MINING MANAGEMENT PLAN AMENDMENT

Nathan River Resources

Bing Bong Loading Facility Dredging Program

Operator name:	NRR Services Pty Ltd
Project name:	Nathan River Project
Authorisation:	1062-01
MMP reporting year:	2024 - 2025
Date:	30 April 2024
Document distribution list:	Department of Industry, Tourism and Trade
	NRR Services Pty Ltd

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2 INTRODUCTION

2.1 Operator Details

Operator details for the Nathan River Project (NRP) are summarised in **Table 2-1** below.

Table 2-1 Summary of Operator details

Operator:	NRR Services Pty Ltd
ABN:	38 634 895 800
Web page	https://www.nathan-river.com/
Email	Simon.Peat@nathan-river.com
Postal and Street address:	47 Callantina Road, Hawthorn, Victoria, 3122
Key contact/s:	Simon Peat – Chief Executive Officer Simon.peat@nathan-river.com 0418 124 024

2.2 Title Details

The mineral title details associated with the NRP are summarised in **Table 2-2**.

Table 2-2 Mineral Titles for the Nathan River Project

Title Number	Title Holder	Expiry Date	Underlying Land Tenure
AA29691	NRR Mining Pty Ltd	28/06/2042	Haul road from Mine to BBLF
AA29692	NRR Mining Pty Ltd	28/06/2042	BBLF offshore
ML28264	NRR Mining Pty Ltd	28/06/2042	Mining infrastructure, waste rock dump (WRD) and ancillary mining services.
ML28266	NRR Mining Pty Ltd	28/06/2042	Airstrip
ML28267	NRR Mining Pty Ltd	28/06/2042	Camp Facility
ML28962	NRR Mining Pty Ltd	28/06/2042	Mining administration facility
ML28963	NRR Mining Pty Ltd	28/06/2042	Airstrip
ML29628	NRR Mining Pty Ltd	28/06/2042	Bing Bong Port and Stockyard
EL25688	NRR Mining Pty Ltd	19/08/2024	BBLF
EL26759	NRR Mining Pty Ltd	30/10/2023	Exploration
EL27143	NRR Mining Pty Ltd	23/08/2024	Exploration
EL29548	NRR Mining Pty Ltd	26/08/2024	Exploration
EMP30340	NRR Mining Pty Ltd	6/01/2025	Exploration
EMP30341	NRR Mining Pty Ltd	6/01/2025	Haul road infrastructure
EMP30342	NRR Mining Pty Ltd	6/01/2025	Haul road infrastructure
EMP30343	NRR Mining Pty Ltd	6/01/2025	Haul road infrastructure
EMP30344	NRR Mining Pty Ltd	6/01/2025	Haul road infrastructure
EMP30345	NRR Mining Pty Ltd	6/01/2025	Haul road infrastructure
EMP30346	NRR Mining Pty Ltd	6/01/2025	Haul road infrastructure
EMP30347	NRR Mining Pty Ltd	6/01/2025	Haul road infrastructure

2.3 Project Details

The NRP (previously referred to as the Roper Bar Iron Ore Project (RBIOP)) is wholly operated by NRR Services Pty Ltd (NRR) since acquiring the NRP in 2019 from the previous operators, Western Desert Resources (WDR). The NRP is located approximately 530 kilometres (km) southeast of Darwin within the Gulf of Carpentaria and is comprised of three main operation domains: the mine, the haul road and the Bing Bong Loading Facility (BBLF). The mine is located within mining leases (ML) 28962, 28267, 28266, 28963 and 28264. The haul road, privately owned and operated by NRR, stretches for 171 km, connecting the mine and the BBLF allowing the haulage of material to the BBLF. The BBLF is situated within ML 29628, located on the south-western coast of Gulf of Carpentaria approximately 50 km north of Borroloola. Glencore's McArthur River Mine (MRM) operates a larger loading facility at the BBLF and is the overarching controller of the Port. The regional location of the NRP is presented in **Figure 2-1**.

The previous operator, WDR commenced mine construction and operations in 2013 following the approval of the Roper Bar Iron Ore Project (RBIOP) Environmental Impact Statement (EIS) under the previous *Environmental Assessment Act.* Upon acquiring the RBIOP, NRR submitted a Mining Management Plan (MMP) in accordance with the *Mining Management Act 2001* (MM Act), receiving approval in the form of mining authorisation 1062 to commence operations in 2020.

NRR currently operates the NRP under the approved Variation of Authorisation 1062-01 granted in October 2023 which authorises the recommencement of mining operations as per the activities detailed in the Stage 1A MMP amendment. The activities which are authorised under the current Variation to Authorisation 1062-01 include:

- Recommencement of mining focusing on the Danehill pit saddle and Zabeel North open-cut pit;
- Processing and sorting of ore;
- Haulage of ore to the BBLF; and
- Transhipment of ore from the BBLF.

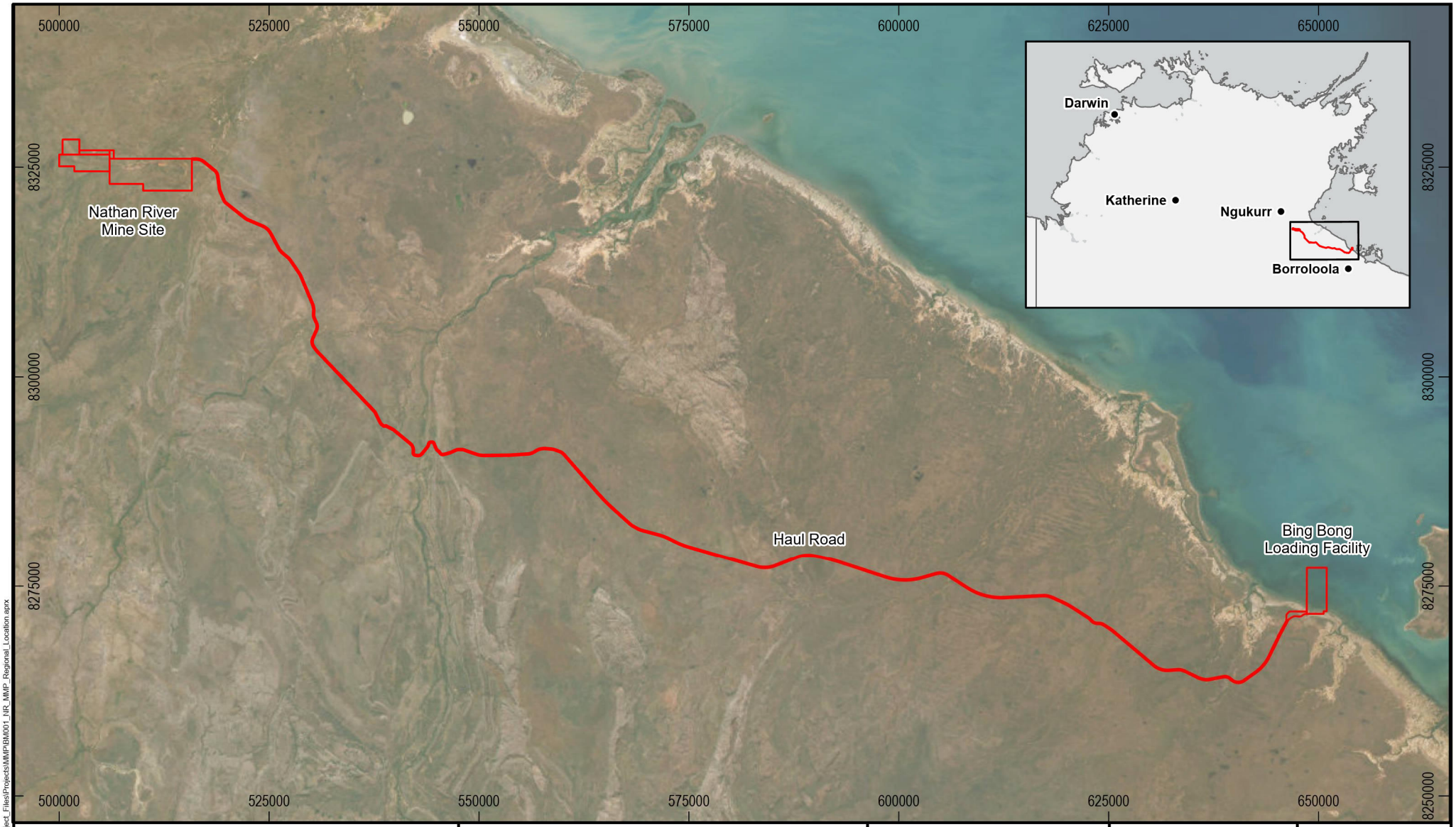
In accordance with section 41(1-5) of the MM Act, should NRR propose amendments to the approved MMP, the amended MMP must be submitted and approved by the Minister prior to the amended MMP taking effect. NRR proposes amendments to the overarching MMP (2020) approved by authorisation 1062-01, seeking to undertake maintenance dredging of the BBLF transhipment zone to facilitate future transhipment activities at the BBLF.

Variation of Authorisation 1062-01 conditional authorises dredging activities at the BBLF as per conditions 34 to 38 are summarised in **Table 2-3**.

Table 2-3 Variation of Authorisation 1062-01 Dredging Conditions

Condition	Description
34	Dredging operations cannot commence until monitoring baselines are determined and trigger limits are set.
	a. Monitoring baselines and trigger limits must be provided to the Department for approval in the form of a *Monitoring and Management Plan* prior to works commencing.
35	Monitoring against trigger limits must be undertaken daily, at suitable tide times, in the first week of dredging operations.
36	In the event of exceedance of trigger limits, dredging works must immediately cease and management methodology be reassessed prior to recommencement of works.
37	Exceedance of trigger limits must be reported to the Department.
38	Should monitoring demonstrate the management systems are effective, monitoring in subsequent weeks can occur at weekly intervals, at suitable tide times.

This MMP amendment assesses the potential environmental risks and proposes management measures to mitigate potential environmental impacts associated with the proposed activities. This plan addresses the relatively low risk activities at the BBLF only and does not address further development of mine operations at the NRP. Further details of the proposed MMP amendments are outlined in **Section 3**.



Legend

Tenement Boundaries

Source: Geoscience Australia 2006, Northern Territory Government (Department of Industry, Tourism and Trade) 2022, Nathan River Resources 2018-2020, METServe 2023, Earthstar Geographics.

Nathan River Project

Regional Location

0 5 10 20

Kilometers

Scale: 1:640,000 (A4)

14/06/2023

Datum: GDA2020
Projection: MGA53

FIGURE 2-1

METSERVE
Mining & Energy Technical Services Pty Ltd

Path: S:\Projects\BM001 Nathan River\ArcGIS\Project_Files\Projects\MMP\BM001_NR_MMP_Regional_Location.aprx

2.4 Declaration

I hereby declare that the information provided in this MMP amendment is true and correct to the best of my knowledge and that I accept that the misrepresentation or omission of facts may delay assessment for authorisation under the MM Act.

Simon Peat

Chief Executive Officer - NRR Services Pty Ltd

Date: 26 April 2024

3 OPERATIONAL ACTIVITIES

NRR currently operates a loadout facility at the BBLF which distributes iron ore material sourced from the NRP to various international markets via marine shipping operations. The loadout facility is comprised of two domains: the stockyard where ore material is stockpiled prior to shipment, and the wharf, where the transhipment barge is loaded. Stockpiled ore material in the BBLF stockyard is loaded onto an overland conveyor which transports material from the stockyard to the transhipment barge at the wharf. Transhipment barges, once loaded, are transported through the BBLF transhipment zone using tugboats out to bulk carrier vessels referred to as ocean-going vessels (OGVs) moored in deeper water off the coast of the BBLF. This method of shipping operations is used due to the shallow nature of the Gulf of Carpentaria, restricting access of OGVs into the BBLF. Each barge has a capacity of approximately 4,000 t (subject to tidal conditions), which requires several barge loads to fill the 60,000 t capacity of each OGV. Since NRR recommenced shipping operations in July 2023, a total of 380,000 t of iron ore material has been shipped from the BBLF (July 2023 – February 2024), averaging 1-2 ships per month. NRR considers this to be a significant success and testament to the simplistic operating approach which NRR have implemented since the NRP was placed into Care & Maintenance in December 2021. NRR continues to further optimise the marine shipping operation in efforts to increase the number of OGVs which can be loaded each month.

NRR's shipping operations at the BBLF takes into consideration the other operator and overall controller of the port, Glencore's McArthur River Mining (MRM). Since the recommencement of shipping activities, NRR has developed a strong relationship with MRM, and operates under their direction should MRM be shipping at the same time as NRR. This strong relationship between the two port operators allows for safe and efficient shipping operations to occur at the BBLF. To continue to ensure safe shipping operations for both operators at the BBLF, maintenance dredging of the BBLF transhipment zone is required. NRR is seeking approval to undertake a small-scale dredging program over the upcoming 2024-2025 wet season.

As per the Northern Territory Environmental Protection Authority's (NT EPA) Guidelines for the Environmental Assessment of Marine Dredging in the Northern Territory (NT EPA 2013), dredging is defined as the excavation, transport and relocation of solid matter from the seabed of any marine, coastal or estuarine waters. Dredging is typically categorised into one or more of the following categories:

- Capital dredging – involves dredging a site for the first time for the purpose of navigation or construction of infrastructure;
- Maintenance dredging – dredging which ensures that existing channels, berths, turning basins or other port areas are maintained within their design dimensions; and
- Extractive dredging – dredging for the purpose of sand / gravel extraction for construction purposes.

