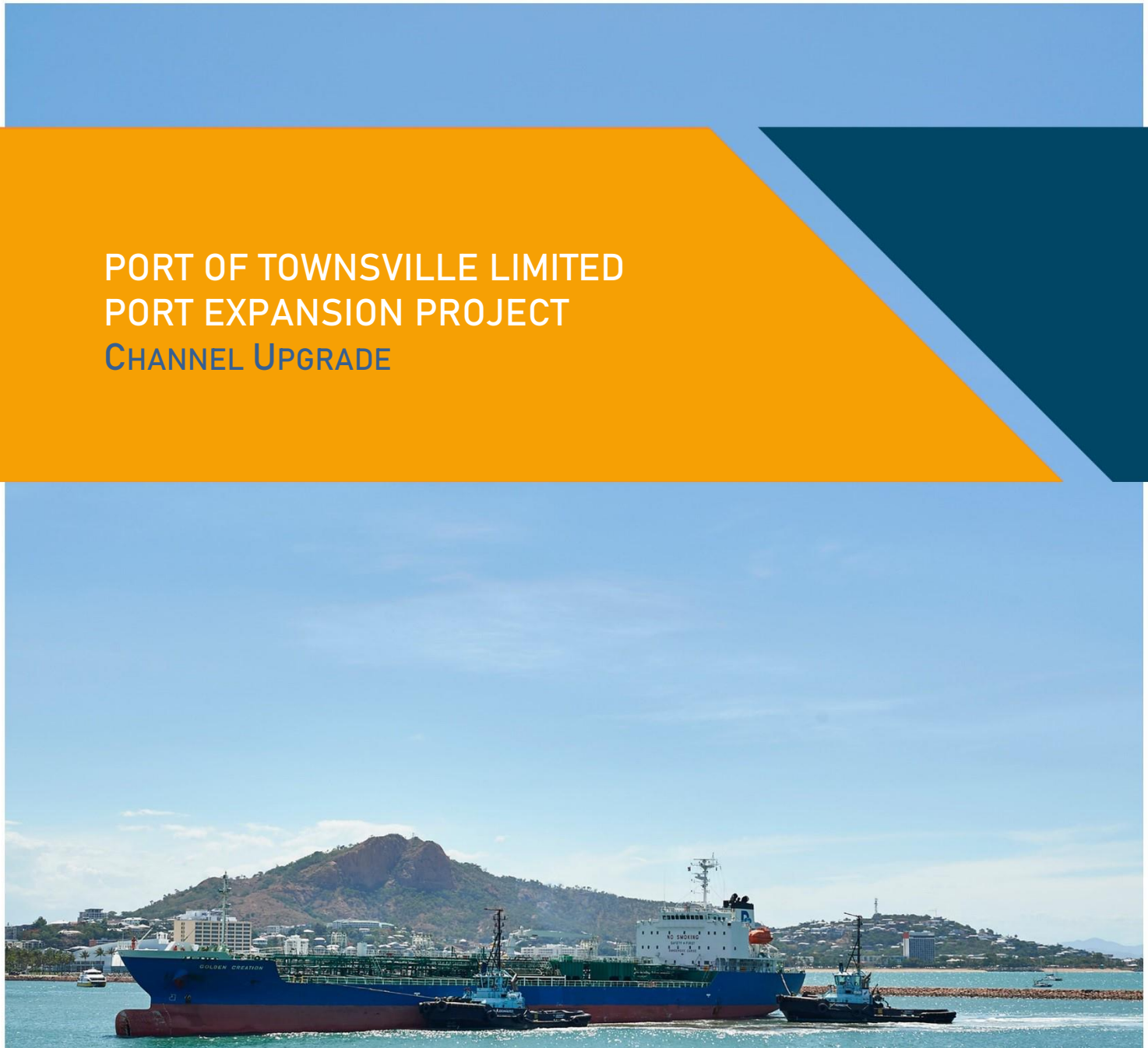
PORT OF TOWNSVILLE LIMITED
PORT EXPANSION PROJECT
CHANNEL UPGRADE



Townsville Port Expansion Channel Upgrade Project

Site Monitoring Plan

February 2020

Document Control Sheet

Revision History

Revision No.	Date	Changed by	Nature of amendment
0	14/02/2020	T Smith	Submitted version

Review History

Revision No.	Date	Reviewed by
0	14/02/2020	M Louden, M Wise prior to submission

Document Approval

Approval of the final Site Monitoring Plan was issued by DAWE on 26 February 2020.

The Site Monitoring 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

Full name (please print)

Marissa Wise

Organisation (please print)

Port of Townsville Limited

Date 14 / 02 / 2020

GLOSSARY

AHD	Australian Height Datum
ANC	Acid Neutralising Capacity
ANZECC	Australian and New Zealand Environment Conservation Council
AS / NZS	Australian Standard / New Zealand Standard
ASS	Acid Sulfate Soil
Background Noise	Means noise, measured in the absence of the noise under investigation, as LA90 adj, T being the a-weighted sound pressure level exceeded for 90% of the time period (of not less than 15 minutes).
CEMP	Construction Environmental Management Plan
CU Project	Townsville Port Expansion Channel Upgrade Project
DES	Queensland Department of Environment and Science
DO	Dissolved Oxygen
EA	Environmental Authority
EC	Electrical Conductivity
EPP (Air)	*Environmental Protection (Air) Policy 2008*
EPP (Noise)	*Environmental Protection (Noise) Policy 2008*
EPP (Water)	*Environmental Protection (Water) Policy 2009*
GPS	Global Positioning System
HVAS	High-Volume Air Samplers
LAeq, adj	The adjusted A-weighted equivalent continuous sound pressure level (in decibels) measured over a stated period of time (of not less than 15 minutes), adjusted for tonality and impulsiveness. In most situations, the LAeq is the most appropriate descriptor used to investigate environmental noise complaints.
m BTOC	Metres below Top of Casing
NATA	National Association of Testing Authorities
PASS	Potential Acid Sulfate Soil
PEP	Port Expansion Project
PM_{10}	Particulate Matter 10 Micrometers or Less in Diameter
Port	The Port of Townsville
POTL	Port of Townsville Limited
RHM	Regional Harbour Master
Significant rain event	Is a rain event that produces stormwater runoff to level that discharge to the marine environment is expected.
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)

TSHD	Trailer Suction Hopper Dredge
TSP	Total Suspended Particulate Matter
TSS	Total Suspended Solids

TABLE OF CONTENTS

TABLES

FIGURES

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 activities. This Site Monitoring Plan forms part of the CEMP and outlines the environmental monitoring requirements to meet the associated conditions of the Queensland State's Environmental Authority (**EA**).

