PORT OF TOWNSVILLE LIMITED
PORT EXPANSION PROJECT
CHANNEL UPGRADE

Townsville Port Expansion Channel Upgrade Project

Tailwater Management Plan

February 2020

Document Control Sheet

Revision History

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Review History

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0	14/02/2020	M Louden, M Wise prior to submission

Document approval

Approval of the final Tailwater Management Plan was issued by DAWE on 26 February 2020.

The Tailwater Management Plan is published on the CU Project's website on 11 March 2020.

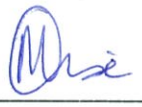
This document has been prepared to meet the Commonwealth Government's EPBC Approval No. 2011/5979 Conditions and the Queensland's Coordinator General's Conditions for the Port of Townsville Limited's Port Expansion Project.

DECLARATION OF ACCURACY

EPBC Number	2011/5979
Project Name	Port of Townsville Port Expansion Project
Approval Holder	Port of Townsville Limited
ACN / ABN	130 077 673 / 44 411 774 236
Approved Action	To expand the Port of Townsville, in Townsville Queensland. The action is for dredging, land reclamation and construction of infrastructure.
Location of the Action	Townsville, Queensland

In making this declaration, I am aware that section 491 of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) makes it an offence in certain circumstances to knowingly provide false or misleading information or documents to specified persons who are known to be performing a duty or carrying out a function under the EPBC Act or the *Environment Protection and Biodiversity Conservation Regulations 2000* (Cth). The offence is punishable on conviction by imprisonment or a fine, or both. I am authorised to bind the approval holder to this declaration and that I have no knowledge of that authorisation being revoked at the time of making this declaration.

Signed



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Port of Townsville Limited

Date 14 / 02 / 2020

GLOSSARY

AEIS	Additional information to the Environmental Impact Statement
ANZECC	Australian and New Zealand Environment Conservation Council
AS/NZS	Australian Standard / New Zealand Standard
ASS	Acid Sulfate Soil
ASSCMP	Acid Sulfate Soil & Contamination Management Plan
Cd	Cadmium
CEMP	Construction Environmental Management Plan
Cr	Chromium
Cu	Copper
CU Project	Townsville Port Expansion Channel Upgrade Project
Department / DAWE	The Australian Government Department of Agriculture, Water and Environment, or any other agency administering the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) from time to time
DES	Queensland Government Department of Environment and Science
DO	Dissolved Oxygen
EA	Environmental Authority
EIS	Environmental Impact Statement
EPP (Water)	*Environmental Protection (Water) Policy 2009*
GPS	Global Positioning System
ITAC	Independent Technical Advisory Committee
NAGD	*National Assessment Guidelines for Dredging 2009*
NATA	National Association of Testing Authorities
Ni	Nickel
NTU	Nephelometric Turbidity Units
PAH	Polycyclic Aromatic Hydrocarbon
PASS	Potential Acid Sulfate Soil
Pb	Lead
PEP	Port Expansion Project
Port	The Port of Townsville
POTL	Port of Townsville Limited
RHM	Regional Harbour Master
Site	The new reclamation area (Lot 794 on SP308904) and the northern extent of the East Port Area at the Port of Townsville (Lot 791 on EP2348)
TBT	Tributyltin

TMP	Tailwater Management Plan
TSHD	Trailer Suction Hopper Dredge
TSS	Total Suspended Solids
Zn	Zinc

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1 INTRODUCTION

Port of Townsville Limited (**POTL**) is a Government Owned Corporation established under the *Government Owned Corporations Act 1993*, which manages the Port of Townsville (**the Port**). The Port is located on Cleveland Bay, approximately three kilometres east of the Townsville city centre in North Queensland (Figure 1). It is a multi-purpose port that handles predominantly bulk and general cargo with a land and sea jurisdiction in excess of 450 km^2. The Port is situated in the Great Barrier Reef World Heritage Area but is outside of the Great Barrier Reef Marine Park. Townsville is a long-established township with a history of urbanisation and industrial activities in the Ross River and Ross Creek drainage system.

The Townsville Port Expansion Channel Upgrade Project (**CU Project**) is Stage 1 of POTL's long-term Port Expansion Project (**PEP**). The PEP aims to create a series of strategic assets that will address current capacity constraints and accommodate future growth in trade over a planning horizon to 2040. It includes development of port infrastructure, namely work to "top of wharf" facilities, capital dredging; reclamation; breakwaters and revetments; berths; access roads; rail loop; and trunk services and utilities. It does not include the development of "above wharf" infrastructure such as terminal pavements; ship-loaders and unloaders; product conveyors; storage buildings for products; rail loaders and unloaders; stacking and reclaiming equipment; storage tanks; and pipelines, which will be subject to separate statutory assessment and approval requirements prior to the start of their operations.

1.1 Scope

The CU Project involves the supply and haulage of marine-grade armour rock; the construction of a reclamation area; and capital dredging and placement of capital dredge material at the Port. The capital dredging, construction activities and infrastructure development for the CU Project will occur inside the existing port limits, the designated water areas in which navigation falls under the control of the Regional Harbour Master (**RHM**). The land-based construction activities will occur on the new reclamation area, namely Lot 794 on SP308904 and the northern extent of the East Port area, namely Lot 791 on EP2348 (**the site**) which is Strategic Port Land (Figure 2).

The capital dredge campaign will last approximately 2 to 3 years and dredge approximately 3.9 million cubic metres from the channels predominantly using a mechanical dredge, with support from a trailer suction hopper dredge (**TSHD**). All the capital dredge material will be placed within the new reclamation area as part of land reclamation activities. Dewatering and ground improvement of emplaced sediments within this area will be undertaken.

A Construction Environmental Management Plan (**CEMP**), detailing appropriate environmental management controls, will be implemented to manage risk and reduce the potential for negative impacts on the environment associated with the CU Project's construction and reclamation activities. This Tailwater Management Plan (**TMP**) forms part of the CEMP and outlines the environmental monitoring and management controls for the tailwater in the new reclamation area from the capital dredge campaign.

A separate tailwater monitoring program is conducted at the Port of Townsville during land placement of maintenance dredge material in the existing dredge ponds. Tailwater discharge from these ponds enters tidal waters through a drainage system into the Ross River, approximately 1.5 km to the south of the CU Project site tailwater discharge point. That program is conducted by POTL's operational Environmental & Planning team and is not part of the CU Project's activities or monitoring.