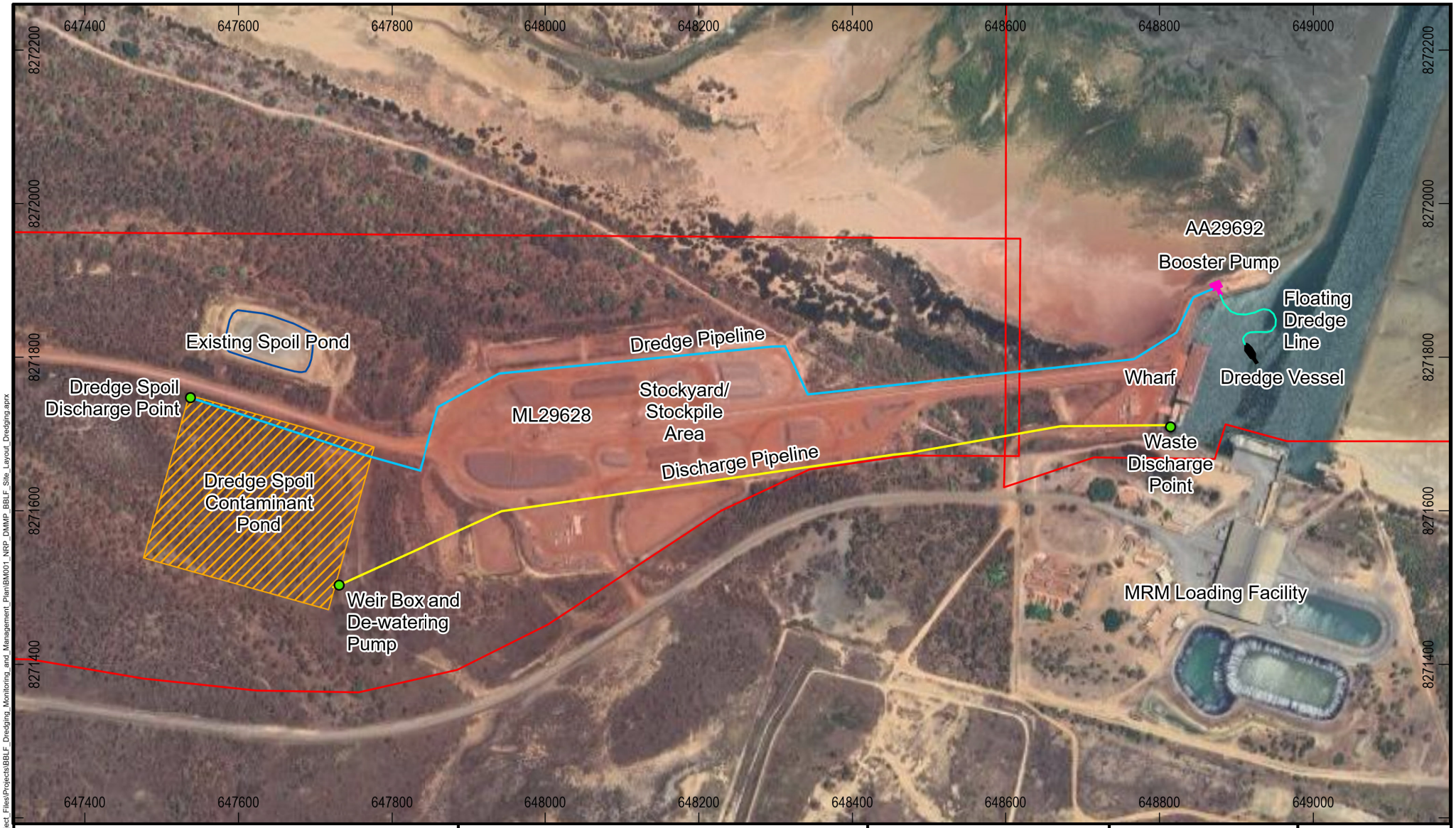
The proposed dredging program is categorised as 'maintenance dredging' as per the NT EPA's Marine Dredging Guideline (NT EPA 2023) given that the BBLF transhipment zone is a previous dredged and disturbed shipping channel. The RBIOP EIS (EcOz 2012) outlined that maintenance dredging of the BBLF transhipment zone would be required every four years to ensure the design depth of the swing basin and channel is sustained throughout operations. Since the last large-scale dredging program completed by MRM in 2012, only one small maintenance dredge of 8,000 m^3 has been completed by NRR in 2020. NRR is seeking approval via this MMP amendment to undertake a further routine maintenance dredging program, which is critical in facilitating future export operations for NRR and MRM.

3.1 MMP Amendment Overview

This MMP amendment seeks to amend the activities currently authorised by Variation of Authorisation 1062-01. NRR proposes a short-term dredging program at the BBLF which will remove built-up marine sediment from the transhipment channel and swing basin, further facilitating access to these areas of the BBLF. The last dredging program undertaken at the BBLF was completed by NRR in 2020, which saw the removal of 8,000 m^3 of material dredged from the transhipment zone. The proposed dredge program is larger and will aim to remove an estimated 90,000 m^3 of material over a four-month period. Dredged material is proposed to be stored in an appropriately constructed dredge spoil pond with decanted seawater to be discharged back to the swing basin under a waste discharge licence (WDL). Construction of the dredge spoil pond is proposed to commence in Q3 2024, with the commencement dredging expected to commence in November/December 2024 and continue throughout the 2024-2025 wet season. The proposed dredging program will ensure future transhipment activities can continue at the BBLF and is considered critical to both NRR and MRM's BBLF operations.

This document proposes an amendment to the overarching 2020 MMP which was granted approval through Authorisation 1062-01. Any activities, management plans, procedures or policies which are not the subject of this amendment will be followed and implemented as per the 2020 MMP. This amendment does not seek any changes to authorised activities at the NRP, and only relates to BBLF operations.

The proposed layout of the dredging program at the BBLF is presented in **Figure 3-1**.



Legend

- Tenement Boundaries
- Infrastructure
- Pump and Discharge Point
- Discharge Pipeline
- Dredge Pipeline
- Floating Dredge Line
- Existing Spoil Pond
- Dredge Spoil Contaminant Pond
- 18 Inch Diesel Booster Pump
- Dredge Vessel

Source: Northern Territory Government (Department of Industry, Tourism and Trade) 2022, Nathan River Resources 2024, METServe 2024. Imagery - © OpenStreetMap and contributors

Nathan River Project

BBLF Site Layout - Dredging

**Infrastructure locations are approximate only. Not to scale.*

0 50 100 200

Meters

Scale: 1:7,000 (A4)

23/04/2024

Datum: GDA2020
Projection: MGA53

FIGURE 3-1

METSERVE
Mining & Energy Technical Services Pty Ltd

Path: S:\Projects\BM001 Nathan River\ArcGIS\Project_Files\Projects\BBLF_Dredging_Monitoring_and_Management_Plan\BM001_NRP_DMMP_BBLF_Site_Layout_Dredging.aprx

3.2 Dredging Program

To facilitate future transhipment activities at the BBLF, maintenance dredging is required to remove siltation within the swing basin and the transhipment channel. Since the most recent, large-scale dredge program completed in 2012, a significant amount of sediment has built up throughout the swing basin and transhipment channel. Majority of this built-up material that has accumulated in the transhipment zone can be indirectly attributed to the ongoing movements of the vessel *Aburri*, manoeuvring in the swing basin as part of ongoing MRM operations and natural sediment infill processes typical of shallow coastal waters.

The proposed dredging program aims to remove approximately 90,000 m^3 of material from the BBLF transhipment zone. This material will be removed using a cutter suction dredger (CSD), a common dredging method which cuts marine sediment into fragments using a rotating cutter head (**Figure 3-2**). While operating, the CSD will remain stationary and anchored to the seabed via a spud at the rear of the vessel. Despite the vessel remaining stationary, the ladder which houses the cutter head, extends into the water to the seabed and is secured by two anchors and winches. These anchors and winches on either side of the ladder allow for the ladder and cutter head to swing sideways without moving the CSD vessel, facilitating the cutting and removal of marine sediment.

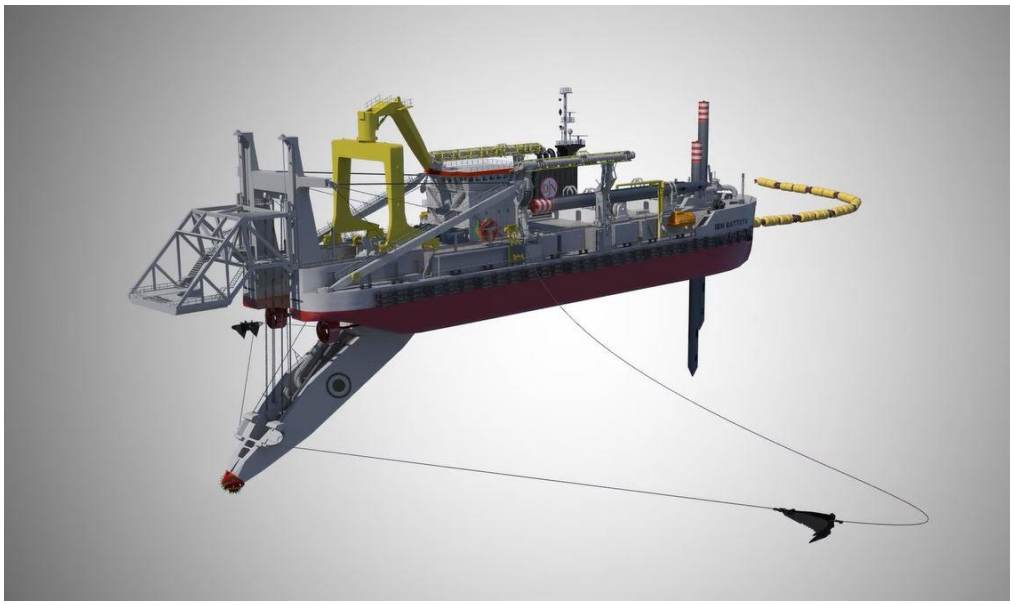


Figure 3-2 Example of a Cutter Suction Dredger (CSD)

Marine sediment and seawater are removed by the dredge's cutter head, sucked up by dredge pumps and transported along a floating pipeline, discharging dredged slurry into the spoil pond located near the BBLF stockyard. Dredge slurry material will be transported and contained within a poly-welded HDPE pipeline to ensure pipeline integrity and reduce the risk of uncontrolled spills from the dredge pipeline. Given the distances between the dredge pontoon and the spoil pond, diesel booster pumps will be positioned on the wharf to assist in transporting the dredge slurry from the CSD to the spoil pond.

Once dredge slurry is discharged into the spoil pond on the north-western corner, sediment and fines are expected to settle to the bottom of the pond as slurry migrates towards the south-eastern corner of the pond. The graded design of the spoil pond will facilitate the settlement of suspended sediment from solution, resulting in relatively clean seawater in the decant area of the spoil pond. Decanted seawater will then be discharged back into the swing basin via a dedicated discharge HDPE pipeline subject to meeting the water quality guidelines stipulated under the WDL. Once the dredge program has been completed, decommissioning of dredge infrastructure will be undertaken. Environmental monitoring will be conducted prior, during and after completion of the dredge program to ensure management and mitigation measures are effective in limiting impact to the receiving environment. The following sections provide details of the dredge design proposed as part of this MMP amendment.

3.2.1 Swing basin

The swing basin within the BBLF incorporates two berthing pockets which allow for the movement of marine vessels in and out of the two berths operated by MRM and NRR. The BBLF swing basin has a design depth of 3.23 m below the lowest astronomical tide (LAT), which allows vessels to move in and out of the basin regardless of tide. A recent hydrographic survey of the swing basin completed in November 2023 (**Figure 3-3**) indicates sections of the swing basin to be much shallower than the design depth of 3.23 m below LAT. The reduced depth of the swing basin has caused the current NRR and MRM shipping operations to be dictated by tidal movements given the lack of clearance for vessels to manoeuvre in and out of the basin on low tide. The current depth of the swing basin has and will continue to significantly restrict the shipping operations of both NRR and MRM at the BBLF until the proposed dredging program is complete.