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

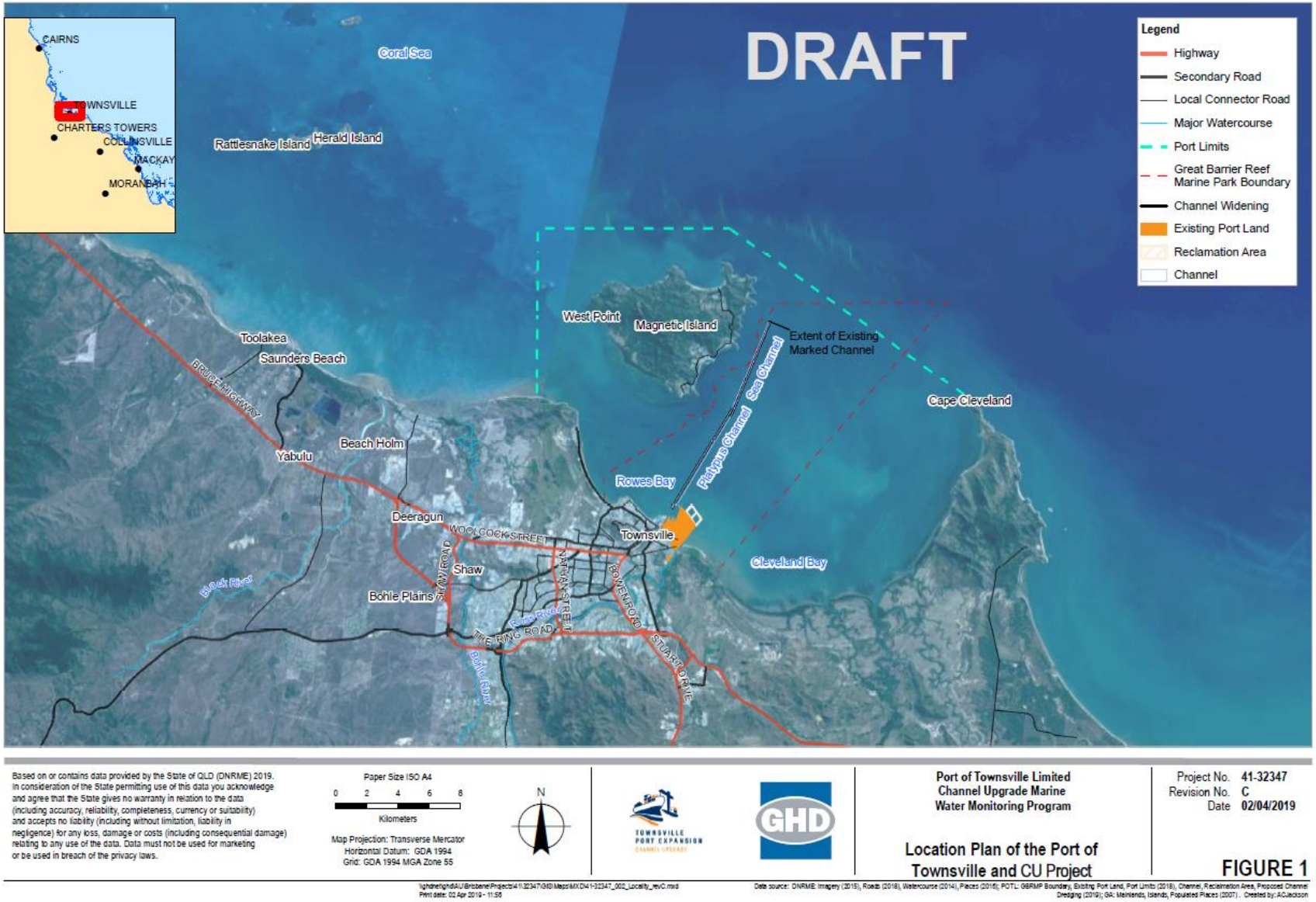


Figure 2: Site Plan for CU Project Rock Wall Construction & Reclamation Activities

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 conditions on site (provided by Appendix A). This document provides the site monitoring plan to address the prescribed conditions. Results of site monitoring will be used to manage risk to sensitive receptors during construction.

1.3 Purpose & Objectives

Several land-based construction activities will occur at the CU Project site (**Figure 2**). This will cause an increase in the traffic and construction activity at the site, which will have the potential to generate dust and air emissions; to contaminate stormwater and groundwater; and to generate noise and vibrations. The CU Site Monitoring Plan 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 3.2);
- Characterise air, stormwater and groundwater quality within and immediately surrounding the site to determine contaminant levels associated with the construction activities compared to levels prior to the CU Project's commencement;
- Assess noise levels in response to complaints from surrounding sensitive receptors against compliance limits stipulated in the Qld Government Approvals;
- 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;
- 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.

Ultimately, it has been designed to monitor the environmental impacts of the site activities during both the Preliminary Works and Construction Phase as well as adding to existing background information prior to the development of the site.

This Site Monitoring Plan is Appendix I of the *CU Marine Environmental Management Plan (CEMP POT 2099).* Management actions and controls relevant to mitigating nuisance and stormwater impacts from the project are 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 EXISTING ENVIRONMENTAL VALUES & RISK ANALYSIS

2.1 Existing Environmental Values

Table 1 provides a summary of the existing environmental values at and surrounding the site.