Figure 1: Locality Plan of the Port of Townsville & CU Project

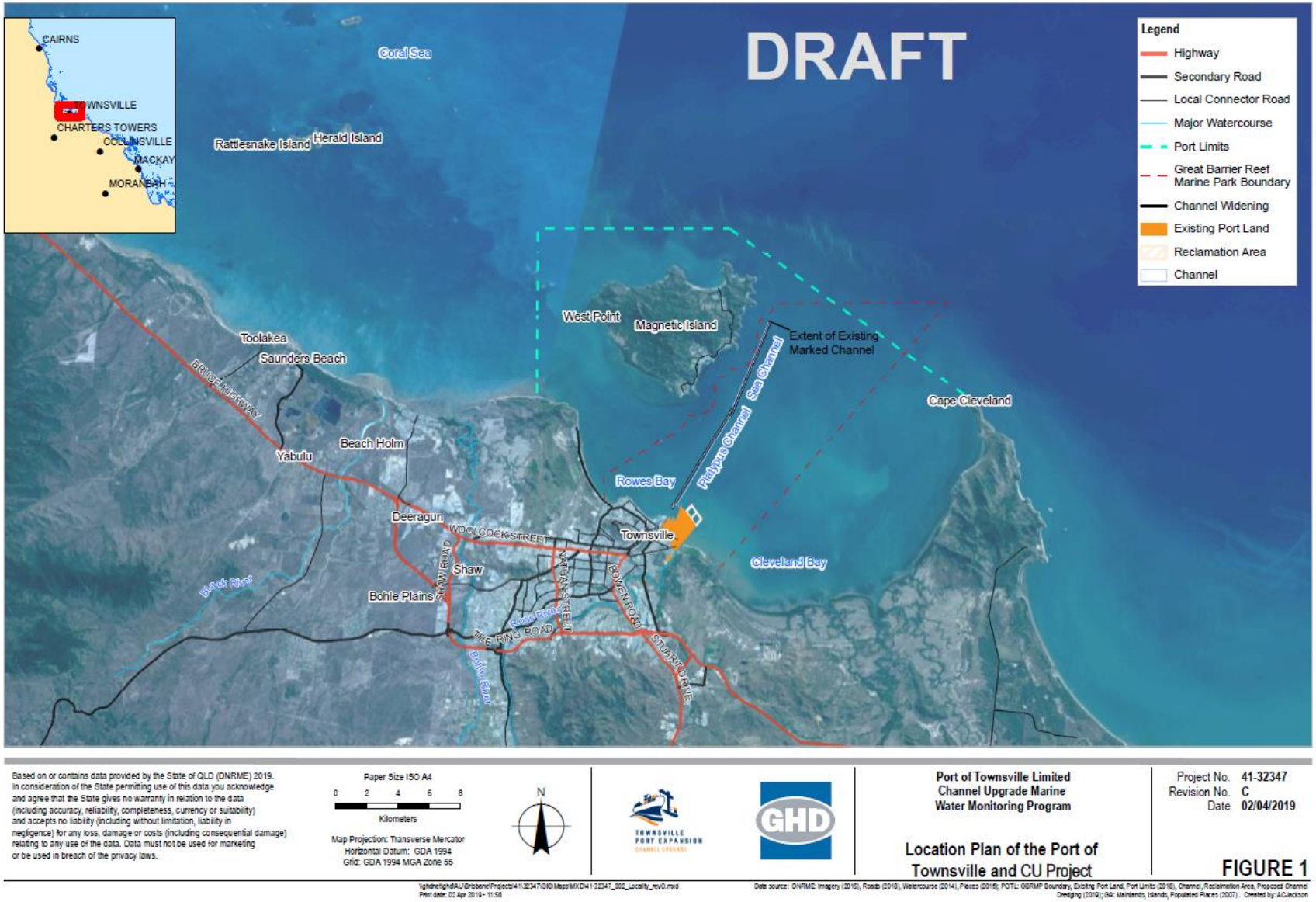

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Figure 2: Lot Plan for CU Project Rock Wall Construction & Reclamation Activities

1.2 Legislative overview

The PEP was the subject of an Environmental Impact Statement (**EIS**) and a further Additional Information to the Environmental Impact Statement (**AEIS**), submitted in support of Commonwealth and State project approval applications.

Commonwealth approval (EBPC 2011/5979) under the Environment Protection and Biodiversity Conservation Act 1999 for the PEP was granted on 5 February 2018. The Queensland Coordinator-General issued an evaluation report on the PEP's EIS/AEIS in September 2017. That report contains conditions to be included in the State Development Permits and Environmental Authorities, for the various stages of the PEP, including the CU Project.

Both Commonwealth and State approvals prescribe conditions relevant to the monitoring of tailwater (provided by Appendix A). This document provides the TMP to address the prescribed conditions. Results of tailwater monitoring will be used to validate the EIS/AEIS tailwater modelling outputs, and manage risk to marine water during tailwater release.

1.3 Purpose & Objectives

The majority (approximately 85%) of the capital dredge material will be loaded into barges by the mechanical dredge and transferred by the barges to the offloading facility at the new reclamation area where it will be placed by excavators into settling ponds. This will involve limited amounts of tailwater being transferred into the reclamation area. The capital dredge material from the TSHD will be hydraulically pumped into the reclamation area, early in the capital dredge campaign, when the reclamation area has available sufficient volume to handle the additional water entrained in the pumped dredged material. The TSHD discharge strategy will ensure there is a low risk of tailwater generation at the release position, due to the low volume and slow rate of water being pumped. Due to this dredging methodology, tailwater releases from the reclamation area are expected to be negligible during the CU Project's capital dredge campaign. However, the perimeter rock walls will incorporate a height adjustable weir box, with gates that open and close the discharge pipes, to control the flow of tailwater release, when required.

The perimeter rock walls of the reclamation area have been designed to withstand extreme metocean conditions (i.e. 50 year design life with a return period of 1 in 500 year storm event), with adequate capacity for the combined volume of capital dredge material and tailwater. Internal bund walls will be designed and installed as required, to control the movement of sediment and water. This is to ensure areas can be dewatered and suspended sediments can settle to control the quality of tailwater; and to also withstand wind-wave action that may be generated within the reclamation area.

The Tailwater Management Plan (TMP) is designed to:

- Conduct the monitoring in a consistent manner which meets the requirements of the appropriate environmental approvals and any standards (as per section 3.1);
- Characterise tailwater quality within the reclamation area to determine contaminant levels associated with the reclamation activities and determine whether the tailwater quality is sufficient to allow a controlled release to occur and for ongoing assessment in the event of uncontrolled release(s);
- Outline representative monitoring in the receiving environment prior to and during release(s). Monitoring will be designed to meet the minimum data requirements outlined in section 4.4.3 of the Queensland Water Quality Guidelines (QWQG) (2009) and define the mixing zone according to the EHP Wastewater Release to Queensland Waters Technical Guideline (2016);
- Define the spatial extent of the mixing zone of defined potential contaminants of concern, and compare this to modelling undertaken in the PEP AEIS;
- Identify trends across a range of environmental parameters to monitor the effectiveness of the CEMP control measures;
- Identify areas of potential concern which may necessitate different management controls than those contained in the CEMP;
- Assess whether there is potential for environmental harm or nuisance;
- Outline management actions to prevent / mitigate adverse impacts to the receiving environment in the event that tailwater quality does not meet the threshold limits stipulated in the Qld Government Approvals;
- Establish a temporal and spatial dataset to inform discussions with regulators and provide supporting information for ongoing performance;
- Timely compilation of draft and final annual monitoring reports and datasets; and

- Timely reporting of all EA limit exceedances to regulators.

The overall objective of the TMP is to avoid or otherwise reduce impacts to sensitive marine environment receptors that could be affected by tailwater released from the reclamation area. This management plan has two interlinked components:

- A component for monitoring water quality, including suspended sediments and metals in the tailwater; and
- A component detailing further investigation and implementation of mitigation actions, if the tailwater monitoring results do not meet threshold limits.

This Tailwater Management Plan is Appendix H of the *CU Marine Environmental Management Plan (CEMP POT 2099).* Management actions and controls relevant to mitigating tailwater impacts from the project are also detailed in the CEMP; this plan covers specifically the monitoring of those aspects to inform the CEMP. This monitoring plan must be read in conjunction with the CEMP to ensure all management and mitigation measures are captured in undertaking this monitoring plan.

2 DREDGE MATERIAL AND TAILWATER CHARACTERISATION

The CEMP establishes the risk level assessed regarding dredge placement and tailwater management. As detailed in the CEMP, the risk assessment is based on the risk management guidelines within POTL's Quality Management System (risk tables reproduced in Appendix B).

