manager - PN Environmental Manager - BMT Technical Advisor - PN Environmental Manager - PN Community Relations Manager
Post Dredging prior to NS handover	- Monitoring and management review - Communications - Stakeholders and public	- Monthly - As required - refer to Community and Stakeholder Engagement Plan (CSEP)	- PN Project Manager - PN Environmental Manager - Environmental monitoring contractors

9 Authorship

This SBMP was originally developed for EIS and MCU approval by David Finney who has 30 years' experience in the planning, approval and environmental management of a wide range of natural resource developments including tourism developments, ports and marinas, mines, quarries, landfills, agriculture, residential estates, aquaculture and service corridors. He provides expert advice on soils, contamination, agricultural land capability, flora/fauna and water quality investigations, and waste management and impact assessments.

The SBMP has been further refined by BMT and Ports North in consultation with Golder Associates and Flanagan Consulting Group based on subsequent input received from the dredging contractors, approval agencies and an independent review by the Technical Advisory Group established for the project.

10 References

BMT November 2018. Flood Risk Assessment

Co-ordinator General Schedule 3. Development Permit for Material Change of Use for Dredging (Concurrence ERA 16) and Undefined Use under Cairns Plan 2016

Flanagan Consulting Group November 2018. Site Water and Materials Balance Assessment

Golder Associates 2018a. Acid Sulfate Soil Risk Assessment

Golder Associates 2018b. Groundwater Assessment

Golder Associates 2018c. DMPA Geotechnical Design Input Report

Golder Associates 2019a. Acid Sulfate Soil Management Plan

Gold Associates 2019b. Groundwater Management Plan

Ports North 2017 CSDP Revised EIS- Chapter C1 Construction Environmental Management Plan

Ports North 2019 Dredge Management Plan

11 Appendices

Appendix A Relevant Project Drawings and Management Plans

The following drawings, reports, and management plans as noted in body of document inform or are the appropriate location for detail on specific issues, and are provided separate to this NS-SBMP due to the need to manage those documents separately (and hence that are not as enclosed appendices).

The latest version of those documents as listed below should therefore be referred to when required;

Drawings

- a) Final Void Footprint and Storage Volumes FCG Sketch 3527- SK14G
- b) General Arrangements FCG Sketch 3527-SK21D

Management Plans and Reports

- a) DMPA Geotechnical Design Input Report
- b) Dredge Management Plan
- c) Storm Water Management and Erosion and Sediment Control Plan (SWESCP)
- d) Site Water and Materials Balance Assessment (SWMBA)
- e) Flood Risk Assessment (FRA)
- f) CSDP Revised EIS Chapter C1 Construction Environmental Management Plan
- g) Groundwater Management Plan (GWMP)
- h) Acid Sulfate Soil Management Plan including:
 - Procedure BD-A Characterisation and Verification of Self-Neutralising PASS (SNP) Dredged Material;
 - Procedure BD-B Treatment and Verification of Dredged Potential Acid Sulfate Soil (PASS); and
 - Procedure BD-C Future Filing Over Placed Dredge material;
- i) Rehabilitation and Final Landform Plan (RFLUP);