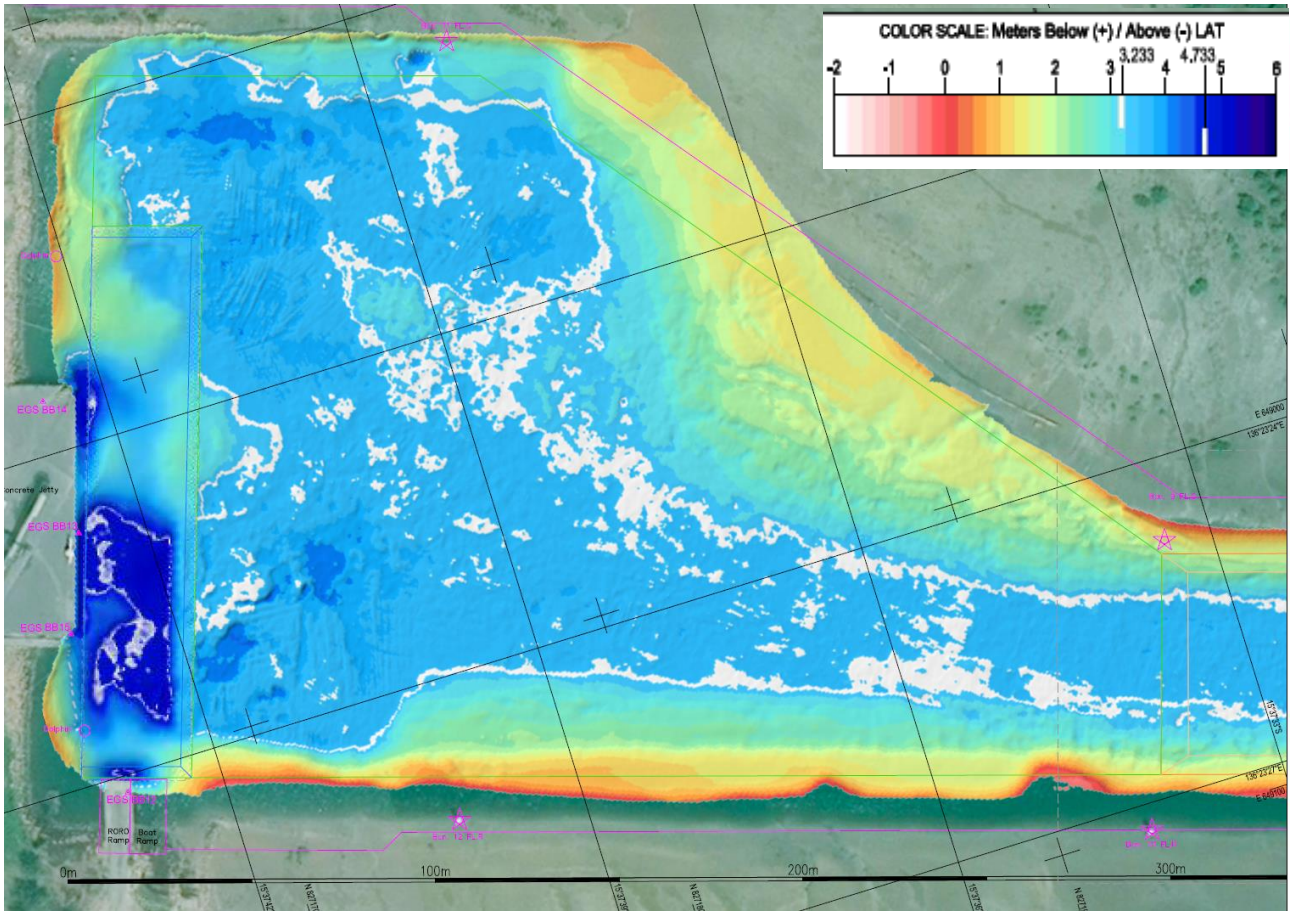


Figure 3-3 **Dredge Design – Swing Basin**

3.2.2 Transhipment Channel

The transhipment channel refers to 3.5 km stretch from the first set of channel beacons to the most seaward beacons as presented in **Figure 3-1**. This channel is 40 m wide and similar to the swing basin, has accumulated a significant amount of marine sediment since previous dredge programs. Evident by the recent hydrographic survey in November 2023, some sections of the channel are shallower than the design depth of 3.23 m below LAT and are shown in **Figure 3-4** below. The proposed dredging program will target areas shallower than 3.23 m (refer to **Figure 3-4** scale bar).

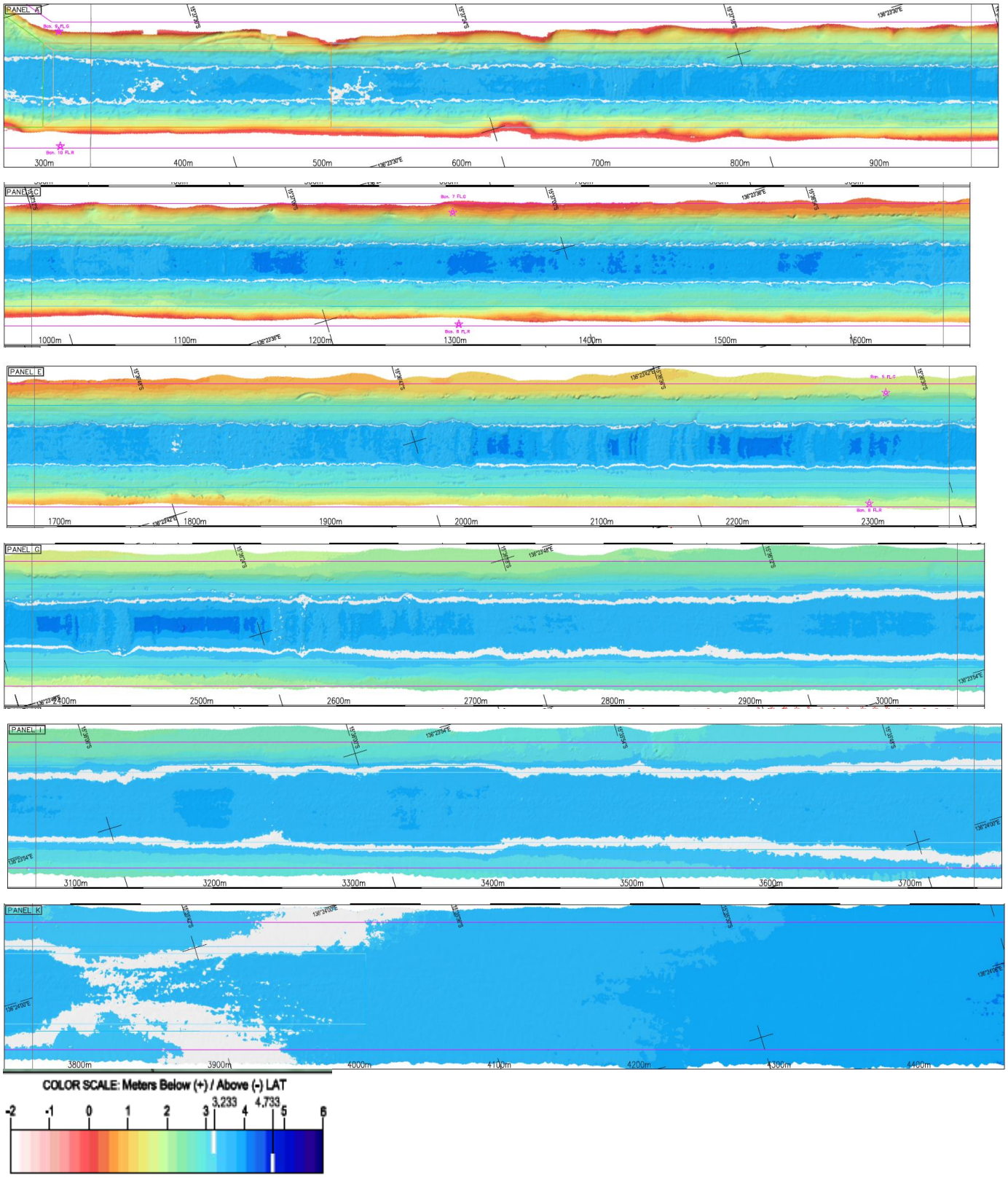


Figure 3-4 **Dredge Design – Transhipment Channel**

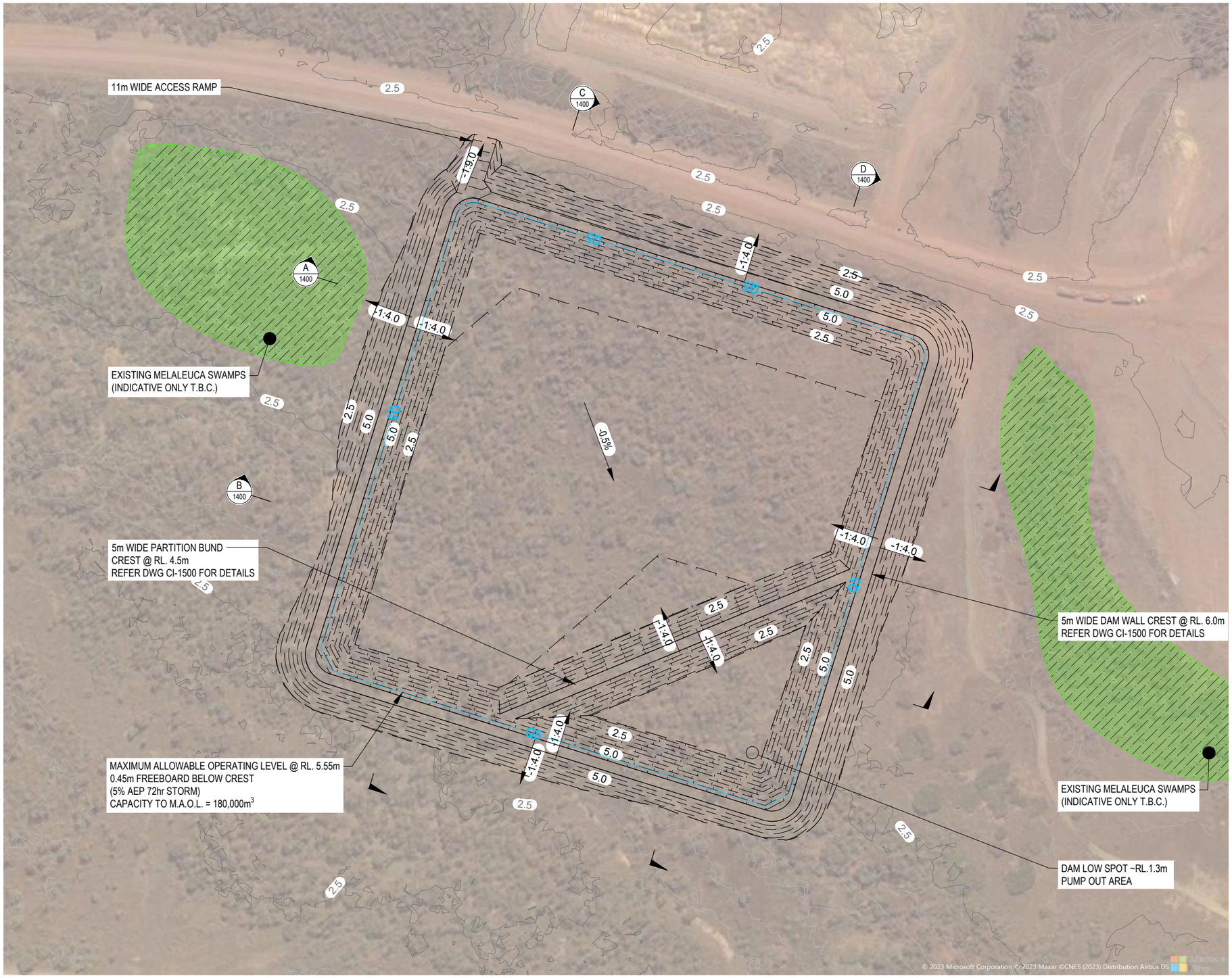
3.2.3 Dredge Spoil Pond

To facilitate the proposed dredging program, NRR must construct an appropriate dredge spoil containment pond to handle and store the dredged material removed from the transhipment zone. NRR currently has one existing dredge spoil pond located within the BBLF ML which was used to stored material from the 2020 dredge program. This existing spoil pond is small and has insufficient capacity to store the required volume of material for this dredge program. Hence, NRR is proposing to construct a new spoil containment pond within the BBLF ML to service the proposed dredge program.

NRR engaged specialist engineers SLR and BLW Marine to develop a spoil pond design and location plan which is presented in **Figure 3-5**. **Table 3-1** summaries the design details of the proposed spoil pond. The detailed design report for the proposed spoil pond completed by SLR is provided for reference in **Appendix B**.

Table 3-1 Spoil Pond Design Details

Design Parameter	Description
Footprint Area	75,900 m^2
Capacity	180,000 m^3
Deposition Slurry	< 20% solids
Dredge discharge flow rate	≤ 2,000 m^3 / hour
Grading	Grade at minimum of 0.5% from northwest corner (dredge spoil discharge point) to southeast corner.
Embankment Wall Height	Varies from 1.9 m to 4.1 m above natural ground level.
Separation Bund Height	3 m
Design Criteria	1 in 20-year AEP, 72 hr storm
Catchment Area	6 ha
Full Storage Volume (FSL)	205 ML
Maximum Operating Volume (MOL)	180 ML



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LEGEND

- 2.5 — EXISTING GROUND CONTOURS (0.5m INTERVALS)
- EXISTING MELALEUCA SWAMPS
- 5.0 — DESIGN CONTOURS (0.5m INTERVALS)
- TOP OF BANK / DAM CREST
- BATTER TOE
- Q5 — MAXIMUM ALLOWABLE OPERATING LEVEL

GENERAL ARRANGEMENT PLAN

SCALE 1:2000

PLOT DATE 06-Oct-2023 12:55:59 PM

REVISIONS				
A	03/10/23	PRELIMINARY DESIGN ISSUE		DOT
	DATE	DESCRIPTION		APPROVED

0.0 20 40 60 80 METRES

SCALE 1:2000

DRAWN:	JM	DATE:	03/10/23
DESIGN:	JM	DATE:	03/10/23
DWG. CHECK:	AK	DATE:	03/10/23
DES. CHECK:	AK	DATE:	03/10/23
RESPONSIBLE PRINCIPAL SIGNATURE:	DANIELLE O'TOOLE	DATE:	03/10/23
RPEQ :			
RPEQ :			

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CLIENT: NRR

PROJECT: BING BONG FACILITY DREDGE POND
PRELIMINARY ENGINEERING DESIGN

DRAWING TITLE: GENERAL ARRANGEMENT PLAN

SIZE: A3

STATUS: PRELIMINARY
NOT TO BE USED
FOR CONSTRUCTION PURPOSES

SCALE: 1:2000

DATUM: GDA94 - Z53

DRAWING NUMBER: 623.030222-CI-1100

REVISION: A

H:\Projects-SLR\623-TSV\623.030222.00001\NRR Bing Bong Dredge Pond Desi\06 SLR Data\01 CAD\GIS\CAD\Drawings\623.030222-CI-1100.dwg

Figure 3-5

The location of the proposed spoil pond took the following site characteristics into consideration:

- Natural topography – ensuring mostly level ground at the location of the spoil pond;
- Vegetation – avoidance of melaleuca swamps mapped within the coastal flat area at BBLF;
- Surface Water – avoidance of drainage lines and swampland which may impede construction;
- Groundwater – avoidance of groundwater supply bores or 'of-use' fresh groundwater resources; and
- Operational feasibility – distance from wharf.