Table 1: Existing Environmental Values

Aspect	Description
Topography	The local topography is dominated by a coastal escarpment located 5 to 10 km inland from the coast, the narrow coastal plain and the estuaries of Ross River (south-east) and Ross Creek (west) (Golder Associates, 2012). To the south lies the mouth of Ross River, low sand dunes and tidal mud flats with mangroves close to shore. The coastal topography near the site has a natural ground level typically between 0 and 3 m Australian height datum (**AHD**). The site itself is generally flat with an elevation between 2.286 and 4.286 m AHD. It consists of a previously reclaimed area and the new reclamation area which will be constructed during the CU Project. The site is separated from the existing industrial areas in the Port which contain built structures ranging up to 30 m.
Geology	The site consists of a large area of reclaimed land which is underlain by Quaternary-aged (Holocene) alluvium and colluvium sediments overlying basement geology comprising Late-Palaeozoic age granite. It is adjacent to coastal tidal flats, mangrove flats, supratidal flats, saltpans and grasslands comprised of silt, mud and sand, minor salt. Near the site, the underlying bedrock is comprised of Permian-age biotite leucogranite and microgranite (Golder Associates, 2012). Across much of Cleveland Bay, including the dredge and reclamation areas, the geology / lithology is comprised of Holocene "surface" seabed sediments (silt and clay with sand zones, ranging in thickness from 0.8 to 3 m), underlain by Pleistocene sediments (sandy clays, clayey sands, silty clays, clayey silts and clays ranging in thickness from 2 to 4 m). Seismic analysis of the CU Project area confirms the presence of relatively shallow density (soft) sediments (implied as Holocene). Bedrock is at least 16.5 m below the existing seabed in the north-eastern boundary of existing Port land (Golder Associates, 2008). The reclaimed land material reflects near-by offshore sediments with varying amounts of sand, silt and clay and some shell grit. The material of the rock wall surrounding the reclaimed land is comprised of various rock types from the Townsville region.
Acid Sulfate Soils	Acid sulfate soils **(ASS)** information indicates: • Soils above the water table within the Port of Townsville have an extremely low probability (very low confidence) of ASS occurring; • Soils discharging from the mouth of Ross River have high probability (very low confidence) of ASS occurring; and • Multiple studies (GHD, 2009) have confirmed that sediments adjacent and beneath Port reclaimed lands are either non-Potential Acid Sulfate Soils (**PASS**) (in the case of brown sands and clays) or are PASS with natural acid neutralising capacity (**ANC**) to create factors of safety of 3-5+, available from calcium particles within the soil. This means these soils are able to self-buffer or may require precautionary lime treatment.
Hydrology	The nearest surface water receptors to the site are Cleveland Bay, located immediately to the north and east, Ross Creek located to the west and Ross River to the south east. The catchments of Ross River and Ross Creek are dominated by urban activities which may impact on marine water quality through both point and diffuse sources of contaminants. Urban sources of potential contaminants in Townsville include refineries, manufacturing and repair facilities, old rail sidings and industrial areas. Multiple industrial sites are licensed to

Aspect	Description
	discharge waste streams into Cleveland Bay east of Ross River (refineries, sewage treatment plant, meatworks etc.) and several landfills (both operating and rehabilitated) are also present in the Ross River catchment. Contaminants from these activities may be transported by stormwater to Port areas and Cleveland Bay, particularly during the wet season. Contaminants from port operations may also be transported by stormwater to the same areas. Flood mapping for City of Townsville shows intermittent areas spread across the extent of the Port are within the extent of the 1% (2.81 m (h), 1.26 m (d)) and 2% (2.78 m (h), 1.23 m (d)) Annual Exceedance Probability flood events due to riverine flooding.
Groundwater	There are two registered bores (RN153973 and RN153974), located near the site. They are sub-artesian and were screened across the aquifer within sand and undefined Quaternary geological profiles. Depths were not recorded. Across the Port and at the site, there are unregistered bores with the total groundwater depths typically gauged in the vicinity of 5.0 to 9.0 m below top of casing (**m BTOC**) with standing water levels typically ranging between 1.5 to 4.0 m BTOC and to a maximum of 6.8 m BTOC. The composition of groundwater at the Port is the result of a number of factors, such as the land use practices; natural chemical and physical characteristics as well as historical contamination; hydrodynamics such as currents, longshore drift, resuspension etc.; port operations including product handling, shipping, tug movements and incidents. Groundwater at the site is not used for human consumption or recreational purposes.
Air	In the dry tropics, climatic conditions such as low rainfall and windy conditions can adversely impact air quality. There are also multiple potential contributing sources of emissions to air within the Townsville and Port air shed including: • Regional dust and smoke; • Emissions from industrial activities such as port operations, refineries, manufacturing and repair facilities, rail and other transport activities; • Localised dust sources from construction, maintenance and landscaping works; and • Dust generated from windblown surfaces with limited or no vegetation, including lands affected by drought. CU Project construction activities have the potential to impact on air quality through both point and diffuse sources of air pollutant emissions. Point sources include rock handling operations and exhaust emissions from vessels and trucks. Diffuse sources include fugitive emissions from construction activities, unsealed roads and land and vessel and truck transport activities. The existing industrial areas of the Port are between Townsville city centre and nearby residents and the CU Project site.
Noise	The site is located next to other construction and industrial activities which can impact on the acoustic amenity of surrounding sensitive receptors. Increased noise levels from the CU Project may arise due to rock handling, piling and traffic. Construction plant and equipment on the site have the potential to increase noise emissions, albeit the nearest residential area is more than 1.5 km from the site.

2.2 Risk Assessment

A number of the land based construction activities have the potential to impact on air, noise, dust and stormwater/groundwater quality to varying levels. These activities are detailed in the Construction Environmental Management Plan (CEMP).