A comprehensive Sediment and Analysis Plan, approved by the Department of Agriculture, Water and Environment (**DAWE**) in accordance with the *National Assessment Guidelines for Dredging*, 2009 (**NAGD**), will be undertaken prior to commencement of the CU Project's capital dredge campaign in order to understand the quality of the material to be dredged. As this capital dredge material is being used for land reclamation, the Queensland Acid Sulfate Soil Technical Manual, 2014 and National Environment Protection (Assessment of site Contamination) Measure, 2013a requirements for samples numbers will be followed, which leads to a higher frequency of sampling than the NAGD requirements. This analysis will characterise both the trace metal concentrations in the sediment as well as the potential acid sulfate soil (**PASS**) capacity of the sediment, incorporating the self-buffering / neutralising capacity. This data will be further supplemented by POTL's ongoing regular sediment monitoring conducted in the existing channels. As detailed in the CU Project Acid Sulfate Soil and Contamination Management Plan (ASSCMP), background studies have indicated a low risk of adverse impacts being generated from PASS, Acid Sulfate Soil (**ASS**), sediment contamination and tailwater release.

A good proportion of the capital dredge material is anticipated to be consolidated ('stiffer/denser') undisturbed residual soils, as detailed in Table 1, with less potential for contamination than the overlying unconsolidated (soft) alluvial marine sediment.

Table 1: Dredge Material Approx. Split of Sediment Types

Material Types	Percentage*
Very Soft Silts and Clays	~21%
Soft to Firm Clays and Loose Sands	~30%
Stiff Clays and Medium Dense Sands	~18%
Very Stiff Clays and Medium Dense Sands	~19%
Hard Clays and Dense to Very Dense Sands	~12%

*Note: Total capital dredge campaign volume is approx. 3,900,000 m^3.

Additional sediment samples will be collected during the reclamation activities to monitor the PASS status. Any PASS capacity will be treated in accordance with the management and mitigation actions detailed in the Acid Sulfate Soil & Contamination Management Plan (**ASSCMP**). In low pH conditions, trace metals may be liberated from sediment particulates into the water column within the reclamation area. Therefore, trace metal concentrations in the overlying water can also indicate the effectiveness of dredge material treatment.

During the CU Project, tailwater may be generated in the reclamation area from:

- Water existing in interstitial voids between the dredge material (i.e. pore water);
- Ambient seawater included in the dredge bucket or hopper during dredging and deposited in the reclamation area, noting this is limited using the mechanical dredge methodology; and
- Rain that falls directly into the reclamation area and mixes with the water described above.

It should be noted, that the CU Project Stormwater and Sediment and Erosion Control Plan (SSECP) directs the majority of stormwater from existing lands to the south east away from the new reclamation area.

During previous maintenance dredge campaigns, the tailwater quality in the settlement ponds has been found to exceed the ANZECC 2000 guidelines for some trace metals, primarily copper, on occasion, but this is highly dependent on the location of the dredging and dredge material, the amount of rainfall etc. The tailwater monitoring program will provide data on tailwater quantities and quality characteristics and is an integral aspect of land-based dredge material management as environmental issues may arise from controlled and uncontrolled releases of water. As described above, the majority of the capital dredge material will ***not*** be hydraulically pumped into the reclamation area, therefore the amount of tailwater will be limited. The tailwater outlet on the reclamation structure will have gates that allow the level of water in the new reclamation area to be regulated, held and released when desired. Following initial sampling results, monitoring and treatment of tailwater will be assessed during this capital dredge campaign in order to refine the contaminants of concern and to mitigate risks involved in the controlled release of tailwater to the receiving environment, such as the potential impact on sensitive receptors from turbidity, etc.

The potential for cumulative impacts from the CU Project tailwater discharge and the POTL maintenance dredging land placement tailwater is considered to be very low. Tailwater discharge from maintenance dredging land placement is very irregular, and for the most part tailwater is evaporated rather than discharged. Additionally, the tailwater discharge outlets are between 1.5km and 2 km apart, with the POTL maintenance outlet discharging into the mouth of the Ross River whereas the CU Project outlet discharges into Cleveland Bay beyond the Ross River mouth. Further, two of the CU Project tailwater monitoring locations are located between the project and the POTL maintenance dredging tailwater outlets and will provide data on the potential for cumulative impact should it be measurable.

3 MONITORING PROGRAM

Tailwater monitoring will be conducted once the reclamation structure is constructed and capital dredge material is being placed into the new reclamation area. The monitoring program outlined in this TMP will monitor the tailwater quality to ensure compliance with the conditions in the Environmental Authority (**EA**) for the CU Project prior to any controlled releases. Controlled release(s) of tailwater will ideally take place after the first period of monitoring results are known (following receipt and interpretation of analytical results), depending on rainfall. PASS, ASS and sediment contamination monitoring requirements are listed in the ASSCMP.

3.1 Relevant documents

The TMP described herein has been developed with reference to the following documents:

- Environmental Authority *EPRXXXXXXXX* (**yet to be issued**);
- EPBC approval decision 2011/5979 – Port of Townsville Port Expansion Project;
- Environment Management Plan Guidelines, Australian Government Department of the Environment (2014);
- Monitoring and Sampling Manual 2018, Environmental Protection (Water) Policy 2009 (DES, 2018);
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality volumes 1 – 3 (ANZECC, 2000);
- *Environmental Protection (Water) Policy 2009;*
- Wastewater release to Queensland waters – Technical guideline (DES, 2016);
- Ross River Basin and Magnetic Island Environmental Values and Water Quality Objectives – Basin No. 118 including all waters of the Ross River Basin, and adjacent coastal waters (including Magnetic Island) (DEHP, 2013);
- AS/NZS 5667.1:1998 *Water quality - Sampling - Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples*. Standards Australia, 2016;
- AS/NZS 5667.9:1998 *Water quality - Sampling - Guidance on sampling from marine waters*. Standards Australia, 2016;
- the Queensland Acid Sulfate Soil Technical Manual, 2014;
- the National Environment Protection (Assessment of site Contamination) Measure, 2013a.

3.2 Parameters

Table 2 provides an overview of the parameters that will be monitored under the TMP. Parameters have been selected based on current knowledge of contaminants likely to be present in the dredged material and include those nominated in the CG Report's Stated EA conditions.

Table 2: Tailwater Monitoring Parameters

Parameter	Relevance	Method
pH	Identifies presence of acids or alkaline substances	Field measurement
DO	Indicates chemical or biological activity	Field measurement
Turbidity (**NTU**)	Indicates clarity of water column	Field measurement
TSS	Indicates degree of catchment disturbance and variety of particulates in the water which may impact on sensitive receptors	Laboratory analysis
Dissolved metals suite* (Aluminium (**Al**), Antimony (**Sb**), Arsenic (**As**), Cadmium (**Cd**), Chromium (**Cr**), Copper (**Cu**), Iron (**Fe**), Lead (**Pb**), Nickel (**Ni**), Silver (**Ag**), Zinc (**Zn**))	Indicates uptake of metal/metalloids into water column which can be harmful to marine life	Laboratory analysis
Visible Gross Pollutants	Identifies presence of pollutants	Field observation
Visible Oils and Greases	Identifies presence of oil-related pollutants and trigger if Polycyclic Aromatic Hydrocarbon (**PAH**) analysis is required	Field observation
Flow rate	Indicates volume of tailwater released to the environment	Field measurement

* Full metal suite to be analysed as part of initial tailwater sampling to characterise the tailwater discharge. Following characterisation, suite to be reduced to metals of potential risk (likely to be Cd, Cr, Cu, Pb, Ni, Zn).