A major factor dictating the proposed location of the spoil pond was the presence of Melaleuca swamps throughout the BBLF ML. Melaleuca swamps are directly associated with marshland, saturated soil profiles and drainage lines; all of which are restrictive to civil construction. An area of higher ground in-between two separate Melaleuca swamps has been selected as the proposed pond location, avoiding the disturbance of the Melaleuca vegetation coupled with ground which is more conducive to civil construction. Further details on the location of the proposed spoil pond is provided in **Section 4.1.3**.

As presented in **Figure 3-5**, the proposed spoil pond is separated into two basins; the main basin and the decant basin. The main basin will settle out and store the dredged marine sediment, whereas the decant basin will store seawater which will be separated from the dredged sediment. The main basin of the spoil pond will be designed with a -0.5% gradient sloping from the northwest to the southeast corner and will assist in the settlement of suspended sediments and fines from dredged seawater. The separation bund between the two basins will be constructed from a semi-permeable material (different to the compacted embankment walls and basin foundation), allowing water to diffuse through this bund into the decant basin. Water stored in the decant basin will be periodically discharged back to the swing basin should water quality of discharge water meet WDL trigger values.

NRR expect to deposit dredge material into the northwestern corner of the spoil pond at a maximum flow rate of 2,000 m^3/hr. This flow rate is anticipated to vary throughout the dredge program due to changes in settlement times, pond capacity and rainfall. Discharge of seawater from the decant basin of the pond back to the BBLF swing basin will occur on a periodic basis and will not exceed a discharge flow rate of 200 L/second. Approximately 450 ML of water is anticipated to be decanted and discharged back to the swing basin over the entirety of the dredge program.

The spoil pond foundations and embankment walls will be sourced from locally available material should it be deemed appropriate for construction. Material proposed for foundation and embankment walls construction will be tested prior to construction and post-construction (in-situ), specifically for compaction. A series of compaction methods and tests will be implemented during the construction to ensure seepage from the pond is limited (see Section 6 of **Appendix B** for further details). Construction of the dredge spoil pond will be supervised by qualified and experienced civil and geotechnical engineers. In accordance with Variation of Authorisation 1062-01 conditions 39 to 45, the proposed dredge spoil pond will be reviewed and subsequently endorsed by an Independent Certifying Engineer (ICE), whereby an 'as-construction' report will be developed and submitted to DITT for approval prior to commission.

In developing the proposed spoil pond design, SLR conducted a Consequence Category Assessment (CCA) to evaluate the level of risk associated with the design and location of the proposed spoil pond. Due to the Northern Territory lacking a specific criterion for dam design, the CCA for this spoil pond followed the Australian National Committee on Large Dam's Guidelines on the Consequence Categories for Dams (ANCOLD 2012). SLR concluded that the proposed dredge spoil pond was considered low in the CCA. Further details on the spoil pond design are discussed in the SLR Detailed Design Report provided in **Appendix B** (SLR 2024).

The proposed dredge spoil pond will service future subsequent maintenance dredging programs, hence the closure and rehabilitation of the pond is not proposed in this MMP period. Closure and rehabilitation of the proposed spoil pond will be addressed in future MMPs during which point the pond holds no further capacity for dredge spoil storage.

3.2.4 Waste Discharge Licence

NRR has recently submitted an application for a WDL to the Department of Environment, Parks and Water Security (DEPWS). NRR has previously held a WDL (WDL 246-01) which authorised the discharge of decant water from the dredge spoil containment cell back into the swing basin. The recent application to DEPWS aims to replicate the discharge conditions (discharge locations, monitoring locations, trigger values etc.) of WDL246-01 for a more straightforward assessment process. The discharge location along with water monitoring locations proposed in the recent WDL application are presented for reference in **Figure 3-6**. The water monitoring program proposed in the WDL application is summarised in **Table 3-2**.

Under the NT EPA's Guidelines for the Environmental Assessment of Marine Dredging in the Northern Territory (NT EPA 2013), dredging programs which propose the disposal of spoil material on land are recommended to discharge decanted seawater back to the sea. Draining and decanting excess seawater from the spoil material for discharge back to the sea aims to minimise evaporative water loss from the spoil pond whereby excessive salts are not retained in the spoil sediment (NT EPA 2013). In order to follow the recommended practice outlined by the NT EPA, a WDL is an essential component to the maintenance dredging program proposed for the BBLF transhipment zone and is considered critical to future shipping operations at the BBLF. The discharge of decant water back to the swing basin reduces the volume of water requiring storage in the spoil pond, allowing for better drying, consolidation of spoil material, reduce salinity within dredged material and reduce the risk of pond seepage.

Retention of large volumes of water within the proposed spoil pond increases the risk of pond seepage along with significantly reducing the capacity of the pond, in turn, limiting the dredge program. Current water infrastructure at the BBLF does not have the capacity to store the volume of decant water expected to be produced by the dredge program should it have to be retained if a WDL is not granted. The proposed WDL will only facilitate wastewater discharge associated with maintenance dredging activities and is not expected to be required outside of dredging programs occurring at the BBLF.

Should a WDL not be granted for the proposed dredging program, NRR and MRM shipping operations at the BBLF will be significantly reduced given the inability to utilise the transhipment zone to its fullest extent. This may potentially result in impacts to local and regional employment opportunities and NT government royalties.

Both field water quality parameters and laboratory samples at the three monitoring locations are proposed to be collected at the frequencies outlined in **Table 3-2**. Field parameters are proposed to be collected daily within the first week of dredging program. Should no exceedances of the corresponding field parameter trigger values occur during that week, field parameter collection will be reduced to weekly. Sampling for the full suite of quality analysis is proposed weekly during the dredging program.

Water quality monitoring (field parameters and sampling) will be completed by a suitably qualified person and follow the applicable Australian Standard (AS/NZS 5667). Water quality samples collected as per **Table 3-2** will be submitted to a NATA accredited laboratory requesting the fastest turn-around time requested for analysis. Given the remote nature of the BBLF, water quality samples will be dispatched to a laboratory as soon as practical. Each monitoring event, the sampler will collect and populate the following information:

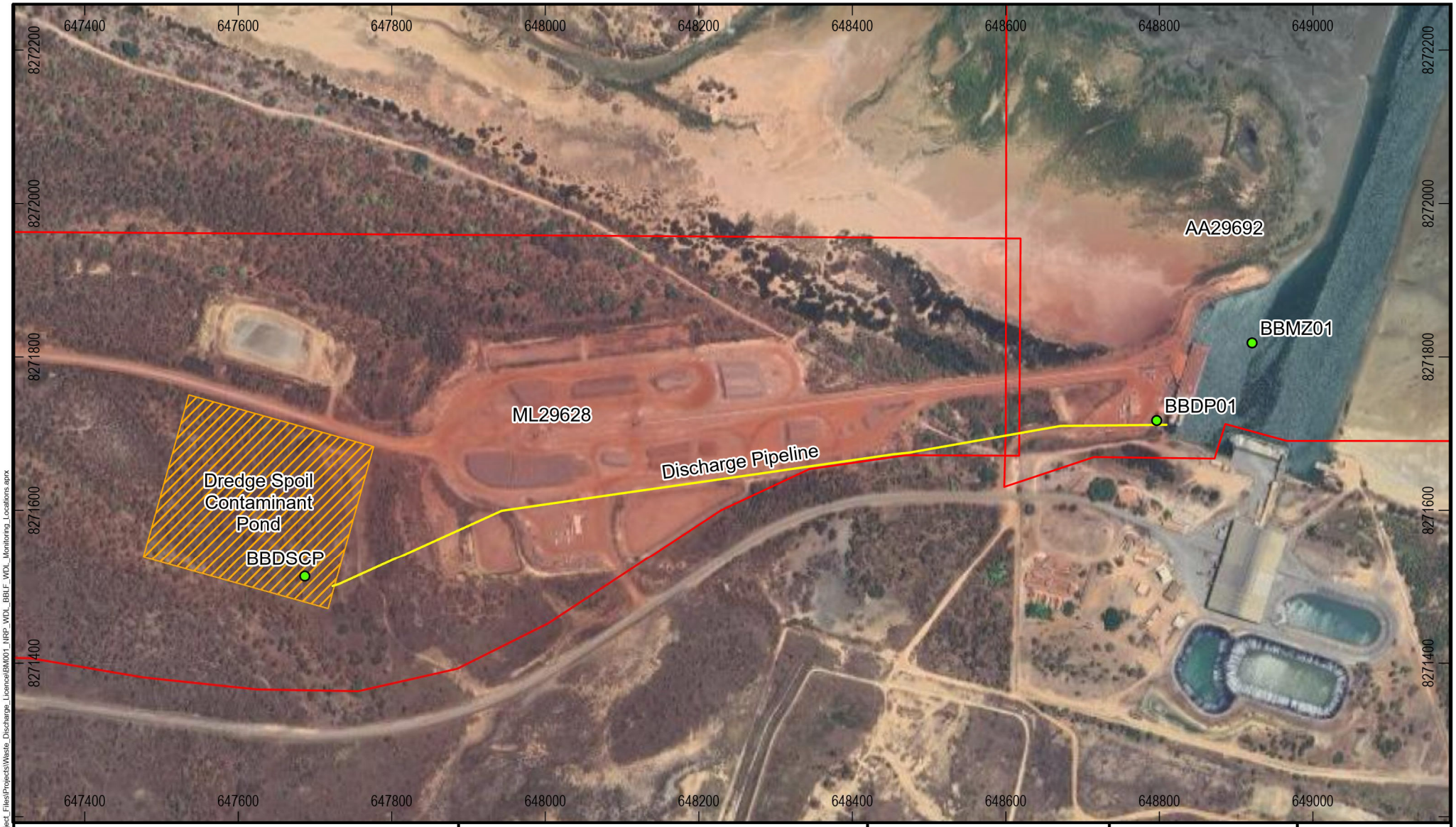
- Date and time the sample was collected;
- Location which the sample was collected;
- Name of the person who collected the sample;
- Chain of custody form relating to the sample;
- Field measurements and analytical results relating to the sample; and
- Laboratory quality assurance and quality control documentation.

Table 3-2 Proposed Monitoring Program for the WDL Application

		Monitoring Locations			Trigger Values
Parameters	**Units**	**DSCP**	**BBDP01**	**BBMZ01**	**BBMZ01**
Field Measurements					
Flow	kL/day	-	C	-	-
Water Level	mb MOL	D	-	-	-
pH	pH units	D	D	B, D, A	8 – 8.4 [1]
Electrical Conductivity (EC)	µS/cm	D	D	B, D, A	-
Dissolved Oxygen (DO)	% saturation	D	D	B, D, A	<90 [1]
Temperature	°C	D	D	B, D, A	-
Turbidity	NTU	D	D	B, D, A	20 [1]
Metals/Metalloids					
Aluminium (Al)	µg/L Unfiltered & Filtered (0.45 µm)	W	W	B, W, A	-
Cadmium (Cd)		W	W	B, W, A	5.5 [2]
Cobalt (Co)		W	W	B, W, A	1 [2]
Copper (Cu)		W	W	B, W, A	1.3 [2]
Iron (Fe)		W	W	B, W, A	-
Lead (Pb)		W	W	B, W, A	4.4 [2]
Manganese (Mn)		W	W	B, W, A	-
Nickel (Ni)		W	W	B, W, A	70 [2]
Zinc (Zn)		W	W	B, W, A	15 [2]
Other					
Total Suspended Solids (TSS)	mg/L Unfiltered	W	W	B, W, A	-

A – the day immediately following cessation of discharge.
B – Immediately before dredging commences.
C – Continuous using flow meter.
D – Daily during discharge.
W – Weekly during discharge.
mb – Meters below.
MOL – Maximum operating level

[1] Default trigger value for tropical Australia, Marine inshore (ANZECC 2000).
[2] Trigger values based on 95% species protection for marine protection (ANZG 2018)



Legend

- Tenement Boundaries
- WDL Monitoring Locations
- Discharge Pipeline
- Dredge Spoil Contaminant Pond

Source: Northern Territory Government (Department of Industry, Tourism and Trade) 2022, Nathan River Resources 2024, METServe 2024. Imagery - © OpenStreetMap and contributors

Nathan River Project

WDL Monitoring Locations

**Infrastructure locations are approximate only. Not to scale.*

0 50 100 200

Meters

Scale: 1:7,000 (A4)

27/03/2024

Datum: GDA2020
Projection: MGA53

FIGURE 3-6

METSERVE
Mining & Energy Technical Services Pty Ltd

Path: S:\Projects\BM001 Nathan River\ArcGIS\Project_Files\Projects\Waste_Discharge_Licence\BM001_NRP_WDL_BBLF_WDL_Monitoring_Locations.aprx

3.3 Improvements from the 2020 Dredge Program

Although the maintenance dredging program conducted in 2020 saw little environmental impact observed, the program did not dredge the amount of material intended owing to a number of operational issues. These operational issues have been summarised in **Table 3-3** below and have been considered when developing this proposed dredging program.