The CEMP also details the potential influence the project will have on the key environmental parameters and establishes the residual risk level assessed for the likely to impact on these elements. 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).

The risk posed to key elements that will be informed by this site monitoring plan are detailed in Table 2, including the element, primary impacting process and raw and residual risk rating. Overall, the potential residual risk posed to each of the relevant environmental parameters is considered medium to low, with medium level impacts expected to stormwater, tailwater and from noise.

Table 2: Risk Overview for the key Activities and Elements relevant to Site Monitoring Plan (Extract from CEMP)

Element	Primary Impacting Process	Potential Impact	Risk Receptor	Raw Likelihood / Consequence	Mitigation Measures	Residual Risk
Stormwater, Sediment and Erosion control	Sediment in stormwater run-off from construction activities leading to increased turbidity of marine waters Exposure and potential release of sediments and contaminants from construction activities and stormwater Stormwater contamination may arise due to leaks and spills of fuel/oil and other hazardous materials or dangerous goods.	Release of contaminants to marine environment leading to impacts on: • marine water and marine sediments • indirect impacts on marine life, • indirect potential impacts to human health	Sensitive receptors, in close proximity to Rockwall Marine Megafauna Indirect on human health	Likely / Minor (local scale) (Medium) Likely / Minor (local scale) (Medium) Likely / Minor (local scale) (Medium	Refer to CEMP Section 5.5.1 for detailed measures	Low Low Low
Air	Constructions activities such as earthworks and vehicle movements have the potential to increase dust emissions. Construction vehicles, plant and equipment will generate fuel combustion emissions. Trucks hauling construction material may track soils onto roads and generate dust.	Increased dust and fuel combustion emissions may result in: • Increased risks to human health; • Environmental nuisance to neighbours and the natural environment; and • Discolouration of buildings or structures.	Human health Amenity for neighbours	Likely / Serious (Substantial) Almost Certain / Minor (Substantial) Likely / Serious (Substantial)	Refer to CEMP Section 5.9 for detailed measures	Low Low Low

Element	Primary Impacting Process	Potential Impact	Risk Receptor	Raw Likelihood / Consequence	Mitigation Measures	Residual Risk
Noise and vibration	On-site construction plant and equipment (e.g. piling works and rock wall construction) may increase noise emissions and cause vibrations. Noise and vibration generated during construction activities (particularly piling works and along haul roads) may cause nuisance. Heavy vehicles on transport access roads have the potential to increase noise emissions and cause vibrations.	Increased noise and vibration may result in environmental nuisance to neighbours and the natural environment	Indirect on human health	Possible / Minor (medium) Possible / Minor (medium) Possible / Minor (medium)	Refer to CEMP Section 5.10 for detailed measures	Low Low Low
Visual amenity and lighting	Construction plant activities may impact visual amenity Dust emissions from the construction activities could cause adverse visual effects. Artificial light from construction activities or port activities may impact.	Visual amenity of air and water may be impacted from construction plant, release of dust emissions or waste and sediment release to water. Artificial light may adversely affect scenic amenity or marine and terrestrial fauna.	Human amenity Marine fauna Terrestrial fauna	Possible / Insignificant (low) Almost Certain / Minor (substantial) Possible / Serious (medium)	Refer to CEMP Section 5.16 for detailed measures	Low Low Medium

3 PROGRAM

The monitoring program outlined in this Site Monitoring Plan will monitor air, stormwater, groundwater and noise within and surrounding the CU Project site, including components to ensure compliance with the associated conditions in the EA. Table 3 provides an overview of the monitoring program requirements.

Table 3: Overview of CU Project Site Monitoring Program Requirements

Air	Water	Noise
Gauge dust contaminant levels standard sampling time period of 28 +/- 2 days	Ad-hoc stormwater monitoring if rain events occur on-site	Noise monitoring in response to regulator request
Monitor air contaminant levels standard sampling time period of 24 hrs every 6 days	Routine groundwater monitoring	Specified noise limits and monitoring conditions in EA
Meteorological equipment runs continuously (wind direction and speed)	Meteorological equipment runs continuously (rainfall)	
Visual monitoring of weather conditions that result in dust liberation and elevated particle concentration	Visual monitoring of turbidity to be carried out on regular basis	
Specified air limits and monitoring conditions in EA		

It is recognised that broader port wide monitoring for each of these aspects is undertaken by the POTL's operational Environmental & Planning team, incorporating both near and far field locations. While these programs are not formally part of the CU Project monitoring plans (noting that the same locations may be utilised in the CU Project), the results of these broader port wide programs may be reviewed as part of interpreting the outcomes of the CU Project specific monitoring. For example, dust/air monitoring within the broader port environs may be used for contextual understanding of the CU air monitoring results.