It should be noted that not all of these parameters will be monitored on all occasions. Metal suite testing will be associated with tailwater characterisation initially and may not be continued routinely.

3.3 Monitoring Locations

Tailwater monitoring will be conducted at six monitoring locations (Figure 3) during the reclamation phase of the CU Project, primarily in the receiving environment. Where discharge of tailwater through the outlet is expected, representative samples will be taken at the tailwater outlet (upstream of the outlet) prior to discharge.

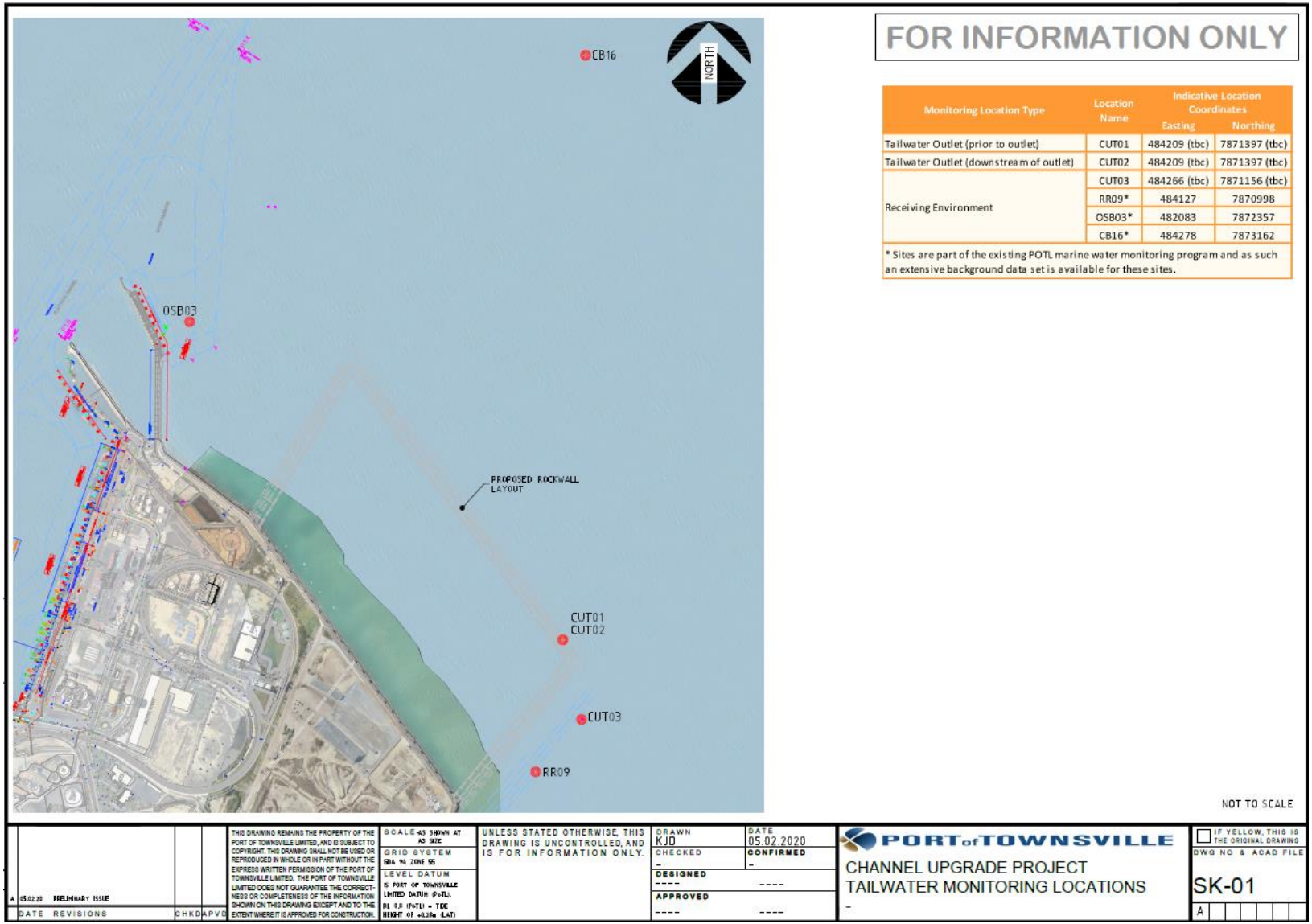
During tailwater release, receiving environment monitoring will also be conducted at the specified monitoring locations. Indicative global positioning system (**GPS**) co-ordinates of monitoring locations are included in Table 3 and Figure 3; these will be finalised once the tailwater outlet has been installed. Monitoring may be conducted at other locations, as required for complaint investigation, incident monitoring etc.

Table 3: Indicative Coordinates of Tailwater Monitoring Locations

Monitoring Location Type	Location Name	Indicative Location Coordinates	
		Easting	Northing
Tailwater Outlet (upstream of outlet)	CUT01	484124 (tbc)	7871297 (tbc)
Tailwater Outlet (downstream of outlet)	CUT02	484124 (tbc)	7871297 (tbc)
Receiving Environment	CUT03	484266 (tbc)	7871156 (tbc)
	RR09*	484127	7870998
	OSB01*	482967	7872185
	CB16*	484278	7873162

* Sites are part of the existing POTL marine water monitoring program and as such an extensive background data set is available for these sites.

Figure 3: Indicative Tailwater Monitoring Locations



Monitoring Location Type	Location Name	Indicative Location Coordinates	
		Easting	Northing
Tailwater Outlet (prior to outlet)	CUT01	484209 (tbc)	7871397 (tbc)
Tailwater Outlet (downstream of outlet)	CUT02	484209 (tbc)	7871397 (tbc)
Receiving Environment	CUT03	484266 (tbc)	7871156 (tbc)
	RR09*	484127	7870998
	OSB03*	482083	7872357
	CB16*	484278	7873162

* Sites are part of the existing POTL marine water monitoring program and as such an extensive background data set is available for these sites.

3.4 Methodology & Equipment

Sampling will be conducted in accordance with the requirements of the Queensland Monitoring and Sampling Manual (DES 2018). All sample analysis will be undertaken by a National Association of Testing Authorities (**NATA**) accredited laboratory; scheduling of analyses will include employing analytical practical quantitation limits of sufficient sensitivity to enable comparisons of results to specified triggers/guidelines. All water monitoring devices will be maintained and calibrated in accordance with manufacturer guidelines.

Collection of samples for laboratory analysis (for TSS, metals and TBT) will be conducted using a sampling pole and suitable clean, sterile sample containers. Samples will be collected from 10 cm below the water surface at the nominated locations. Care will be taken to ensure that collected samples are representative of the tailwater to be released/receiving waters to be sampled. Samples will be handled and dispatched in accordance with instructions from the analytical laboratory.

A hand-held water meter will be used to analyse the physical parameters:

- Turbidity (NTU);
- Dissolved oxygen (DO) (percent saturation); and
- pH (pH units)

The hand held water meter will be calibrated and maintained according to the manufacturer's specifications.

Visual observations of oil/grease/sheens on the water surface and colouration and odours will also be made.

Flow rate measuring equipment will be installed at the tailwater outlet to ensure compliance with the EA conditions relating to total allowable daily volume.

Monitoring of the receiving environment/mixing zone will be conducted from a vessel using a sampling pole and a hand-held water meter as described above. Due to the shallow conditions at the nominated monitoring locations, vessel monitoring will be scheduled around high tidal conditions.