Table 3-3 2020 Dredge program issues and learnt improvements

Item	Description	Improvement to be implemented
Spoil Containment Pond	Size and design of the spoil pond was inadequate and did not allow for the settlement of suspended solids from decant water, resulting in high suspended solids in decant water.	The new spoil contaminant pond has been designed to include a separate decant basin located at the furthest point of the pond down-gradient from the dredge slurry discharge inlet.
	Build-up of spoil material directly in front of the discharge inlet into the pond which required the excavation of material to facilitate further dredge spoil deposition into the pond.	The new spoil contaminant pond has been designed with a 0.5% floor gradient, allowing for the migration of spoil slurry away from the discharge inlet towards the south-eastern corner. This is expected to prevent the buildup of material at the discharge inlet.
Pipeline Infrastructure	A single, shared pipeline was constructed for the dredging and discharge operation. This limited NRR's ability to discharge decant water to the swing basin whilst dredging. Discharge of decant water only occurred at night whilst dredging was not occurring, restricting NRR's ability to monitor any visual impacts associated with discharging.	Two pipelines will be constructed: one dedicated dredge pipeline and one dedicated discharge pipeline. This will allow NRR the opportunity to discharge whilst the dredge is active, and the ability to discharge during daylight hours.
Monitoring Programs	DGT monitoring post-dredge completion did not identify any exceedances, thus this monitoring was not justified or added any additional value.	Should no exceedances be identified in the first DGT monitoring round within the initial month of dredging activities, post-dredge DGT monitoring is not considered necessary.
	A condition of the previous WDL (246-01) required samples to be dispatched to the laboratory by air freight within 24 hours of collection. Given the remoteness of the BBLF and lack of daily flights, this is not achievable.	NRR will ensure samples are dispatched to the laboratory as soon as practical whilst ensuring the required analysis is conducted within the relevant laboratory holding times.
	Revolving the routine monitoring programs around tidal movements proved to be difficult from a personnel perspective. Tidal movements are relatively minimal within the BBLF and did not seem to affect monitoring results.	Routine monitoring programs will not revolve around tidal movements; however, tidal movement at the time of monitoring will be noted.
	Drone aerial surveys proved to be a useful tool to identify and survey the magnitude and direction of turbidity plumes associated with the dredging activities.	Drone aerial surveys will be conducted on a routine basis.

3.4 Stakeholder Consultation

Significant stakeholder consultation has and will continue to occur throughout NRR's tenure of the NRP. Table 3-4 summarises the stakeholder which are considered to be relevant to the dredging program proposed in this MMP amendment.

Table 3-4 Relevant stakeholders

Stakeholder Group	Stakeholder
NT Government (relevant departments)	Department of Industry, Trade and Tourism (DITT)
	Department of Parks, Environment and Water Security (DEPWS)
	NT Environmental Protection Authority (NT EPA)
	Parks & Wildlife Commission of the NT
Local Government	Roper Gulf Regional Council
Local Communities	Borroloola
Industry	Glencore's McArthur River Mining (MRM)
NGO's	Northern Land Council (NLC)
	Amateur Fishermen's Association of the Northern Territory (AFANT)
Local Clubs / Businesses	King Ash Bay Fishing Club

Table 3-5 below summarises the stakeholder consultation process conducted and includes details of:

- Key stakeholders consulted with including local and NT government departments, local communities, traditional owners, and other Non-Government Organisations (NGOs);
- Method of consultation;
- Consultation dates;
- Key points of discussion / concern; and
- Ongoing consultation planned.

In support of this consultation process, NRR has an established Community Liaison and Complaints Register, which it will utilise for the duration of the proposed dredging program. All complaints received shall be recorded in the existing complaints register which NRR currently implements, investigated and appropriate action taken if required.

3.5 Security Calculation

In accordance with condition 10 of the authorisation, the security provided under condition 9 must be reassessed and revised following each submission of an amendment to the current MMP. Given the submission of this MMP amendment, NRR has reassessed and provided an updated security cost which is considered to cover the proposed activities in this MMP amendment. The security remains largely unchanged from the security calculated associated with the Stage 1B MMP amendment, with the addition of the proposed dredge spoil containment pond.

The revised security held for the NRP inclusive of the activities proposed in this amendment has been calculated at **$6,355,322**.

Table 3-5 Consultation Details

Stakeholder	Consultation Method	Date Consulted (or planned)	Key Points of Discussion / Concern	Planned consultation for duration of proposed MMP period
NT Government (relevant departments)				
DITT	Written Communication via the submission of the MMP amendment.	At time of MMP amendment submission.	TBA	As required throughout the MMP amendment assessment process.
DEPWS	Submission of the MMP amendment and WDL Application	At time of MMP amendment submission.		As required basis.
NT EPA	Submission of the MMP amendment and WDL Application	At time of MMP amendment submission.		As required basis.
PWC NT	Written Communication	Post-submission, on advice from NT EPA.	Letter sent by NRR outlining NRR's proposed activities, the approval process underway and NRR contact details if any queries or concerns.	As required basis.
Local Government				
Roper Gulf Regional Council	Written Communication	Post-submission, on advice from NT EPA.	Letter sent by NRR outlining NRR's proposed activities, the approval process underway and NRR contact details if any queries or concerns.	As required basis.

Stakeholder	Consultation Method	Date Consulted (or planned)	Key Points of Discussion / Concern	Planned consultation for duration of proposed MMP period
Local Communities				
Borroloola	Meeting	Post-submission, on advice from NT EPA.	Planned meetings with NLC and relevant Traditional Owners to discuss proposed and future works.	As required basis.
Industry				
Glencore's McArthur River Mining	Meeting	During MMP amendment and WDL application preparation.		Ongoing communications with MRM throughout dredging program.
NGOs				
NLC	Written Communication	Post-submission, on advice from NT EPA.	Letter sent by NRR outlining NRR's proposed activities, the approval process underway and NRR contact details if any queries or concerns.	As required basis.
AFANT	Written Communication	Post-submission, on advice from NT EPA.		
Local Clubs / Businesses				
KAB Fishing Club	Written Communication	Post-submission, on advice from NT EPA.	Letter sent by NRR outlining NRR's proposed activities, the approval process underway and NRR contact details if any queries or concerns.	As required basis.

4 ENVIRONMENTAL MANAGEMENT

The NRP operates under a broader Environmental Management System (EMS) (NRR 2019) that has been developed to provide a methodology for the environmental management of the NRP in accordance with its environmental policy, legal responsibilities, relevant guidelines and site-specific requirements.

The EMS has been created to identify environmental risks, establish performance measures and develop performance indicators for all aspects of the NRP. This also includes the design and implementation of monitoring and management programs. The EMS also establishes the review, reporting and communication processes for the NRP, as they apply to both internal and to external stakeholders as well as administering authorities. This includes the reporting of incidents, registering of complaints and communicating of environmental management responsibilities to NRP employees, contractors and visitors. The NRP's General Managers are responsible for the implementation of all on site work programs under this policy and the EMS.

The overarching objectives of the NRP EMS include compliance with:

- All regulatory approval conditions including applicable DITT Authorisation and Commonwealth EPBC approval; and
- NRR's Environmental Policy, which includes the intent of preventing negative impact on the environment and the community.

The following sections discuss the potential environmental impacts associated with the propose dredging activities and outlines the monitoring and mitigation measures which will be implemented throughout the program. In accordance with condition 34 of NRR's authorisation 1062-01, a detailed Dredging Monitoring and Management Plan has been developed which further details mitigation measures and monitoring programs to be implemented throughout the dredging activities (**Appendix A**).

4.1 Potential Impacts and Mitigation Measures

Environmental impacts associated with marine dredging operations largely depend on the sensitivity, value and quality of the marine environment impacted on, and the context, intensity, duration, magnitude and geographic extend of the impact. In the case of the proposed dredging program at the BBLF, dredge activities will be focused on the previously disturbed transhipment zone. Given the transhipment zone holds minimal environmental values due to previous capital dredging programs, limited additional environmental impacts are expected to arise associated with proposed maintenance dredging program. Despite this, there is the potential for environmental impacts associated with the construction and operation of the new spoil containment pond.

The NT EPA guideline (NT EPA 2013) outlines several potential direct and indirect impacts that are typically associated with dredging activities. Direct impacts occur predominately within the immediately area adjacent to where dredges excavate and where spoil is dumped. Direct impacts from dredging can involve the irreversible loss of benthic habitats and communities, whereby '*irreversible*' is defined as *'lacking a capacity to return or recover to a state resembling that prior to being impacted within a timeframe of five years or less'* (NT EPA 2013). Indirect impacts from dredging can include the generation/mobilisation of suspended sediments into the water column in a plume that affects a larger area around the dredge site. The mobilisation of sediments often raise the level of sediment accretion and turbidity within the water column, exceeding the natural tolerances of benthic habitats over time. Indirect impacts from dredging can affect ecological processes resulting in impacts ranging in severity from '*irreversible*' to '*readily-reversible'* (NT EPA 2013).

The NT EPA guideline provides the following examples of potential environmental impacts associated with dredging which are considered relevant to the proposed BBLF dredging program and spoil pond construction:

Maintenance Dredging

- Increased turbidity and reduced light availability;
- Direct loss of benthic communities and habitats by removal or burial;
- Increased sedimentation affecting marine flora and fauna;
- Contaminant release impacting on water quality;
- Modifications to physical and habitat processes resulting from changes to bed topography (depth, channel profile), hydrodynamics (current, wave action);

Spoil Pond

- Removal of vegetation;
- Seepage and water quality impacts to surrounding surface waters and underlying groundwater resource; and
- Effects of Potentially Acid Sulphate Solids (PASS).

The following sections will discuss these potential environmental impacts with relevance to the proposed dredging program at the BBLF. The potential impacts of sea disposal of dredge material have not been discussed as this is not proposed for the dredge program.

4.1.1 Benthic Habitat Removal

As mentioned above, the BBLF transhipment zone is a previously modified, dredged passage which lacks significant habitat for benthic communities such as seagrasses owing to previous capital dredging programs which have occurred. The NT EPA Marine Dredging Guidelines (NT EPA 2023) recognises that benthic biota may colonise previously dredged areas between maintenance events and may be removed in future maintenance dredging. However, further impacts on these directly-affected biota are not considered to be a key consideration in the assessment of maintenance dredging proposals. This is due to those direct impacts being largely unavoidable and recolonising biota being well-adapted to surviving within dynamic benthic habitats. Hence, the risk of benthic habitat removal associated with the proposed dredging activities is considered low given the lack of such habitat within the already disturbed transhipment zone.

4.1.2 Marine Water Quality

Marine water quality will be temporarily impacted by increased turbidity and potentially elevated dissolved metal concentrations. Dissolved metals may potentially mobilise into the water column during dredging given the high likelihood of metals within the upper marine sediments of the transhipment zone as a result of dust and ore spillages during ship loading. There is also potential for spillages of hydrocarbons during refuelling of the dredge vessel, and in a worst-case scenario equipment failure, grounding or collision.

Turbidity and heavy metals

In addition to the NT EPA's guidance on benthic biota being well-adapted to surviving dynamic benthic habitats, studies of the local assemblages of benthic invertebrates and seagrasses within the BBLF and surrounds have recorded naturally high resilience to turbid waters. This is primarily due to the high prevalence of seasonal monsoons and high cyclone activity within the Gulf of Carpentaria (ERIAS 2018). It has also been noted that seagrass communities in the closest proximity to the BBLF are demonstrating normal health and natural succession (ERIAS 2016 and 2018). Further to this, current ongoing monitoring conducted by MRM at the BBLF has concluded that there are no significant turbidity impacts associated with previous dredge maintenance programs or ongoing shipping operations at the BBLF (ERIAS 2018). Monitoring data available from previous BBLF dredge programs indicate that water quality impacts are expected to be localised. During the 2020 maintenance dredging program, turbidity did not exceed the 20 NTU trigger limit outside of a 50 m zone around the dredge vessel, and dissolved metal concentrations exceeding the ANZECC (2000) 95% level of protection guidelines were not recorded outside of the swing basin (EcOz 2021).

The NT EPA Guidelines identifies two main sources of turbidity typically associated with dredging activities. These include:

- Physical interaction of dredging equipment with the seabed; and
- Spills of sediment-laden water from dredge barges.

Physical interaction of dredging equipment with the seabed causes sediment to mobilise into the surrounding water column at the dredge site. When all of the dredged material is not captured by the dredging equipment (e.g. fugitive loss from a CSD cutter head), a proportion is liberated into the surrounding water column as suspended sediment. Turbulence from propellers and movement of hulls can also disturb and lift sediments into the water column where under-keel clearance is limited. Certain dredging methods require the storage and transport of dredged material from the dredged site via dedicated barges. This increases the risk and frequency of dredged material spills into the marine environment.

The proposed dredging activities are expected to increase turbidity in waters within the immediate vicinity of the dredge site for short periods of time during operations. To limit the magnitude and migration of turbidity plumes from the immediate dredge site, NRR has implemented control measures in the design of the dredge program to assist with this. One such design feature which aims to mitigate the magnitude of turbidity plumes is the selected dredge method of a CSD. CSD's are a commonly used method when dredging in sensitive environments given the less intensity interaction with the seabed. This results in a significant reduction of turbidity plumes at the dredge site in comparison to other methods like backhoe dredge methods. In addition to this, the CSD method enables the dredge vessel to remain stationary (whilst the dredge head swings sideways) when dredging, avoiding the need to move around and potentially mobilising more sediment into the water column.

Another common source of turbidity associated with dredging activities, spills from dredge barges, is not considered to be relevant to NRR's proposed dredge program. As outlined in **Section 3.2**, from the cutter head of the dredge to the spoil pond discharge point, dredge material will be entirely contained within a welded HDPE pipeline in order to prevent any spills of dredge material back into the receiving waters. No dredge material will be stored on the dredge vessel, removing the risk of spilling dredged material into the marine environment.