3.1 Monitoring Locations

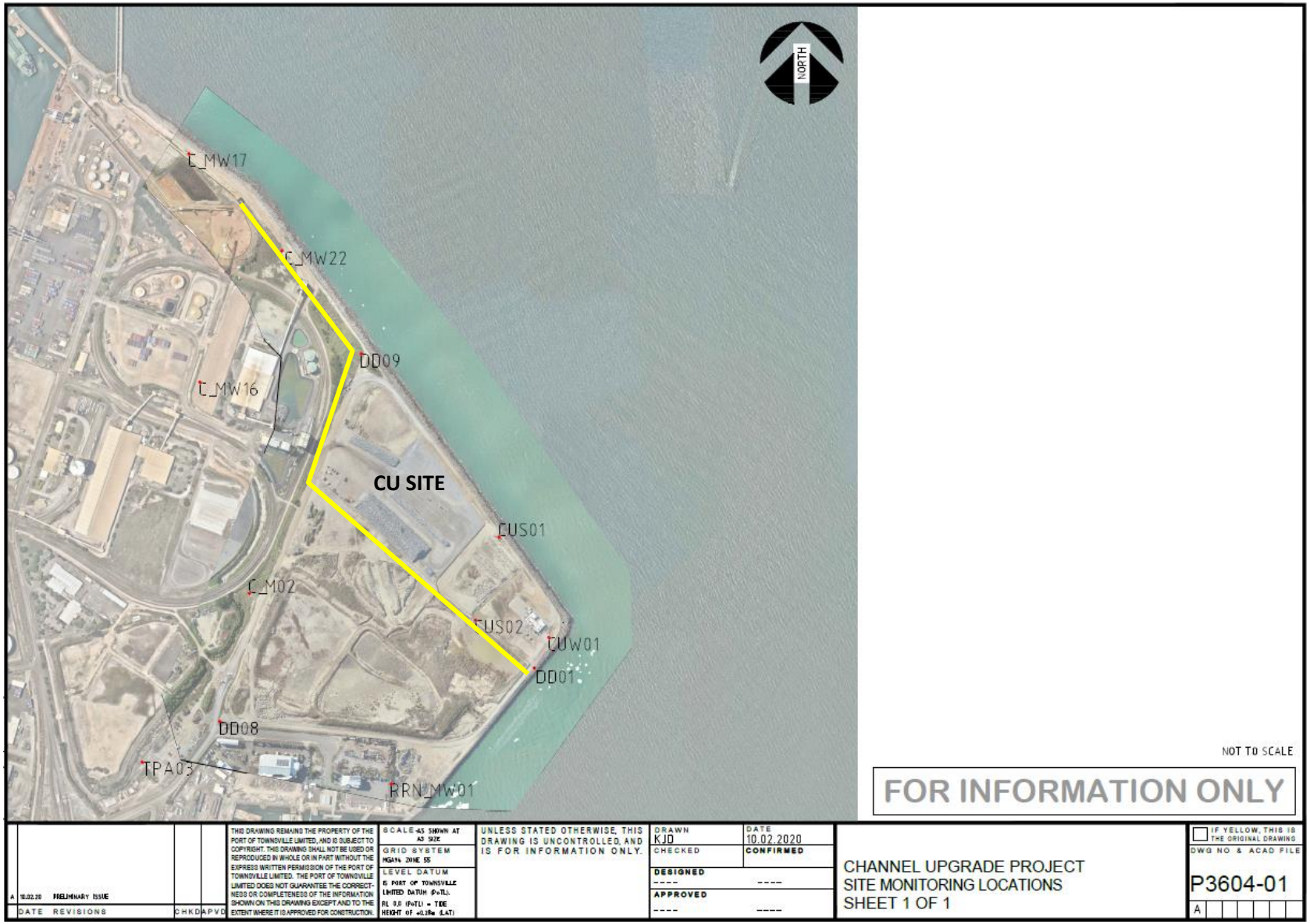
Routine monitoring (air, stormwater and groundwater) and meteorological monitoring will be conducted at 16 locations, either within or at the boundaries of the site (Figure 3). Global positioning system (**GPS**) co-ordinates for all monitoring locations are included in **Table 4**. Monitoring may be conducted at other locations, as required for complaint investigation, incident monitoring etc.

Table 4: CU Project Site Monitoring Locations

Monitoring Component	Area	Location Name	Location Coordinates	
			Easting	Northing
Air	Site	DD01*	483823	7870808
	Site Boundary	DD02	483257	7870947
	Site Boundary	DD08	483188	7870700
	Site	DD09	483474	7871442
	Site	CUW01	483852	7870870
	Site	CUH01	To be determined	To be determined
Stormwater	Site	CUS01	483752	7871072
	Site	CUS02	483704	7870905
Groundwater	Site Boundary	C_M02	483248	7870959
	Site Boundary	C_MW16	483148	7871385
	Site Boundary	C_MW17	483126	7871846
	Site Boundary	C_MW22	483314	7871650
	Site Boundary	RRN_MW01	483534	7870574
	Site Boundary	TPA03	483032	7870618
Noise	Site	CUN01	To be determined as required by complaint	To be determined as required by complaint

* DD01 location moved approx. 100m south on 24/2/2020 to accommodate construction activities.

Figure 3: CU Project Site Monitoring Locations



3.2 Methodology, Equipment & Frequency

Proposed monitoring equipment, methodologies and frequencies are summarised in **Table 5.** All monitoring equipment will be maintained and calibrated in accordance with the manufacturer's instructions and operated by an appropriately qualified person.

Sampling will be conducted in accordance with the requirements of the relevant monitoring manual or AS/NZ Standard, including but not limited to:

Water:	Queensland Monitoring and Sampling Manual (DES 2018) or the relevant AS / NZ Standards.
Ground water:	AZ/NZS 5667.11:1998 (R2016) Water Quality – Sampling – Guidance on sampling of groundwaters
Air:	AS/NZS 3580.1.1: 2016. Methods for sampling and analysis of ambient air.
Noise:	Noise Measurement Manual, 2013.

Air monitoring will be carried out using both dust deposition gauges, and high-volume air samplers (**HVAS**) or other method approved by the Administering Authority. The dust deposition gauges passively collect dust fall from the surrounding air over a 28 day period, whilst the HVAS actively draws in the surrounding air over a 24 hour period. Samples are transported to a National Association of Testing Authorities **(NATA)** accredited laboratory for analysis of the composition of the deposited dust and its metal/metalloid composition. Meteorological equipment installed within the broader port monitoring network will be utilised to provide data such as wind direction, wind speed and rainfall in real time. This data can be used to understand meteorological effects on local air quality.

Stormwater will be manually collected using a sampling pole and suitable clean, sterile water sample containers. A hand-held water meter will be used to analyse the physical components e.g. turbidity, total suspended solids (**TSS**), electrical conductivity (**EC**), dissolved oxygen (**DO**) and pH as field measurements and visual observations of oil/grease/sheens on the water surface and colouration and odours will also be made. Samples are transported to a NATA accredited laboratory for analysis. The frequency of stormwater monitoring is dependent upon the number and duration of rain events with the aim of conducting monitoring immediately after significant rainfall events when possible (dependent on rainfall quantity and whether there is enough water running through the drains to collect a sample). Weekend or night time sampling is avoided for safety reasons.