3.5 Frequency & Timing

At least one round of tailwater monitoring will be conducted at the tailwater outlet (upstream of the outlet) prior to any controlled release. Additional sampling at the tailwater outlet (upstream and downstream of the outlet pipe) will be conducted on a daily basis during any release, with Total Suspended Solids to be sampled monthly during releases. As soon as practical, following the commencement of an uncontrolled release, tailwater monitoring will be conducted at the tailwater outlet and will continue daily until the uncontrolled release ends. The flow monitor will be automatically activated during any release.

Mixing zone monitoring will be conducted throughout the CU Project. Routine receiving environment monitoring will be conducted in February; May; August; and November. Additional vessel monitoring will be scheduled prior to, and daily during a controlled release (for selected parameters), with monitoring conducted after a release ceases. During an uncontrolled release, vessel monitoring will be conducted as soon as practically possible after the release commences, daily during the release and once the release ceases. Total suspended solids will be sampled monthly during releases.

Visual observations will be conducted as part of the daily routine environmental inspections for the duration of the CU Project.

Tailwater flow rates will be compiled each day when a tailwater discharge is occurring, with total daily flow monitored by the CU Project team and the reclamation contractors to ensure the daily release limit is not exceeded.

3.6 Quality Assurance / Quality Control

3.6.1 Field Quality Assurance / Control Measures

Collection of samples for laboratory analysis will be undertaken in accordance with the quality assurance and quality control measures outlined in the Queensland Government Monitoring and Sampling Manual (DES 2018). This will include:

- Conduct monitoring in similar weather conditions (where possible).
- Works to be undertaken by appropriately trained and experienced field staff;
- Use of properly maintained, calibrated monitoring equipment, including decontamination of equipment between locations;
- Implementation of appropriate monitoring techniques in accordance with relevant guidelines as listed in Section 3.1., including clear and accurate labelling of sample containers and completion of field record sheets;
- Collection of one field duplicate for laboratory analysis per monitoring event;
- Adherence to water sample preservation and handling procedures, including provision of samples to the laboratory within required holding times with accurate chain of custody forms.

3.6.2 Laboratory Quality Assurance / Control Measures

Only NATA accredited laboratories will be used to analyse samples and therefore strict quality assurance and quality control procedures will be in place. Routine laboratory controls include:

- Certified Reference Materials
- Laboratory Duplicates
- Laboratory Control Spikes
- Matrix Spikes
- Surrogates
- Secondary and project Standards
- Intra Laboratory (Proficiency) Testing
- Client and Industry managed independent audits and accreditations.

Inter laboratory testing will also be investigated to demonstrate quality assurance.

All laboratory analysis procedures will be completed within the laboratory specified practical quantification limits. These limits are expected to provide adequate sensitivity for the selected parameters to enable assessment of the particular characteristic against the limits.

4 THRESHOLD LIMITS

Tailwater parameters will be assessed against the site-specific threshold limits listed in the EA and reproduced in Table 4. Monitoring results meeting the threshold limits indicate that tailwater may be released with acceptable risks to the environment. Monitoring results outside the threshold limits will trigger additional assessments and possible mitigation actions.

Table 4: Tailwater Threshold Limits

Parameter	Threshold Limits
pH	6.5 – 8.5
DO	60 – 105% saturation
Turbidity	<50 NTU no excessive plumes along the perimeter of the reclamation structure
TSS	monitor only
Persistent sheens	not be visible on the water surface*
Odours/Colouration	no unusual odour or colouration*
Flow Rate	<285 ML/day

Note: *Limit is not specified in EA.

Water quality objectives for Cleveland Bay and the Project site have been prescribed under the *Environmental Protection (Water) Policy 2009*. The Project site is located within the MD2241 Townsville Port Subzone of the Ross River Basin and Magnetic Island Environmental Values and Water Quality Objectives – Basin No. 118 (including all waters of the Ross River Basin, and adjacent coastal waters (including Magnetic Island)).

As per the requirements of the EA, results of the TMP will also be compared against the objectives outlined in that report, particularly for metals and TBT. Any toxicant results that are not included in that report will be compared against the National water quality guidelines: *Australian and New Zealand Environment and Conservation Council Guidelines (ANZECC 2000).*

Further to the threshold analysis, within 40 Business days of commencing tailwater release, a full analysis of the tailwater discharge characteristics will be undertaken to identify and describe any adverse impacts to receiving water environmental values (including suitability of tailwater release limits) due to authorised tailwater releases. This will also include definition of the spatial extent of the mixing zone, using an appropriate near field model in relation to selected metals of concern. Details of the assessment and model to be used will be developed through direct engagement with the CU Project ITAC.

5 MITIGATION ACTIONS IF THRESHOLD LIMITS EXCEEDED

This plan will address the performance objectives prescribed for Tailwater by the CEMP.

Mitigation actions will be considered on a case-by-case basis based on comparison of tailwater monitoring results against the threshold limits detailed in Section 4. In the case of field monitoring, the results will be reported to CU Project Management and appropriate actions will be taken in real time. In the case of laboratory analysis where thresholds are not met, the Project Director CU, in conjunction with the Environment Advisor CU, will undertake an incident investigation in accordance with POTL's incident response procedure ***(POT 1499 Environmental Incident Management Procedure)***. This may be undertaken in conjunction with the respective contractors, consultants, relevant agency representatives or other project team members. Any exceedances of the tailwater threshold limits may be discussed with relevant parties as part of the incident investigation. Incident specific mitigation or management actions will be determined, implemented and monitored for effectiveness in order to amend standard work procedures where necessary. This process will also determine the level of notification required. Table 5 identifies indicative mitigation actions.

Table 5: Indicative Mitigation Actions for Exceedances of Tailwater Thresholds Limits

Threshold Limit Triggered	Immediate Response / Action	Mitigation Action
Excessive plumes along the perimeter of the reclamation structure visually observed.	Conduct sampling.	Repair areas of deterioration of the reclamation walls (e.g. re-lining with geotextile material and rock).
Any observances of turbidity incidents from tailwater releases, which are likely to cause environmental harm to the immediate location and/or surrounding areas.	Report the incident to the Project Director CU, and Manager Environment CU/Environmental Advisor CU as soon as practicable, but within 24 hours.	The Project Director CU and Manager Environment CU, in conjunction with the Environment Advisor CU, must undertake / facilitate the necessary incident response procedure.
Exceedance of turbidity or TSS threshold limits in the reclamation area – prior to a controlled release.	Review the on-site control measures promptly to ensure that all reasonable and practicable measures are being taken in terms of both the hydrologic and sediment loading in the reclamation area and tailwater release.	Review dredge production rates and close tailwater outlet gates to increase tailwater retention time and allow sediments to settle in the ponds before release. Establish internal bund walls within the reclamation area in a manner that maximises settlement of sediments and reduces further erosion and mobilisation of sediments.
Exceedance of pH in the reclamation area – prior to a controlled release.	Review implementation of ASS / PASS treatment measures in the ASSCMP to ensure effectiveness.	Add additional agricultural lime or other mechanism to increase pH and monitor pH during dosing to limit risk of over dosing. Refer to ASSCMP for dredging and reclamation for detailed mitigation actions.
Dissolved trace metal concentrations above water quality guidelines in the reclamation area – prior to a controlled release.	Calculate expected trace metal concentrations in the receiving environment based on tailwater chemistry, the volume of tailwater, expected tailwater	Treat tailwater in the reclamation area using an environmentally friendly and legislatively compliant flocculation agent to bring the tailwater quality to an acceptable standard.