NRR also intends to complete the proposed dredge program over the monsoonal wet season. During this time of year, turbidity within shallow, coastal waters such as the BBLF are naturally elevated due to high rainfall and contributions from surface water run-off. By scheduling the dredge program during periods of naturally high turbidity, additional turbidity associated with dredging is less likely to impact the marine environment, namely benthic communities. This sentiment is shared by the NT EPA who outline in the Marine Dredging Guidelines that Darwin Harbour dredging programs are typically scheduled over the wet season during periods of naturally elevated turbidity to lessen the potential impacts on the marine environment (NT EPA 2023).

Along with the dredge program design aiming to mitigate the potential impacts of turbidity generation, NRR has proposed an extensive water quality monitoring program to be conducted prior, during and at completion of the dredge program. This monitoring program will facilitate the pro-active detection of any adverse impacts to water quality associated with dredging activities. During dredging operations, turbidity will be frequently monitored at several locations surrounding the dredge site, whereby if trigger values are exceeded, dredging operations will be postponed until measures are implemented to reduce the turbidity plume. Further information on the proposed monitoring program are detailed in the Dredging Monitoring and Management Plan (**Appendix A**).

The relatively small scale and short timeframe of the proposed maintenance dredging program will result in a localised and short-term impact to water quality. Given that there has not been an impact on seagrass from activities at the BBLF to date, the maintenance dredging poses a low risk of any significant impacts from elevated turbidity or metals in the wider marine environment.

Hydrocarbon spills

The likelihood of a major spill occurring is low given that relatively small amounts of fuel which are stored on the dredge and/or handled during refuelling. Release of large amounts of oil or fuel to the BBLF transhipment zone could result in reduction to water quality. However, due to the relatively small tidal range and weak currents at the BBLF, impacts on benthic ecology and marine assemblages could be minimised through the implementation of emergency spill response procedures. Minor releases of fuel or oil into the marine environment are unlikely to cause any long-term impact subject to the timely implementation of spill response.

4.1.3 Dredge Spoil Pond

To facilitate the proposed dredge program, a new dredge spoil containment pond must be constructed at the BBLF. There is an existing spoil pond on the NRR BBLF ML which has been utilised in previous maintenance dredging programs. This existing contaminant pond has limited available capacity to store the required amount of spoil proposed to be dredged in this upcoming program. Hence, NRR is seeking to construct a larger, more appropriately designed dredge spoil contaminant pond within the NRR ML at the BBLF as per the design outlined in **Section 3.2.3**. Although the proposed spoil contaminant pond is critical to the overall dredge program, several potential environmental impacts have been identified to be associated with the construction and operation of the spoil containment pond. These potential impacts include:

- The removal of undisturbed vegetation at the site of the spoil pond;
- Spoil pond seepage and water quality impacts to surrounding surface waters and underlying groundwaters; and
- Excavation and interaction with PASS during construction.

Removal of vegetation

No vegetation communities present within NRR's BBLF ML are listed under the *Territory Parks and Wildlife Conservation Act 1979* (TPWC Act) or *Environmental Protection and Biodiversity Conservation Act* (EPBC Act). Yet, there are vegetation communities which have been considered 'locally noteworthy' from the perspective of conserving habitat which is in good condition, maintains landform stability or contributes to the hydrology and connectivity of the coastal environment (EcOz 2012). These vegetation communities considered to be 'locally noteworthy' include:

- Mangroves;
- Monsoon Vine Thicket Community;
- Cypress Pine Woodland; and
- Melaleuca Swamp.

All four of these vegetation communities were considered when selecting the proposed spoil pond location, ensuring the least amount of impact to each vegetation community. Vegetation mapping completed as part of the RBIOP EIS (EcOz 2012) indicates the site of the proposed spoil pond primarily includes *Grevillea striata* and *Pandanus spiralis*, two dominant and widely spread coastal species across the BBLF. The proposed location of the spoil pond sits outside the known patches of *Melaleuca viridiflora*, avoiding the disturbance of these patches as they are considered 'locally noteworthy' by the EIS and are typically associated with water-logged ground whereby such ground conditions are not conducive to the civil construction of the proposed pond. RBIOP EIS vegetation mapping is presented in **Figure 4-1**.

NRR seeks to clear approximately 8 hectares (ha) of vegetated land within the NRR BBLF ML. The proposed location for the spoil pond does not contain any known areas of endangered or of-concern flora communities and avoids vegetation which has previously been considered 'locally noteworthy' by the EIS. The loss of this small patch of vegetation is not considered to cause significantly impact to the environment at the BBLF.

The footprint of the proposed spoil pond was not directly included and assessed in the RBIOP EIS as the design of the BBLF has varied since this assessment was completed. Despite this, given the proposed area is within NRR's authorised ML boundary, it is considered that the EIS has assessed disturbance of all areas within the ML.

Pond seepage and surrounding water quality

The environmental impacts associated with the storage of saturated marine sediment within land-based dredge spoil containment facilities is the potential for contaminated or highly saline water to seep into the receiving environment and impact surrounding vegetation, surface water and groundwater quality. Although NRR intends to construct the proposed spoil pond so that seepage from the bund walls and pond floor is limited, the potential for poor-quality seepage from the proposed pond has been assessed below.

The risk of impacts to vegetation surrounding the spoil pond from potentially increased salinity is considered low, as the littoral vegetation assemblages present are salt tolerant by nature (EcOz 2012). The existing dredge spoil storage pond has existed for approximately 11 years, since the construction of the BBLF, without record of significant vegetation dieback, indicating that the containment bunds and floor are operating as designed. Further to this, current monitoring of similar vegetation for impacts from the storage of dredge spoil and potential salinity at the nearby MRM operation, has concluded that the vegetation of the area is generally tolerant of high saline conditions (ERIAS 2016 and 2018).

Impacts to groundwater from contaminated and/or saline seepage from the proposed spoil pond are considered to be negligible. Historic water quality from groundwater monitoring bores at the BBLF indicate highly saline groundwater conditions. Monitoring bore, BBMB01, approximately 250 m away from the proposed spoil pond site recorded an electrical conductivity of 103,000 µS/cm in July 2023, significantly higher than the EC of seawater (~50,000 µS/cm). Given the highly saline nature of groundwater at the BBLF, there are limited beneficial uses for groundwater at the BBLF. Impacts on surrounding groundwater quality associated with spoil pond seepage are not expected to occur. Routine groundwater monitoring of level and quality will continue on a bi-annual basis allowing the detection of any significant changes in water quality.

Under the NT EPA's Guidelines for the Environmental Assessment of Marine Dredging in the Northern Territory (NT EPA 2013), dredging programs which propose the disposal of spoil material on land are recommended to discharge decanted seawater back to the sea. Draining and decanting excess seawater from the spoil material for discharge back to the sea aims to minimise evaporative water loss from the spoil pond whereby excessive salts are not retained in the spoil sediment (NT EPA 2013). Following the NT EPA's advice, the proposed dredge program has been designed to allow for the return of decanted spoil water back to the sea via a WDL. The decant of seawater from spoil material will reduce the overall salinity captured within the dried sediments and moisture of the stored material, reducing the overall risk of seepage from the pond to the receiving environment. As mentioned in **Section 3.2.4**, an application for a WDL has been submitted for assessment and approval by the DEPWS.

Given the nature of the receiving environment surrounding the proposed dredge pond, impacts from highly saline or poor-quality seepage to vegetation, surface water and groundwater is considered to be limited should it occur.

Interaction with PASS

A potential impact from the disturbance of sediments within marine environments in the Northern Territory is the interaction with PASS. The likelihood of the dredged material being PASS is considered low based on the fact that no PASS material was encountered during the capital dredging program and subsequent maintenance programs since. An assessment of PASS was undertaken as part of geotechnical investigations prior to construction of the BBLF and did not identify any materials that required management (Cardno 2013).

Nonetheless, during the initial construction of the proposed spoil pond and within the first week of dredge material disposal into the spoil pond, sediment testing will be undertaken to identify PASS. Should material reflect PASS characteristics, PASS material will be handled in accordance with the Northern Territory Land Suitability Guidelines (Department of Lands, Planning and the Environment 2013), and the relevant recommendations outlined in 'Acid Sulfate Soils of the Darwin Region' (Land and Water Division Department of Natural Resources, Environment the Arts and Sport 2008).

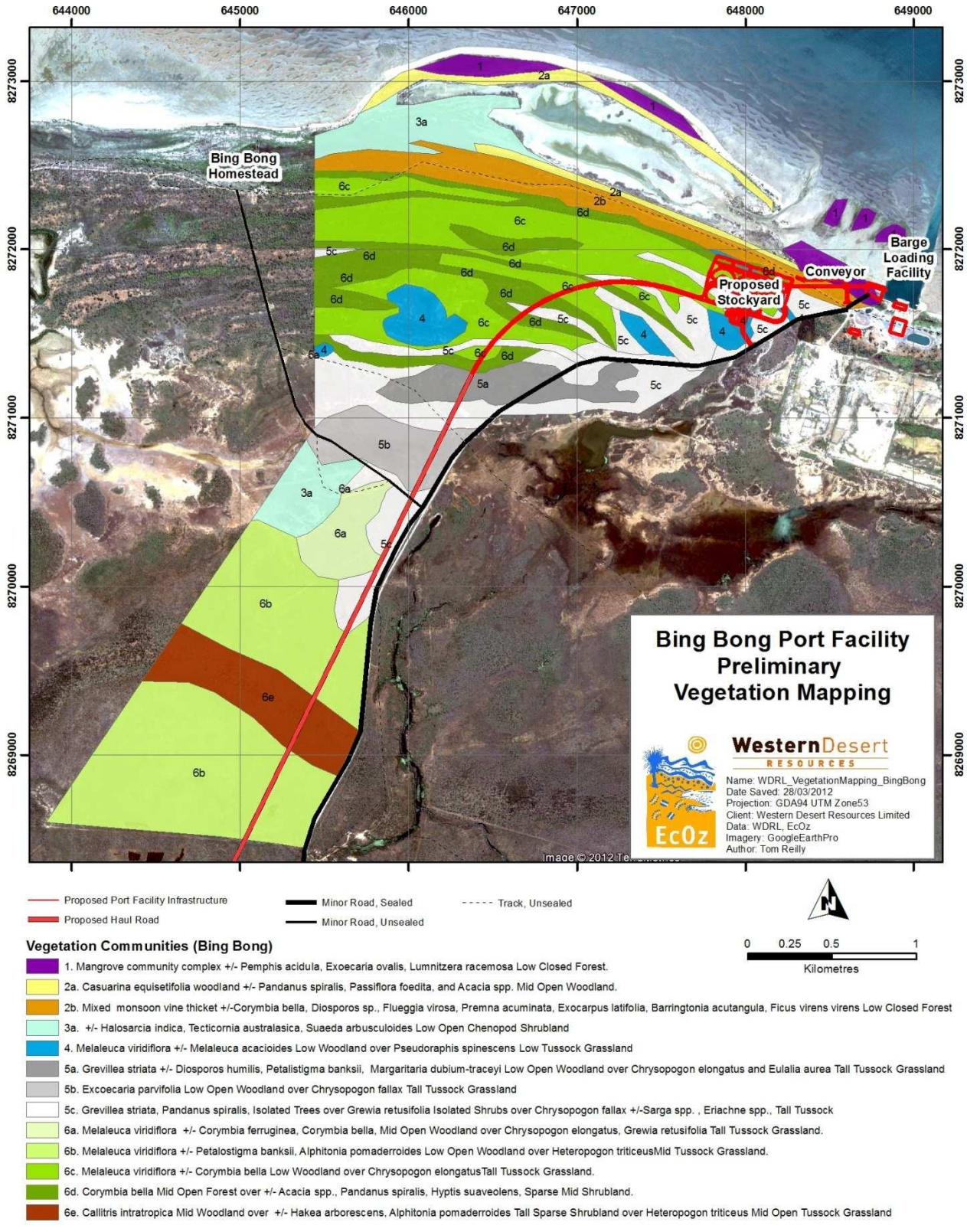


Figure 4-1 BBLF Vegetation Mapping (RBIOP EIS 2012)

4.1.4 Impacts & Mitigation

The risk of any significant or irreversible direct or indirect impacts from the proposed dredging program and the construction/operation of the new dredge spoil pond is considered low owing to the following factors:

- No proposed marine dumping of dredge spoil;
- Short-term maintenance dredging program (~90,000 m^3 in a four-month period) to be undertaken in the wet season when water quality within the marine environment will be naturally elevated, decreasing the severity of impacts to water quality should this occur;
- Historical sediment monitoring within the BBLF transhipment zone have indicated concentrations below ANZG default guideline values. Elevated metal concentrations may be present in some of the dredged material; however, volumes are expected to be minimal;
- Previous geotechnical investigations and previous dredge material sampling indicate negligible risk of the dredged or excavated material containing PASS;
- Spoil material will be pumped directly to the proposed dredge spoil containment pond from the dredge vessel via a fully contained HDPE pipeline;
- Maximising retention times of decant water within the spoil pond to ensure sediments are allowed to settle prior to discharge;
- A new, appropriately designed dredge spoil containment pond incorporating design improvements highlighted from the previous spoil pond inefficiencies;
- There has been no recorded incidence of significant vegetation die back following placement and storage of spoil material in NRR's and MRM's existing spoil storage areas;
- Monitoring of the 2020 maintenance dredging program (EcOz 2021) indicated that water quality impacts were limited and localised to the BBLF transhipment zone;
- There is limited seagrass or significant habitat for motile marine species within the transhipment zone (ERIAS 2018) that would be directly affected by physical disturbance or water quality; and
- Long-term monitoring programs in the marine waters surrounding the BBLF indicate no significant point source or cumulative impact to water quality or habitats outside of the BBLF transhipment zone from past dredging and operational activities.