Groundwater bores will be monitored on a quarterly basis for groundwater levels and water quality. Samples are either grabbed or pumped up for extraction from the bore and are handled and analysed in a similar manner to stormwater samples.

Noise monitoring will only be conducted in response to a regulator's request to address complaint(s). Any noise monitoring will be conducted using a methodology proposed by a suitably qualified consultant. The Port is developing a noise model for site-specific port activities which will assist in the investigation of any noise-related complaints.

Table 5: CU Project Site Monitoring Equipment, Methodology and Frequency

Monitoring Component	Equipment / Methodology	Frequency
Air	Dust deposition gauges (laboratory analysis)	Monthly / every 28 days (+/- 2)
	HVAS (laboratory analysis)	24 hrs / every 6 days
	Weather instruments (field measurement)	Continuous
Stormwater	Grab sample (laboratory analysis) *In-situ* water quality meter (field measurement)	During significant rain events
Groundwater	Grab sample (laboratory analysis) *In-situ* water quality meter (field measurement) Measuring tape with attached 'plopper' (field measurement) Peristaltic pump to extract sample	Every March, June and September
Noise	Noise logger (field measurement)	Reactive (complaints) Proactive (baseline or during works likely to cause disturbance)

3.3 Parameters

Based on the available information and current knowledge of the site and the potential impact of the construction activities, along with the requirements of the EA air, water and noise quality objectives, the parameters listed in **Table 6** are monitored. When required, all monitoring samples will be transported to a NATA accredited laboratory for analysis.

Table 6: CU Project Site Monitoring Parameters

Monitoring Component	Parameter	Relevance	Method
Air	Dust fall (total solids)	Indicates the mass of the particulate matter deposited in a deposition gauge	Laboratory analysis
	Ash content	Indicates the mass of that portion of the insoluble matter remaining after combustion	Laboratory analysis
	Combustible matter	Indicates the mass of that portion of the insoluble matter lost during combustion	Laboratory analysis
	Total soluble matter	Indicates the mass of the soluble portion of the deposited matter	Laboratory analysis
	Total insoluble matter	Indicates the mass of the insoluble portion of the deposited matter	Laboratory analysis
	Total metals / metalloids (As, Cd, Cu, Pb, Ni, Zn)	Indicates total concentration and amount of metals / metalloids in the deposited matter	Laboratory analysis
	Total Suspended Particulate Matter (**TSP**)	Indicates the mass of that portion of the air particles that are less than 100 microns in diameter suspended in the air	Laboratory analysis

Monitoring Component	Parameter	Relevance	Method
	Particulate Matter (**PM_{10}**)	Indicates the mass of that portion of the air particles that are less than 10 microns in diameter, i.e. inhalable particles	Laboratory analysis
	Trace metals / metalloids (As, Cd, Cu, Pb, Ni, Zn)	Indicates total concentration and amount of metals/metalloids in the TSP or PM_{10} fraction of the air column respectively	Laboratory analysis
	Wind speed	Indicates the speed of the wind which is useful for interpreting dust generation / fallout	Field measurement
	Wind direction	Indicates the direction of the wind which is useful for interpreting dust generation / fallout	Field measurement
	Rainfall	Indicates the total rainfall which has a mitigation effect on dust generation / fallout	Field measurement
Water	pH	Identifies presence of acids or alkaline substances	Field measurement
	EC	Indicates the ability of water to conduct an electrical current, which indicates the presence of salts / fresh water influence	Field measurement
	DO	Indicates chemical or biological activity	Field measurement
	TSS	Indicates degree of catchment disturbance and variety of particulates in the water which may impact on sensitive receptors	Field measurement / Laboratory analysis
	Total metals / metalloids (As, Cd, Cr, Cu, Pb, Ni, 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 & Grease	Identifies presence of oil-related pollutants and trigger if PAH analysis is required	Field observation
	Water Table Height	Indicates disturbance to the groundwater catchment	Field measurement
Noise	LAeqT	In most situations, the LAeq,T is the most appropriate descriptor used to investigate environmental noise complaints.	Noise meter

3.4 Quality Assurance / Quality Control

3.4.1 Field Quality Assurance / Control Measures

To ensure good quality data is collected, each field trip will adhere to the following quality assurance and quality control measures:

- Conduct monitoring in similar weather conditions (where applicable) to remove the impact of weather on the measured results.
- Use properly trained and experienced field staff.

- Use and properly maintain appropriate calibrated monitoring equipment, including cleaning of equipment between locations.
- Use proper monitoring techniques in accordance with relevant guidelines such as ANZECC 2000 and DES 2018, including clear and accurate labelling of sample containers and completion of field record sheets.
- Follow water and sediment sample preservation and handling procedures and supply samples to the laboratory within nominated holding times with accurate chain of custody forms. Supply all samples to the laboratory within seven days of collection.

3.4.2 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.

4 PERFORMANCE OBJECTIVES

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

Performance objectives for this monitoring plan will be a combination of site-specific limits detailed in the EA and site-specific limits established through relevant guidelines and water quality performance objectives. Queensland air and noise quality objectives are detailed in the EPP (Air) and EPP (Noise) respectively and the Townsville City Council environmental nuisance guidelines. National guidelines for water quality are the *Australian and New Zealand Environment and Conservation Council Guidelines (ANZECC 2000).* The ANZECC 2000 guidelines are general in nature and are not regional specific, however they can be used where regional guidelines are not adequate or available, for example when assessing toxicants such as metals and metalloids. Regional values have been developed for all Queensland regions and are contained in the *Queensland Water Quality Guidelines 2009*. The Townsville Ross River basin falls within the Central Queensland Coast region and the parameters covered are nutrients and physico-chemical parameters. Local Ross River Basins environmental values and water quality objectives have been prepared and are scheduled under the *Environmental Protection (Water) Policy 2009*. These form sub-region guidelines for Townsville.