Threshold Limit Triggered	Immediate Response / Action	Mitigation Action
	release rates and flushing times.	Alternatively, if results of these dilution / mixing calculations indicate that marine water quality in the receiving environment would be potentially adversely affected, laboratory ecotoxicity tests may be undertaken to assess the toxicity of the released tailwater and dilution factors required such that the tailwater would be non-toxic to sensitive marine organisms.
Exceedance of turbidity, TSS or pH threshold limits at the tailwater outlet during a controlled or uncontrolled release.	Raise the tailwater release gates to cease tailwater discharge and retain tailwater on site longer to reduce the turbidity to the background levels found in Ross River. Where tailwater requires time to slow / cease (due to lag), continue to monitor discharge every 1 hour until exceedance subsides (during daylight hours).	Establish internal bund walls within the reclamation area in a manner that maximises settlement of sediments and reduces further erosion and mobilisation of sediments. Control the gates to slow the rate of release and increase the holding capacity.
Exceedance of turbidity, TSS or pH threshold limits in the mixing zone / receiving environment during a controlled or uncontrolled release.	Review data for trends and compare results to historical baseline survey trends and meteorological parameters to establish spatial footprint and potential cause of exceedance. If necessary, interrogate data collected under marine water monitoring program to determine if sensitive receptors are at risk of impact from tailwater. Continue to monitor discharge every 1 hour at the tailwater outlet until exceedance subsides (during daylight hours).	If exceedance caused by tailwater release operations, consider options available to cease release. Discuss appropriate mitigation actions with regulators. Implement agreed action(s) to change release operations, practice, plant or schedule as appropriate to avoid future exceedances. Carry out monitoring on next tide to demonstrate mitigation action(s) have been effective. If required, implement additional mitigation actions (internal bund walls, serpentines, silt curtain etc.) to reduce impact.
Exceedances of dissolved trace metal concentrations during a controlled or uncontrolled release.	Check results of receiving environment monitoring.	If results of receiving environment monitoring indicates that water quality in the receiving environment is adversely affected, laboratory ecotoxicity tests may be undertaken to assess the toxicity of the released tailwater. Depending on the results, mitigation action(s) may be required as discussed above.
Exceedance of flow limits during an uncontrolled or controlled release.	Cease release.	Monitor flow rates more regularly during releases.

6 REPORTING AND RESPONSIBILITY

POTL will take responsibility for coordinating the implementation of this management and monitoring plan, with the assistance of suitably qualified contractors/consultants where required.

POTL will produce an annual summary of the monitoring results from the TMP. Copies of all finalised report(s) will be kept on-site and will be available for regulatory inspection. If requested by the regulators, all monitoring data and information related to this TMP will be submitted within 30 business days of the request, or within a timeframe agreed in writing between POTL and the relevant regulator.

In the event of a significant tailwater control or quality incident, relevant regulators will be notified in a timely manner of the incident and control measures being implemented to address the incident.

In addition, within 40 business days of tailwater release commencing, POTL will provide a report to the regulators that identifies and describes any adverse impacts to receiving water environmental values due to the tailwater release. This report will:

- Describe the concentrations of contaminants in the tailwater released to the receiving environment
- Define the spatial extent of the mixing zone, using an appropriate nearfield model approved by the Independent Technical Advisory Committee (**ITAC**), in relation to contaminants of concern
- Compare results to modelled outputs detailed in the PEP AEIS
- Assess the suitability of the tailwater release limits detailed in Section 4 to protect receiving water environmental values
- Meet the minimum data requirements outlined in Section 4.4.3 of the Queensland Water Quality Guidelines (2009) and define the mixing zone according to the EHP Wastewater Release to Queensland Waters Technical Guideline (2016).
- Compare the results of the monitoring to the water quality objectives prescribed for the site under the *Environmental Protection (Water) Policy 2009*.

Where adaptive management controls are to be amended during the CU Project in response to recommendations, the relevant Management Plans (CEMP, MEMP, DMP) will be updated to incorporate updated management arrangements into the on ground practices. The updating of the plans will occur immediately, or as part of the regular review of the plan depending on the significance of the management action modification. A record of changes made will be kept.

In the event that the monitoring plan needs to be revised during implementation, then POTL will consult with the regulators on the need for amendments and submit a revised plan for approval. Changes of a minor administrative nature will not require approval, in accordance with the Department's policy on management plans.

7 CONTINUOUS IMPROVEMENT

The Tailwater Monitoring Plan (TMP) will be subject to regular review.

This TMP is a "living document" which will undergo formal review annually during the construction phase. During delivery, review and amendment will occur as necessary via adaptive management actions to ensure it remains fit for purpose and achieves the required program objectives; including identification and implementation of any new or changing environmental risks and mitigation action outcomes. Recommendations on improvements or amendments are to be reported as part of the annual reporting process. This will align with the regular review of the performance of the CEMP as required under the approval conditions.

Feedback systems will be in place for the duration of the CU Project to enable this TMP to be updated and responsive to learning from any incidents, complaints and ongoing monitoring results and to reflect knowledge gained. Other triggers for TMP review may include:

- As a result of the tailwater release assessment conducted within 40 days of commencement of tailwater release;
- Changes in operations or management;
- Changes in environmental legislation and/or policies; and
- New technologies / innovation relevant to applied monitoring methods and mitigation actions that provide innovative means of executing activities in order to meet performance objectives.

Changes to the TMP may be developed and implemented in consultation with relevant regulators and other stakeholders over time. All changes are to maintain the approval conditions and be approved by the CU Project Management, before implementation.

Information from this TMP will be used to assist with improving the control measures in the CEMP.

As noted in section 6, an annual report on the tailwater monitoring undertaken will be produced that will identify the results found and an interpretation of the results in relation to the CU construction activities. This information will be reviewed and considered by POTL to identify any recommendations on likely causes of exceedances or raised levels and necessary management actions to be implemented as a result of the monitoring outcomes. These reports will also detail the application of any mitigation actions implemented as per Section 5.

Continuous improvement will also be achieved via the *Construction Environmental Management Plan*, to which this plan is a part of (Appendix H of CEMP). Consideration and review of improvements to the CEMP will be reflected within this Plan.

As noted, where the monitoring identifies the need for revised management actions, the CEMP will be revised to incorporate the adaptive management arrangements. This will include the assessment of any monitoring program modifications.

As per Condition 38 of the EPBC Act Approval (EPBC 2011/5979), any changes to this Monitoring Plan, or any of the Management Plans as a result of the outcomes of the TMP will be notified to the Department.

8 REFERENCES

ANZECC 2000. *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Australian and New Zealand Environment Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, 2000.

AS/NZS 5667.1:1998. *Water quality - Sampling - Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples*. Standards Australia, 2016.

AS/NZS 5667.9:1998. *Water quality - Sampling - Guidance on sampling from marine waters*. Standards Australia, 2016.

DES 2016. *Wastewater release to Queensland waters – Technical Guideline*. Department of Environment and Science, Brisbane. ESR/2015/1654 Version 2.01, 2016.

DES 2018. *Queensland Monitoring and Sampling Manual*. Department of Environment and Science, Brisbane, 2018.

DSITIA 2014. *Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines*. Department of Science, Information Technology, Innovation and the Arts, Brisbane, 2014.

EPP (Water) 2009. *Environmental Protection (Water) Policy 2009: Ross River Basin and Magnetic Island Environmental Values and Water Quality Objectives Basin No. 118 including all waters of the Ross River Basin, and adjacent coastal waters (including Magnetic Island)*. Department of Environment and Heritage Protection, Brisbane, 2016.

NAGD 2009. *National Assessment Guidelines for Dredging*. Department of Environment and Energy, Canberra, 2009.

NEPC 2013. *National Environment Protection (Assessment of Site Contamination) Measure Schedule B(2) Guideline on Data Collection, Sample Design and Reporting.* National Environment Protection Council 1999 (Amended 2013).