To reduce risks to the marine and terrestrial environments surrounding the BBLF to 'as low as reasonably possible', the following additional mitigation measures will be implemented:

- Dredge rates will be altered in response to environmental conditions and monitoring results (exceedances of triggers), with dredging rates decreased as required to minimise the extent of the sediment plume;
- Testing of dredged material for PASS and treating if required;
- Use of flocculants or filters if required, to further remove sediments from the decant water prior to discharge;
- Visual observation for marine fauna and temporary cessation of dredging if fauna encroach on the dredging vessel in accordance with *NRP Marine Monitoring and Management Plan (MMMP).*
- Spill response equipment and training provided to all personnel; and
- Implementation of the Shipboard Oil Pollution Emergency Plan.

In summary, it is considered that the likelihood of any significant or irreversible direct or indirect impacts from dredging activities and the storage of dredge spoil on land at the BBLF is very low.

4.2 Environmental Training and Education

Environmental training and education will be facilitated through site inductions and toolbox talks. The site induction will be provided to all staff and include the following:

- Identification of site environmental values;
- An understanding of the requirements of the current MMP;
- Roles and responsibilities of site personnel;
- Environmental emergency response procedures;
- Site environmental controls;
- Environmental incident identification and response; and
- The potential consequences (for both NRR and individuals) of not meeting environmental obligations/responsibilities.

The NRR Safety Department will log site visitors and maintain database of site inductions completed. Records of all training and induction will be maintained and be available for inspection.

4.3 Environmental Emergency Preparedness and Response

The most likely risk of an environmental emergency at the BBLF is the potential of a spill of hydrocarbons during the proposed activities. The small quantities of fuel / oil that is stored at the BBLF poses limited risk to the environment. The emergency procedure that NRP will put in place to manage this limited risk are as follows:

- Alert co-workers and report the incident/or accident to the immediate supervisor;
- Trap any liquid if possible by bunding the area to prevent it from reaching any waterways and the marine environment;
- Without placing the safety of the individual at risk, identify the source of the leak if possible and determine if it can safely be stopped immediately;
- Conduct an assessment of the incident to determine the severity of the incident and reporting requirements per section 29 of the *Mining Management Act*;
- If the incident is significant, the BBLF General Manager / CEO must report the incident to DITT as soon as practicable after the occurrence;
- Manage any threat of fire by having the appropriate fire extinguishers that can deal with oil based fires and grass fires;
- Any contaminated soil and material such as rags and blankets must be disposed of at an approved facility; and
- Ensure that reporting details and the occurrence of the incident are noted in the diary for the site.

Other potential emergency situations at the BBLF site may include:

- Fire; and
- Severe weather including cyclones.

5 REFERENCES

ANZECC & ARMCANZ (2000), Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra.

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Appendix A – BBLF Dredging Monitoring and Management Plan

DREDGING MONITORING AND MANAGEMENT PLAN

Nathan River Resources

Bing Bong Loading Facility Dredging Program

Operator name:	NRR Services Pty Ltd
Project name:	Nathan River Project
Authorisation:	1062-01
MMP reporting year:	2024 - 2025
Date:	30 April 2024
Document distribution list:	Department of Industry, Tourism and Trade
	NRR Services Pty Ltd

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1 INTRODUCTION

The NRP (previously referred to as the Roper Bar Iron Ore Project (RBIOP)) is wholly operated by NRR Services Pty Ltd (NRR) since acquiring the NRP in 2019 from the previous operators, Western Desert Resources (WDR). The NRP is located approximately 530 kilometres (km) southeast of Darwin within the Gulf of Carpentaria and is comprised of three main operation domains: the mine, the haul road and the Bing Bong Loading Facility (BBLF). The mine is located within mining leases (ML) 28962, 28267, 28266, 28963 and 28264. The haul road, privately owned and operated by NRR, stretches for 171 km, connecting the mine and the BBLF allowing the haulage of material to the BBLF. The BBLF is situated within ML 29628, located on the south-western coast of Gulf of Carpentaria approximately 50 km north of Borroloola. Glencore's McArthur River Mine (MRM) operates a larger loading facility at the BBLF and is the overarching controller of the Port. The regional location of the NRP is presented in **Figure 1-1**.

The previous operator, WDR commenced mine construction and operations in 2013 following the approval of the Roper Bar Iron Ore Project (RBIOP) Environmental Impact Statement (EIS) under the previous *Environmental Assessment Act.* Upon acquiring the RBIOP, NRR submitted a Mining Management Plan (MMP) in accordance with the *Mining Management Act 2001* (MM Act), receiving approval in the form of mining authorisation 1062 to commence operations in 2020.

NRR currently operates the NRP under the approved Variation of Authorisation 1062-01 granted in October 2023 which authorises the recommencement of mining, haulage and shipping operations across the three domains of the NRP.

NRR proposes to undertake a maintenance dredging program within the BBLF transhipment zone to facilitate future shipping operations at the BBLF during 2024.

1.1 Objectives

The objectives of this Dredging Monitoring and Management Plan (DMMP) are to:

- Protect the terrestrial and marine environment surrounding the BBLF from any potential impacts associated with maintenance dredging activities;
- Demonstrate consideration of potential impacts to the terrestrial and marine environment values of the BBLF and surrounds associated with the proposed dredging activities;
- Provide practical and achievable monitoring programs to ensure early detection of potential impacts, providing effective management and mitigation measures and inform future dredge management plans;
- Communicate environmental protection requirements to all personnel involved in undertaking the proposed dredging activities; and
- Provide regulatory authorities with a basis to confirm compliance with environmental policies and monitoring conditions.

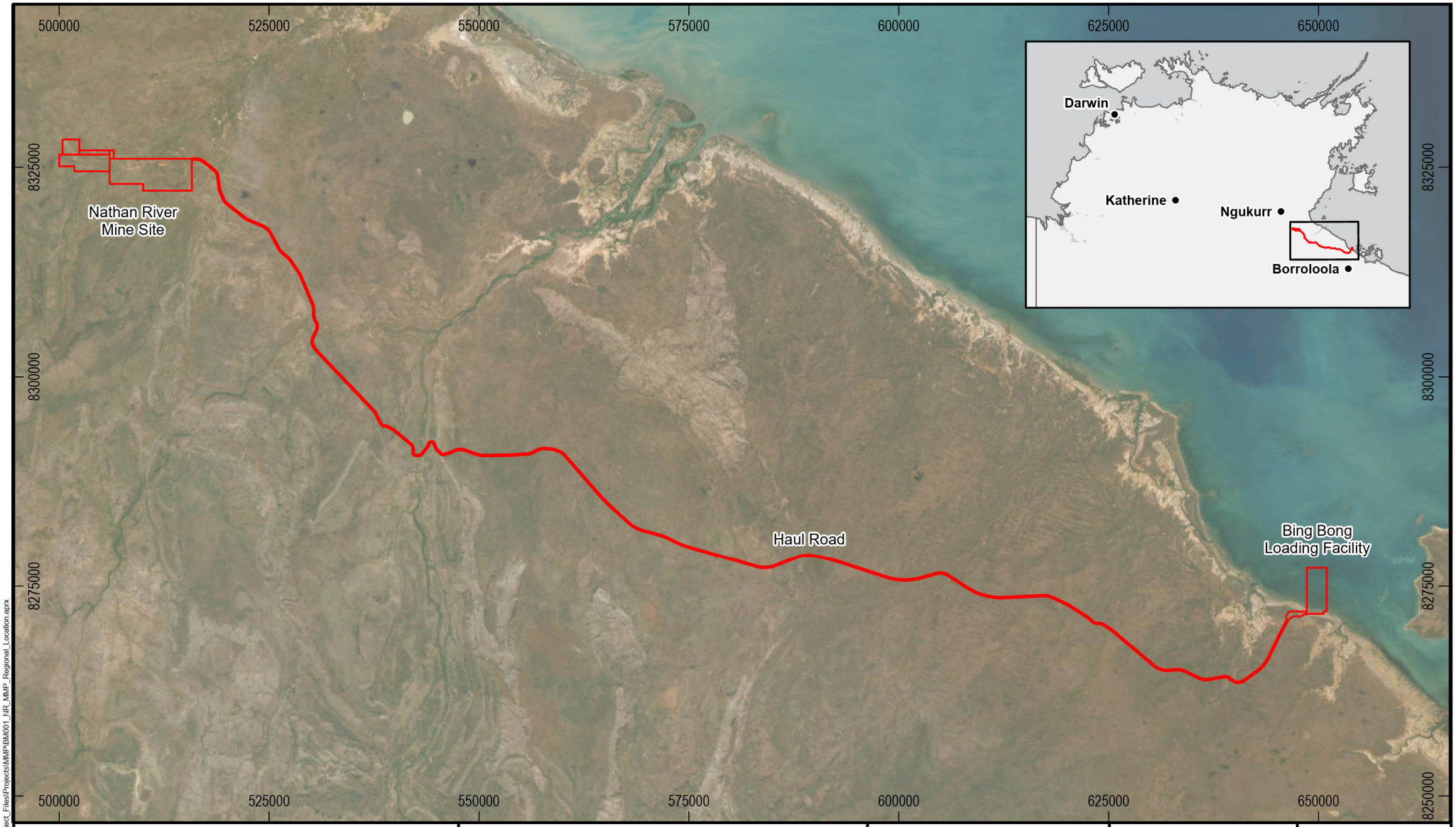
1.2 Purpose

The purpose of this DMMP is to provide a framework for planning and managing maintenance dredging so that potential impacts to the environment are minimised. All other impacts associated with routine operations at the BBLF are addressed in the NRP MMP (NRR 2020).

The DMMP is a requirement of NRR's mining authorisation (1062-01) issued under the MM Act and will be submitted to the Department of Industry, Tourism and Trade (DITT) for approval prior to the commencement of dredging activities. Authorisation conditions relating to dredging activities are outlined in **Table 1-1** below.

Table 1-1 Variation of Authorisation 1062-01 Dredging Conditions

Condition	Description
34	Dredging operations cannot commence until monitoring baselines are determined and trigger limits are set.
	a. Monitoring baselines and trigger limits must be provided to the Department for approval in the form of a *Monitoring and Management Plan* prior to works commencing.
35	Monitoring against trigger limits must be undertaken daily, at suitable tide times, in the first week of dredging operations.
36	In the event of exceedance of trigger limits, dredging works must immediately cease and management methodology be reassessed prior to recommencement of works.
37	Exceedance of trigger limits must be reported to the Department.
38	Should monitoring demonstrate the management systems are effective, monitoring in subsequent weeks can occur at weekly intervals, at suitable tide times.



Legend

Tenement Boundaries

Source: Geoscience Australia 2006, Northern Territory Government (Department of Industry, Tourism and Trade) 2022, Nathan River Resources 2018-2020, METServe 2023, Earthstar Geographics.

Nathan River Project

Regional Location

0 5 10 20

Kilometers

Scale: 1:640,000 (A4)

14/06/2023

Datum: GDA2020
Projection: MGA53

FIGURE 1-1

METSERVE
Mining & Energy Technical Services Pty Ltd

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2 LEGISLATIVE AND POLICY REQUIREMENTS

The Commonwealth and Northern Territory legislative requirements applicable to the proposed dredging activities at BBLF are summarised in the sections below.

2.1 Commonwealth Legislation and Policies

The maintenance dredging program proposed for the BBLF does not require referral to the Commonwealth under the *Environment Protection and Biodiversity Conservation Act* 2000 (EPBC Act) as the 'prior authorisation' provisions of section 43 of the EPBC Act apply. NRR does not consider the action to trigger a matter of national environmental significance.

2.2 Northern Territory Legislation

The key pieces of NT legislation applicable to the proposed maintenance dredging activities at BBLF are listed below in **Table 2-1**.

Table 2-1 NT legislation relevant to dredging program

Legislation	Relevance to activities
NT Mining Management Act	'Authorisation' for operation of the NRP is subject to annual revision and approval of an MMP. Activities not addressed in the MMP, including maintenance dredging, require separate approval from DITT. An MMP amendment will be submitted to DITT seeking approval for the proposed maintenance dredging activities, whereby this DMMP is a key component of the MMP amendment.
NT Water Act	Under section 74 of the Water Act, a Waste Discharge License (WDL) is required to authorise the discharge of decant water from the spoil containment pond to the receiving environment. NRR has recently submitted an application for a WDL for the proposed dredging activity.
Aboriginal Sacred Sites Act	Establishes protection for Aboriginal sacred sites. No registered or recorded sacred sites are known to occur within NRR BBLF lease.
NT Heritage Conservation Act	Archaeological heritage sites must not be disturbed or destroyed without a permit. There are no registered heritage sites located within the maintenance dredge footprint. No previously undisturbed areas will be affected by the proposed activities.

2.3 NRR Environmental Compliance Requirements

As a condition of NRR's mining authorisation 1062-01 issued by DITT under the MM Act, there are two main annual plans/reports which are required to demonstrate compliance with environmental regulations/conditions of approval and commitment to continual improvement. These include:

- the Mining Management Plan (MMP) revision (if any); and
- the Environmental Mining Report (EMR).

The NRP operates under a broader Environmental Management System (EMS) (NRR 2019) that has been developed to provide a methodology for the environmental management of the NRP in accordance with its environmental policy, legal responsibilities, relevant guidelines and site-specific requirements.

The EMS has been created to identify environmental risks, establish performance measures and develop performance indicators for all aspects of the NRP. This also includes the design and implementation of monitoring and management programs. The EMS establishes the review, reporting and communication processes for the NRP, as they apply to both internal and to external stakeholders as well as administering authorities. This includes the reporting of incidents, registering of complaints and communicating of environmental management responsibilities to NRP employees, contractors and visitors. The NRP's General Managers are responsible for the implementation of all on site work programs under this policy and the EMS.