With respect to metals/metalloids in marine waters, the ANZECC 2000 guidelines provide four levels of protection for different ecosystems (80%, 90%, 95% and 99%). For Cleveland Bay, which is considered to be '*slightly to moderately disturbed*', the 95% protection level is commonly applied. Whilst a comparison to the objectives is undertaken to provide an overall trend for stormwater quality and to help identify any emerging issues, it should be noted that the monitoring locations are at the point of discharge and not at the edge of the mixing zone and the receiving environment.

Site monitoring parameters will be assessed against the performance objectives listed in **Table 7**.

Table 7: Monitoring Performance Objectives for the CU Site

Monitoring Component	Parameter	Performance Objective	Source
Air	Dust fall – total insoluble matter	120 mg/m^2/day (or 3.65g/m^2/month)	EA Limit
	TSP	90 µg/m^3 calendar year average	EA Limit
	PM_{10}	50 µg/m^3 rolling 24 hour average	EA Limit
Stormwater	pH	6.5 – 8.5	EA Limit
	TSS	270 mg/L (road)	QWQG 2009
	Cadmium	0.03 mg/L	QWQG 2009
	Copper	0.095 mg/L	QWQG 2009
	Lead	0.12 mg/L	QWQG 2009
	Zinc	0.4 mg/L	QWQG 2009
	Persistent sheens	not be visible on the water surface	n/a
	Odours/Colouration	no unusual odour or colouration	n/a
Groundwater	Water Table Height	metres below ground	No specified guideline – Compare to baseline levels only
Noise	LAeq adj, 15 mins	Background + 10 dB – 7:00am-6:00pm Background + 5 dB – 6:00pm-10:00pm Background + 0 dB or 40 dB – 10:00pm-7:00am	EA Limit – sensitive place
	LAeq adj, 15 mins	Background + 10 dB – 7:00am-6:00pm Background + 10 dB – 6:00pm-10:00pm Background + 5 dB – 10:00pm-7:00am	EA Limit – commercial place

5 REPORTING AND RESPONSIBILITY

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

POTL will produce an annual summary of the monitoring results from the CU Site Monitoring Program. 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 Site Monitoring Program 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 an exceedance of an EA limit or monitoring results significantly above a guideline value, relevant regulators will be notified in a timely manner as per conditional requirements of the monitoring result and of the control measures being implemented to address the incident.

Where 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.

6 CONTINUOUS IMPROVEMENT

The Site Monitoring Plan will be subject to regular review.

This plan 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 inclusive of identification and implementation of any new or changing environmental risks and mitigation actions. 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 Site Monitoring Plan to be updated and responsive to learning from any incidents, complaints and ongoing monitoring results and to reflect knowledge gained. Other triggers for Site Monitoring Plan review may include:

- Changes in project 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 Site Monitoring Plan 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 CU Project Management, before implementation. Information from this Site Monitoring Plan will be used to assist with improving the control measures in the CEMP.

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

As noted in section 0, an annual report on the site 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.

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 site monitoring will be notified to the Department.

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

7 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 3580.1.1: 2016. Methods for sampling and analysis of ambient air. Part 1.1: Guide to siting air monitoring equipment. Standards Australia, 2016.

AS/NZS 3580.10.1: 2016. Methods for sampling and analysis of ambient air. Method 10.1: Determination of particulate matter—Deposited matter—Gravimetric method. Standards Australia, 2016.

AS/NZS 3580.14: 2014. Methods for sampling and analysis of ambient air. Part 14: Meteorological monitoring for ambient air quality monitoring applications. Standards Australia, 2014.

AZ/NZS 5667.11:1998 (R2016) Water Quality – Sampling – Guidance on sampling of groundwaters. Standards Australia. 2016.

Department of Environment and Heritage. Noise Measurement Manual. 2013.

EPP (Air) 2008. *Environmental Protection (Air) Policy 2008*. Department of Environment and Science, 2016.

EPP (Noise) 2008. *Environmental Protection (Noise) Policy 2008*. Department of Environment and Science, 2012

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, 2016.

GHD 2009. *Townsville Marine Precinct Project – Environmental Impact Statement. Appendix H – Acid Sulfate Soils Investigation*.: GHD Pty Ltd, Townsville, 2009.

Golder Associates 2008. *Summary of Geotechnical Testing Undertaken in the Port of Townsville Redevelopment Area*. Golder Associates Pty Ltd, Brisbane, 2008.

Golder Associates 2012. *Townsville Port Expansion Environmental Impact Statement; Environmental Management Plan (Acid Sulfate Soils)*. Golder Associates Pty Ltd, Brisbane, 2012.

APPENDIX A

Commonwealth (EPBC Approval) and State (EA) Conditions relevant to Site Monitoring requirements

Coordinator General's Stated Conditions (EA) relevant to this Site Monitoring Plan