QASSIT 1998. *Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils in Queensland 1998.* Queensland Acid Sulfate Soils Investigation Team, Brisbane, 1998.

QWQG 2009. *Queensland Water Quality Guidelines*. Department of Environment and Heritage Protection, Brisbane, 2013.

APPENDIX A

Commonwealth (EPBC Approval) and State (EA) Conditions relevant to Tailwater

Coordinator General's Stated Conditions (EA) relevant to this TMP

<table>
<tr><th>Ref</th><th>Cond. No.</th><th>Condition Requirement</th><th>Plan Reference</th><th>Demonstration of how the plan addresses the condition requirement</th></tr>
<tr><td>1</td><td>WT1</td><td>The only contaminants to be released to surface waters from the placement and management of dredge spoil are tailwater releases from the reclamation area to the mouth of the Ross River in accordance with Table WT1 – Surface water release limits and the associated monitoring requirements.
Table WT1 – Surface water release limits
<table>
<tr><th rowspan="2">Monitoring location name</th><th colspan="2">Release Points(s) Description (GDA94 decimal degrees)*</th><th rowspan="2">Quality characteristic (units)</th><th rowspan="2">Limit</th><th rowspan="2">Limit Type</th><th rowspan="2">Minimum Monitoring Frequency</th></tr>
<tr><th>Latitude</th><th>Longitude</th></tr>
<tr><td rowspan="4">End of pipe</td><td rowspan="4">TBA</td><td rowspan="4">TBA</td><td>pH</td><td>6.5 – 8.5</td><td>Range (minimum to maximum)</td><td>Daily during releases</td></tr>
<tr><td>Dissolved oxygen</td><td>60-105% saturation</td><td>Range (minimum to maximum)</td><td>Daily during releases</td></tr>
<tr><td>Turbidity</td><td>50 NTU</td><td>Maximum</td><td>Daily during releases</td></tr>
<tr><td>Total Suspended Solids</td><td>Monitor only</td><td>N/A</td><td>Monthly during releases</td></tr>
</table>
*Decimal degrees to be provided to a minimum of 4 decimal places
Surface water release limits associated monitoring requirements:
a) Monitoring must be in accordance with the methods prescribed in the current edition of the Department of Environment and Heritage Protection Monitoring and Sampling Manual;
b) All determinations must employ analytical practical quantitation limits of sufficient sensitivity to enable comparisons to be made against the limits relevant to the particular water or sediment quality characteristic;
c) Monitoring must be undertaken during a release and at the frequency stated;
d) Suspended solids samples must be taken so as to allow a correlation with turbidity levels; all monitoring devices must be calibrated and maintained according to the manufacturer's instruction manual.</td><td>3</td><td>Section 3 details the tailwater monitoring to be undertaken as part of the CU project, including location, frequency, equipment and parameters to be applied. This will indicate compliance with this condition.</td></tr>
<tr><td>2</td><td>WT2</td><td>The maximum tailwater release volume from the end of pipe referred to in Table WT1 – Surface water release limits must not exceed 285 Ml/day.</td><td>3.2
4</td><td>Section 3.2 and 4 details the flow monitoring for tailwater discharge, including location, frequency and total daily volume limit. This will indicate compliance with this condition.</td></tr>
<tr><td>3</td><td>WT3</td><td>Within 40 business days of commencing tailwater releases a report must be submitted to the administering authority that identifies and describes any adverse impacts to receiving water environmental values due to the authorized tailwater release.
The report must:
a) Describe concentrations of toxicants in the tailwater releases and the receiving environment;
b) Define the spatial extent of the mixing zone, using an appropriate nearfield model approved by the Technical Advisory Committee, in relation to contaminants of concern, including but not limited to: aluminum, antimony, arsenic, cadmium, chromium copper, iron, lead, nickel, silver, zinc.
c) Compare results to modelled outputs detailed in the Townsville Port Expansion Project Additional Information to the Environmental Impact Statement Appendix A2 Townsville Port Expansion AEIS Hydrodynamic and Advection – Dispersion Modelling Technical Report, prepared by BMT WBM, dated 30/03/2016, reference R.B21057.003.03.AEIS-Modelling.docx revision 3;</td><td>4
6</td><td>Section 4 details the characterization of tailwater discharge within 40 days of the commencement of tailwater discharge. This will include detailing and comparison to conditional requirements listed.

Section 6 details the reporting requirement for the tailwater characterization.</td></tr>
</table>

Ref	Cond. No.	Condition Requirement	Plan Reference	Demonstration of how the plan addresses the condition requirement
		d) Assess the suitability of current tailwater release limits outlined in **Table WT1 – Surface water release limits** to protect receiving water **environmental values;** e) Meet the minimum data requirements outlined in Section 4.4.3 of the *Queensland Water Quality Guidelines (2009)* and define the mixing zone according to the *EHP Wastewater Release to Queensland Waters Technical Guideline (2016).* **Associated monitoring requirements** a) Compare results of tailwater and receiving environment monitoring with Environmental Protection (Water) Policy 2009 (EPP (Water)) water quality objectives schedule under the EPP (Water) Ross River Basin and Magnetic Island Environmental Values and Water Quality Objectives Basin No. 118, including all waters of the Ross River Basin, and adjacent coastal waters (including Magnetic Island); b) All monitoring devices must be calibrated and maintained according to the manufacturer's instruction manual; c) Monitoring of tailwater and the receiving environment must be undertaken during tailwater releases.		

Definitions:

Administering authority: means the Department of Environment and Heritage Protection or its successor or predecessors.

Environmental value is:

a) A quality or physical characteristic of the environment that is conducive to ecological health or public amenity or safety; or
b) Another quality of the environment identified and declared to be an environmental value under an environmental protection policy or regulation.

Receiving waters: means the waters into which this environmental authority authorizes tailwater releases from the reclamation area.

Technical Advisory Committee: means an assembly of appropriately-qualified persons representing experts in various scientific fields, formed to be capable of assessing sediment plume-associated monitoring data and presenting advice to conducting the dredging campaign and protecting sensitive receptors as directed under this authority and the Dredge Management Plan.

EPBC Approval conditions relevant to this TMP

Ref	Cond. No.	Condition Requirement	Plan Reference	Demonstration of how the plan addresses the condition requirement
1	8	**Reclamation area** The person undertaking the action must ensure that: c) The design, materials and methods of construction for the reclamation area must prevent water quality impacts from leaching material through the bund wall, release of tailwater and storm-water run-off	**3**	Section 3 details the tailwater monitoring to be undertaken as part of the CU project, including location, frequency, equipment and parameters to be applied. This will indicate compliance with this condition and the prevention of water quality impacts via release of tailwater.
2	10	**Construction and management of the reclamation area** The person taking the action must submit a Construction Environmental Management Plan (CEMP) for the **Minister's** approval, which includes measures to mitigate impacts to **MNES** from the construction of the reclamation area before the **commencement** of the action. The person taking the action must not **commence** the action unless the **Minister** has approved the CEMP. The CEMP must be prepared in accordance with the **Department's Environmental Management Plan Guidelines** and include at least the following: f) A program to monitor, manage and treat tailwater before release into the marine environment	**3**	Section 3 details the tailwater monitoring to be undertaken as part of the CU project, including location, frequency, equipment and parameters to be applied. This will indicate compliance with this condition and the prevention of water quality impacts via release of tailwater.
3	26	**Dredging Completion Report** At the completion of **capital dredging** for each **stage** of the action the person taking the action must submit a Dredging Completion Report to the **Minister**. The Dredging Completion Report must: a) Include details (including assumptions, inputs and findings) of modelling used to determine the actual amount (tonnes) of **fine sediment** returned to the marine environment as a result of the action during dredging and release of tailwater from the reclamation area; and b) Delineate and quantify (in tonnes): i. **Fine sediment** returned to the marine environment that was not available for resuspension before **commencement**; and ii. **Fine sediment** returned to the marine environment that was available for resuspension before **commencement.**	**3**	Section 3 details the tailwater monitoring to be undertaken as part of the CU project, including location, frequency, equipment and parameters to be measured. This will contribute to any estimation of the quantity of fine sediment released as a result of the action, including the release of tailwater.