<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>G3</td><td>Any breach of a condition of this environmental authority must be reported to the administering authority as soon as practicable within 24 hours of you becoming aware of the breach. Records must be kept including full details of the breach and any subsequent actions undertaken.</td><td>5</td><td>Section 5 details the reporting and responsibility aspects associated with site monitoring, including the reporting of breaches to the administering authority.</td></tr>
<tr><td>2</td><td>N1</td><td>You must ensure that noise generated at the activity does not cause the criteria in Table N1. Noise Limits to be exceeded at a sensitive plan or commercial place.
Table N1. Noise Limits
<table>
<tr><td>Noise Level measured in dB(A)</td><td>7am – 6pm</td><td>6pm – 10 pm</td><td>10pm – 7am</td></tr>
<tr><td colspan="4">Noise measured at a sensitive place</td></tr>
<tr><td>$L_{Aeq\ adj,\ 15\ mins}$</td><td>Background noise + 10</td><td>Background noise + 5</td><td>The greater of:
a) Background noise + 0; or
b) 40</td></tr>
<tr><td colspan="4">Noise measured at a commercial place</td></tr>
<tr><td>$L_{Aeq\ adj,\ 15\ mins}$</td><td>Background noise + 10</td><td>Background noise + 10</td><td>Background noise + 5</td></tr>
</table></td><td>4</td><td>Table 7 in section 4 details the noise monitoring performance objectives that will be applied should a complaint be received.</td></tr>
<tr><td>3</td><td>N2</td><td>When requested by the administering authority, noise monitoring must be undertaken within a reasonable and practicable timeframe nominated by the administering authority at any sensitive place or commercial place, and the results must be notified within 14 days to the administering authority following completion of monitoring.</td><td>3.2</td><td>Table 5 in section 3.2 details the frequency, methodology and equipment to be utilized to investigate a noise complaint.</td></tr>
<tr><td>4</td><td>N3</td><td>Noise monitoring and recording must include the following descriptor characteristics and matters:
a) $L_{AN,\ T}$ (where N equals the statistical levels of 1, 10 and 90 and T = 15 minutes);
b) Background noise L_{A90};</td><td>3.3</td><td>Table 6 in section 3.3 lists the parameters to be measured when undertaking noise monitoring.</td></tr>
</table>

Ref	Cond. No.	Condition Requirement	Plan Reference	Demonstration of how the plan addresses the condition requirement
		c) The level and frequency of occurrence of impulsive or tonal noise and any adjustment and penalties to statistical levels; d) atmospheric conditions including temperature, relative humidity and wind speed and directions; e) effects due to extraneous factors such as traffic noise; f) location, date and time of monitoring; g) if the complaint concerns low frequency noise, $Max_{LPLIN,T}$ and one third octave band measurements in $dB_{(LIN)}$ for centre frequencies in the 10 – 200 H_Z range.		
5	N4	If monitoring indicates exceedance of the limits in Table N1 Noise limits, then you must: a) address the complaint including the use of appropriate dispute resolution if required; or b) immediately implement noise abatement measure so that emissions of noise from the activity do not result in further environmental nuisance.	CEMP	The CEMP details the corrective actions to be taken in the event of a monitoring exceedance.
6	N5	The method of measurement and reporting of noise level must comply with the latest edition of the administering authorities Noise Measurement Manual	3.2	Section 3.2 details the standards and monitoring manuals associated with the conduct of the noise monitoring.
7	A1	You must ensure that all reasonable and feasible avoidance and mitigation measures are employed so that the dust and particulate matter emissions generated by the activity do not cause exceedances of the following levels when measured at any sensitive place or commercial place: a) dust deposition of 120 milligrams per square metre per day, averaged over 1 month, when monitored in accordance with the most recent version of Australian Standard AS 3580.10.1; b) a concentration of particulate matter with an aerodynamic diameter of less than 10 micrometre (µm) (PM10) suspended in the atmosphere of 50 micrograms per cubic metre over a 24 hour averaging time, when monitored in accordance with the most recent version of Australian Standard AS 3580.9.6 or any other method approved by the administering authority; c) a concentration of particulate matter suspended in the atmosphere of 90 micrograms per cubic metre over a 1 year averaging time, when monitored in	4	**Table 7** in section 4 details the air monitoring performance objectives that will be applied for all dust monitoring undertaken.

Ref	Cond. No.	Condition Requirement	Plan Reference	Demonstration of how the plan addresses the condition requirement
		accordance with the most recent version of Australian Standard AS 3580.9.3 or any other method approved by the administering authority;		
8	A2	When requested by the administering authority, dust and particulate monitoring must be undertaken and the results notified within 14 days to the administering authority following completion of monitoring. Monitoring must be carried out at a place(s) relevant to the potentially affected sensitive place or commercial place and must include: a) for a complaint alleging dust nuisance, total suspended particulate matter (TSP) and dust deposition; and b) for a complaint alleging adverse health effects caused by dust, the concentration per cubic metre of particulate matter with an aerodynamic diameter of less than 10 micrometre (pm) (PM10) suspended in the atmosphere over a 24hr averaging time.	3	Section 3 details the air/dust monitoring to be undertaken as part of the CU project, including location, frequency, equipment and parameters to be applied.

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.

Background Noise means noise, measured in the absence of the noise under investigation, as L A90,T being the A-weighted sound pressure level exceeded for 90 percent of the time period of not less than 15 minutes, using Fast response.

Commercial place means a place used as a workplace, an office or for business or commercial purposes and includes a place within the curtilage of such a place reasonably used by persons at that place.

LAEQ means the adjusted A-weighted equivalent continuous sound pressure level (in decibels) adjusted for tonality and impulsiveness, during the time period T, where T is measured for a period no less than 15 minutes when the activity is causing a steady state noise and no shorter than 1 hour when the approved activity is causing an intermittent noise.

Sensitive place includes the following and includes a place within the curtilage of such a place reasonably used by persons at that place:

a) a dwelling, residential allotment, mobile home or caravan park, residential marina or other residential premises;
b) a motel, hotel or hostel;
c) a kindergarten, school, university or other educational institution;
d) a medical centre or hospital;
e) a protected area under the Nature Conservation Act 1992, the Marine Parks Act 1992 or a World Heritage Area;
f) a public thoroughfare, park or gardens;
g) for noise, a place defined as a sensitive receptor for the purposes of the Environmental Protection (Noise) Policy 2008.

You means the holder of the environmental authority.

EPBC Approval conditions relevant to this Site Monitoring Plan

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 and stormwater 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 and stormwater runoff.
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: c) specific and auditable mitigation and management measures to avoid and minimise impacts to MNES, including: controls, performance indicators, early warning trigger levels, risk management, adaptive management strategies,	**3, 4**	Section 3 and 4 details environmental monitoring to be undertaken through this plan to provide performance indicators and early warning trigger levels for actions detailed in the CEMP.

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.
Stage As identified at Section 2.4.1 of the *Townsville Port Expansion Project – Additional Information to the Environmental Impact Statement (October 2016).*

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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