Definitions:

Minister: The Minister administering the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) and includes a delegate of the Minister
MNES: Matters of National Environmental Significance: In the context of this approval: Great Barrier Reef World Heritage Area, Great Barrier Reef National Heritage Place, Listed turtle species, listed dolphin species, and all other Cetaceans, Dugong (*Dugong dugon*), Commonwealth marine area and the Great Barrier Reef Marine Park.
Commencement: Any works that are required to be undertaken for construction (includes works associated with the construction of the reclamation area, pile driving activities, dredging activities, and any infrastructure associated with the action). Excludes preliminary works.
Capital dredging: as defined in the NAGD, being 'dredging for navigation, to enlarge or deepen existing channels and port areas or to create new ones.
Stage As identified at Section 2.4.1 of the *Townsville Port Expansion Project – Additional Information to the Environmental Impact Statement (October 2016).*
Fine sediment: < 15.6 µm fine silt and clay

APPENDIX B

Extract from POT442 – Risk Management Guidelines

ANNEXURE A – QUALITATIVE MEASURES OF CONSEQUENCE OR IMPACT

Rank		Operations (Trade)	Financial Loss	Asset Loss	Interruption to Services	Reputation, Image & Political Implications	Performance	Criminal Penalty	Information Security	Safety	Health	ENVIRONMENT	
												Nature & Extent of Potential / Actual Environmental Harm	Frequency, Intensity, Duration, Offensiveness of Activity
1	Insignificant	Insignificant impacts on operations and trade. No navigation closure. Insignificant delays.	$0 - $50K	Little or no impact on assets	< ½ day	Unsubstantiated, low impact, low profile or no news items. No political implications.	Up to 5% variation to KPI	Pecuniary	Can be dealt with by routine operations.	Minor temporary – irritation, first aid treatment required.	Reversible health effects of concern.	Environmental Nuisance resulting in insignificant impacts on the natural receiving environment, plants and/or wildlife. No impact on community or business.	Low frequency / intensity / duration activity (days). No substantiated offensive amenity impacts on surrounding area.
2	Minor	Minor impact on operations and trade. No navigation closure but minor revenue loss due to loading or unloading delays.	$50K - $500K	Minor loss or damage to assets	½ - 1 day	Substantiated, low impact, low news profile. Minor political implications resulting in minor local media attention.	5 -10% variation to KPI	Pecuniary	May threaten the efficiency or effectiveness of some aspect of the infrastructure but would be dealt with internally.	Minor temporary – medical treatment required.	Severe reversible health effects of concern.	Environmental Nuisance resulting in minor adverse impacts on or unreasonable interference with the natural receiving environment, plants and/or wildlife, but noticeable effect on amenity. Minimal impact on community or businesses.	Minor frequency / intensity / duration activity carried out during normal operating hours over a short term (weeks). Minor amenity impacts experienced within surrounding area with potential to trigger complaints.
3	Serious	Temporary navigation closure or prolonged restriction of navigation.	$500K - $5m	Major damage to assets	1 day – 1 week	Substantiated, public embarrassment, moderate impact, moderate (local) media attention. Political implications resulting in directions given by the shareholding Ministers.	10-25% variation to KPI	Imprisonment	Would not threaten the infrastructure but would mean that the program could be subject to significant review or changed ways of operating.	Major permanent – loss of body part or function.	Short term health problems or irreversible health effects of concern.	Actual or potential Material Environmental Harm resulting in noticeable adverse or unreasonable impact on the natural environment, plants and/or wildlife within surrounding area. Noticeable impact on community or businesses.	Medium frequency / intensity / duration activity carried out for a significant period of time on most days or over a period of months. Adverse amenity impacts on community giving rise to multiple/sustained substantiated complaints.
4	Major	Temporary closure of a navigation channel affecting movements to the port for several days. Ensuing loss of trade.	$5m - $10m	Significant loss of assets	1 week – 1 month	Substantiated, public embarrassment, high impact, high (local and national) news profile, third party actions. Political implications resulting in state/ national inquiry.	25-50% variation to KPI	Imprisonment	May threaten the survival or continued effective functioning of the infrastructure or project and require top-level management intervention.	Major permanent– single fatality, total blindness, quadriplegia.	Health impacts, long term/chronic health problems or life threatening or disabling illness.	Material Environmental Harm resulting in significant adverse or unreasonable impact on the natural receiving environment, plants and/or wildlife over an extensive area as a result of the duration or magnitude or nature of impact. Extended disruption/impact to community or businesses. Potential exists to remedy the impact if the activity is ceased or impact is reversible.	High frequency / intensity / duration activity carried out during most hours of the day or impact is long term (years). Significant adverse impacts on community.
5	Catastrophic	Port closes, navigation seriously disrupted for an extended period. Serious and long term loss of trade.	>$10m	Complete loss of assets	> 1 month	Substantiated, public embarrassment, very high multiple impacts, high widespread (national and international) news profile, third party actions. Political implications resulting in state/ national inquiry. Significant national and worldwide attention from governments and media condemning activity.	>50% variation to KPI	Imprisonment	May threaten the survival of not only the infrastructure but also the business, possibly causing major problems for clients.	Multiple fatalities	Long term, permanent or irreversible health problems. Chronic health affects too many people.	Serious Environmental Harm resulting in irreversible, high or widespread adverse impact on the natural receiving environment/high conservation or special significance area. Severe and protracted disruption/impact to community or businesses. Irreversible loss of amenity experienced.	Permanent high frequency / intensity / duration activity carried out 24/7. Serious adverse impacts on community.

ANNEXURE B – QUALITATIVE MEASURE OF LIKELIHOOD

Level	Descriptor	Description	Ongoing Activities	Projects
1	Rare	May only occur in exceptional circumstances	Unlikely in the life of the facility	0.1% chance
2	Unlikely	Could occur at some time	Once in 20 years	1% chance
3	Possible	Might occur at some time	Once in 5 years	10% chance
4	Likely	Will probably occur in most circumstances	Once per year	50% chance
5	Almost Certain	Expected to occur in most circumstances	Many times per year, continuous	99% chance

ANNEXURE C – RISK EVALUATION FACTORS

	Consequence	Insignificant	Minor	Serious	Major	Catastrophic
Likelihood	***Score***	***1***	***2***	***3***	***4***	***5***
Rare	***1***	**L** ***1***	**L** ***2***	**L** ***3***	**L** ***4***	**M** ***5***
Unlikely	***2***	**L** ***2***	**L** ***4***	**M** ***6***	**M** ***8***	**S** ***10***
Possible	***3***	**L** ***3***	**M** ***6***	**M** ***9***	**S** ***12***	**H** ***15***
Likely	***4***	**L** ***4***	**M** ***8***	**S** ***12***	**H** ***16***	**E** ***20***
Almost Certain	***5***	**M** ***5***	**S** ***10***	**H** ***15***	**E** ***20***	**E** ***25***

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