The overarching objectives of the NRP EMS include compliance with:

- All regulatory approval conditions including applicable DITT Authorisation and Commonwealth EPBC approval; and
- NRR's Environmental Policy (NRR 2019), which includes the intent of preventing negative impact on the environment and the community.

2.4 Agreements with McArthur River Mine (MRM)

NRR's shipping operations at the BBLF takes into consideration the other operator and overall controller of the port, Glencore's McArthur River Mining (MRM). Since the recommencement of shipping activities, NRR has developed a strong relationship with MRM, and operates under their direction should MRM be shipping at the same time as NRR. This strong relationship between the two port operators allows for safe and efficient shipping operations to occur at the BBLF. To continue to ensure safe shipping operations for both operators at the BBLF, maintenance dredging of the BBLF transhipment zone is required. The proposed maintenance dredging program will service both NRR and MRM shipping operations at the BBLF.

2.5 Guidelines and strategies

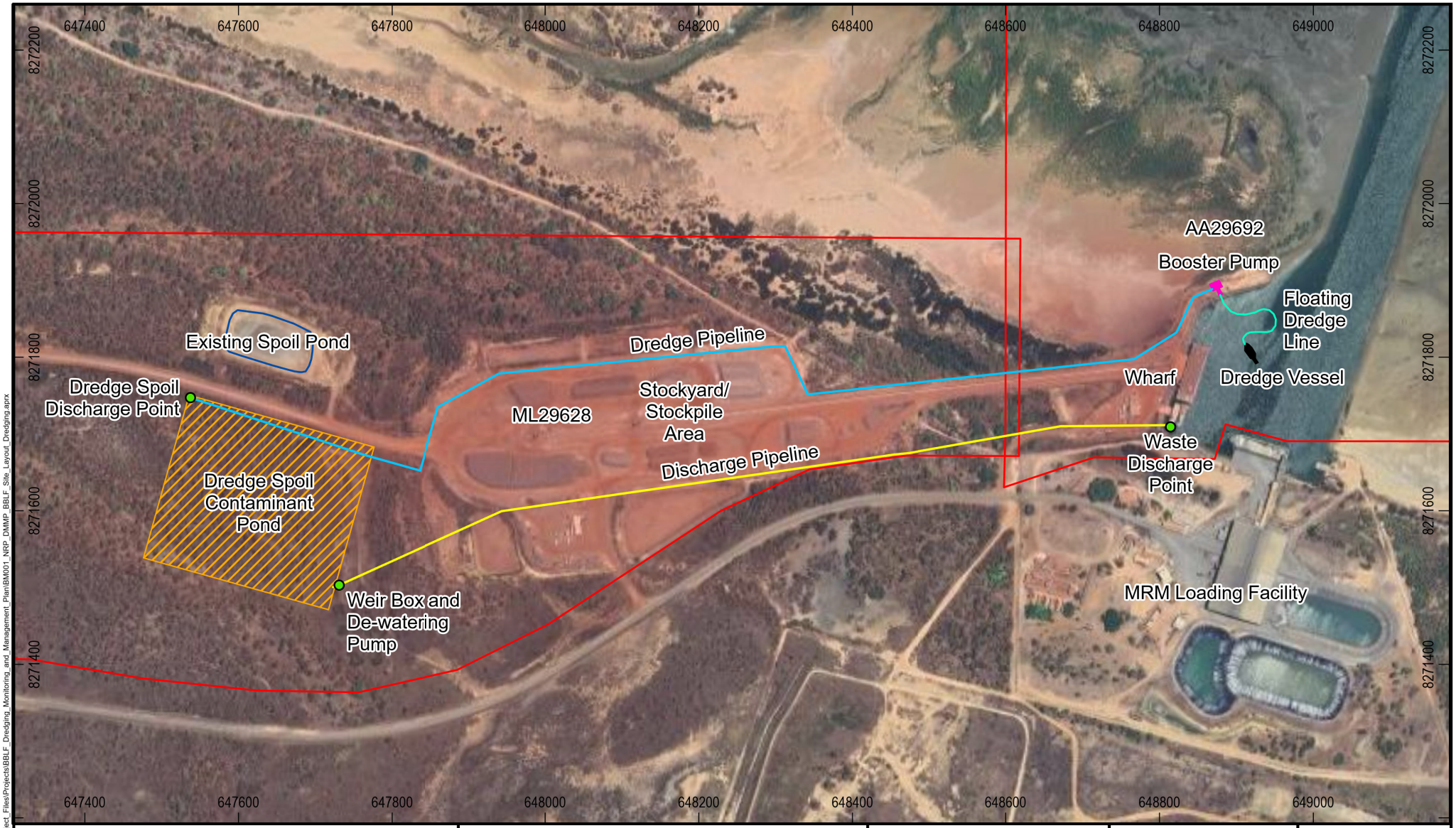
The following guidelines have been referenced in this DMMP:

- ANZECC 2000 Guidelines for Aquatic Ecosystems (marine);
- ANZECC 2000 Interim Sediment Quality Guidelines;
- Handbook for Sediment Quality Assessment (Simpson and Batley 2016);
- Queensland Acid Sulfate Soil Technical Manual (Dear et al. 2014):
- Guidelines for the Environmental Assessment of Marine Dredging in the Northern Territory (NT EPA 2013);
- Marine Dredging Guidelines (NT EPA 2023); and
- National Assessment Guidelines for Dredging, Commonwealth of Australia, Canberra 2009 (Australian Government 2009).

3 DESCRIPTION OF DREDGING ACTIVITIES

NRR proposes a short-term, maintenance dredging program at the BBLF which will remove built-up marine sediment from the transhipment channel and swing basin, further facilitating access to these areas of the BBLF. The last dredging program undertaken at the BBLF was completed by NRR in 2020, which saw the removal of 8,000 m^3 of material dredged from the transhipment zone. The proposed dredge program is larger and will aim to remove an estimated 90,000 m^3 of material over a four-month period. Dredged material is proposed to be stored in an appropriately constructed dredge spoil pond with decanted seawater proposed to be discharged back to the swing basin under a waste discharge licence (WDL). Construction of the dredge spoil pond is expected to commence in Q3 2024 (subject to approvals), with dredging to commence in November/December 2024 and continue throughout the 2024-2025 wet season. The proposed dredging program will ensure future transhipment activities can continue at the BBLF and is considered critical to both NRR and MRM's BBLF operations.

The site layout for the proposed dredging program at the BBLF is presented in **Figure 3-1**.



Legend

- Tenement Boundaries
- Infrastructure
- Pump and Discharge Point
- Discharge Pipeline
- Dredge Pipeline
- Floating Dredge Line
- Existing Spoil Pond
- Dredge Spoil Contaminant Pond
- 18 Inch Diesel Booster Pump
- Dredge Vessel

Source: Northern Territory Government (Department of Industry, Tourism and Trade) 2022, Nathan River Resources 2024, METServe 2024. Imagery - © OpenStreetMap and contributors

Nathan River Project

BBLF Site Layout - Dredging

**Infrastructure locations are approximate only. Not to scale.*

0 50 100 200

Meters

Scale: 1:7,000 (A4)

23/04/2024

Datum: GDA2020
Projection: MGA53

FIGURE 3-1

METSERVE
Mining & Energy Technical Services Pty Ltd

Path: S:\Projects\BM001 Nathan River\ArcGIS\Project_Files\Projects\BBLF_Dredging_Monitoring_and_Management_Plan\BM001_NRP_DMMP_BBLF_Site_Layout_Dredging.aprx

3.1 Dredge Program

No dredging has occurred at the BBLF since the small-scale dredge program in 2020. Since the most recent large-scale dredge program completed in 2012, a significant amount of sediment has accumulated within the swing basin and transhipment channel. Majority of this deposited material can be indirectly attributed to the ongoing movements of the vessel *Aburri,* manoeuvring in the swing basin as part of ongoing MRM operations and natural sediment infill processes typical of shallow coastal waters.

The proposed dredging program aims to remove approximately 90,000 m^3 of material from the swing basin and transhipment channel over a period of four months. This material will be removed using a cutter suction dredger (CSD), a common dredging method which cuts marine sediment into fragments with a rotating cutter head (**Figure 3-2**). While operating, the CSD will remain stationary and anchored to the seabed via a spud at the rear of the vessel. Despite the vessel remaining stationary, the ladder which houses the cutter head, extends into the water to the seabed and is secured by two anchors and winches. These anchors and winches on either side of the ladder allow for the ladder and cutter head to swing sideways without moving the CSD vessel, facilitating the cutting and removal of marine sediment.

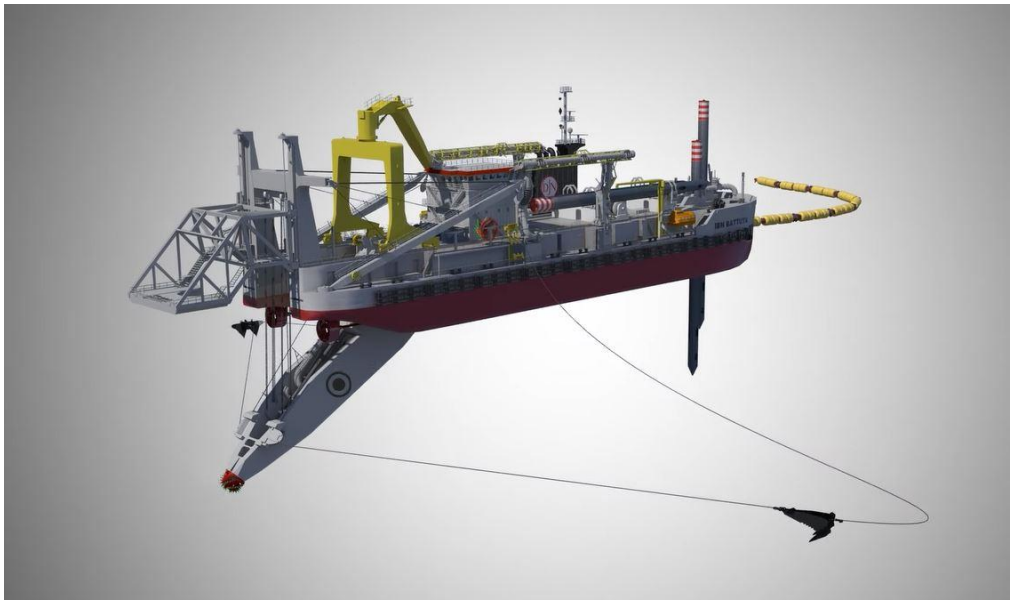


Figure 3-2 Example of a Cutter Suction Dredger (CSD)

Marine sediment and seawater are removed by the dredge's cutter head, sucked up by dredge pumps and transported along a floating pipeline, discharging dredged slurry into the spoil pond located near the BBLF stockyard. Dredge slurry material will be transported and contained within a poly-welded HDPE pipeline to ensure pipeline integrity and reduce the risk of uncontrolled spills from the dredge pipeline. Given the distances between the dredge pontoon and the spoil pond, diesel booster pumps will be positioned on the wharf to assist in transporting the dredge slurry from the CSD to the spoil pond.

Once dredge slurry is discharged into the spoil pond on the north-western corner, sediment and fines are expected to settle to the bottom of the pond as slurry migrates towards the south-eastern corner of the pond. Numerous baffles and the graded design of the spoil pond will facilitate the settlement of sediment from solution, resulting in relatively clean seawater in the decant area of the spoil pond. Decanted seawater will then be discharged back into the swing basin via a dedicated discharge HDPE pipeline subject to meeting the water quality guidelines stipulated under the WDL. Once the dredge program has been completed, decommissioning of dredge infrastructure will be undertaken. Environmental monitoring will be conducted prior, during and after completion of the dredge program to ensure management and mitigation measures are effective in limiting impact to the receiving environment.

The proposed dredge spoil pond will service future subsequent maintenance dredging programs, hence the closure and rehabilitation of the pond is not proposed in this MMP period. Closure and rehabilitation of the proposed spoil pond will be addressed at which point the pond holds no further capacity for dredge spoil storage.

3.1.1 Swing basin

The swing basin within the BBLF incorporates two berthing pockets which allow for the movement of marine vessels in and out of the two berths operated by MRM and NRR. The BBLF swing basin has a design depth of 3.23 m below the lowest astronomical tide (LAT), which facilitates vessel movements regardless of tide. A recent hydrographic survey of the swing basin completed in November 2023 indicates sections of the swing basin to be much shallower than the design depth of 3.23 m below LAT. The reduced depth of the swing basin has caused the current NRR and MRM shipping operations to be dictated by tidal movements given the lack of clearance for vessels to manoeuvre in and out of the basin on low tide. The current depth of the swing basin has and will continue to significantly restrict the shipping operations of both NRR and MRM at the BBLF until the proposed dredging program is complete.

3.1.2 Transhipment Channel

The transhipment channel refers to 3.5 km stretch from the first set of channel beacons to the most seaward beacons. This channel is 40 m wide and similar to the swing basin, has accumulated a significant amount of marine sediment since previous dredge programs where sections of the channel are shallower than the design depth of 3.23 m below LAT.

3.2 Dredge material composition

The expected chemical composition of dredge material to be encountered during the dredge program has been assessed with reference to marine sediment monitoring data available sourced from MRM monitoring programs and Potential Acid Sulphate Soils (PASS) sampling undertaken at the BBLF during the construction of NRR's BBLF (Cardno, 2013) and records from previous dredge programs at the BBLF.

Bioavailable metals

Marine sediments are monitored annually by MRM at a total of 10 monitoring sites located in the vicinity of the BBLF (**Table 3-1**). MRM have provided the results of the annual marine sediment sampling program from 2020 to 2023 to NRR (raw data provided in **Appendix D**). This data has been analysed for the presence of contaminants in the material that will be dredged.

Table 3-1 MRM Marine sediment sampling locations

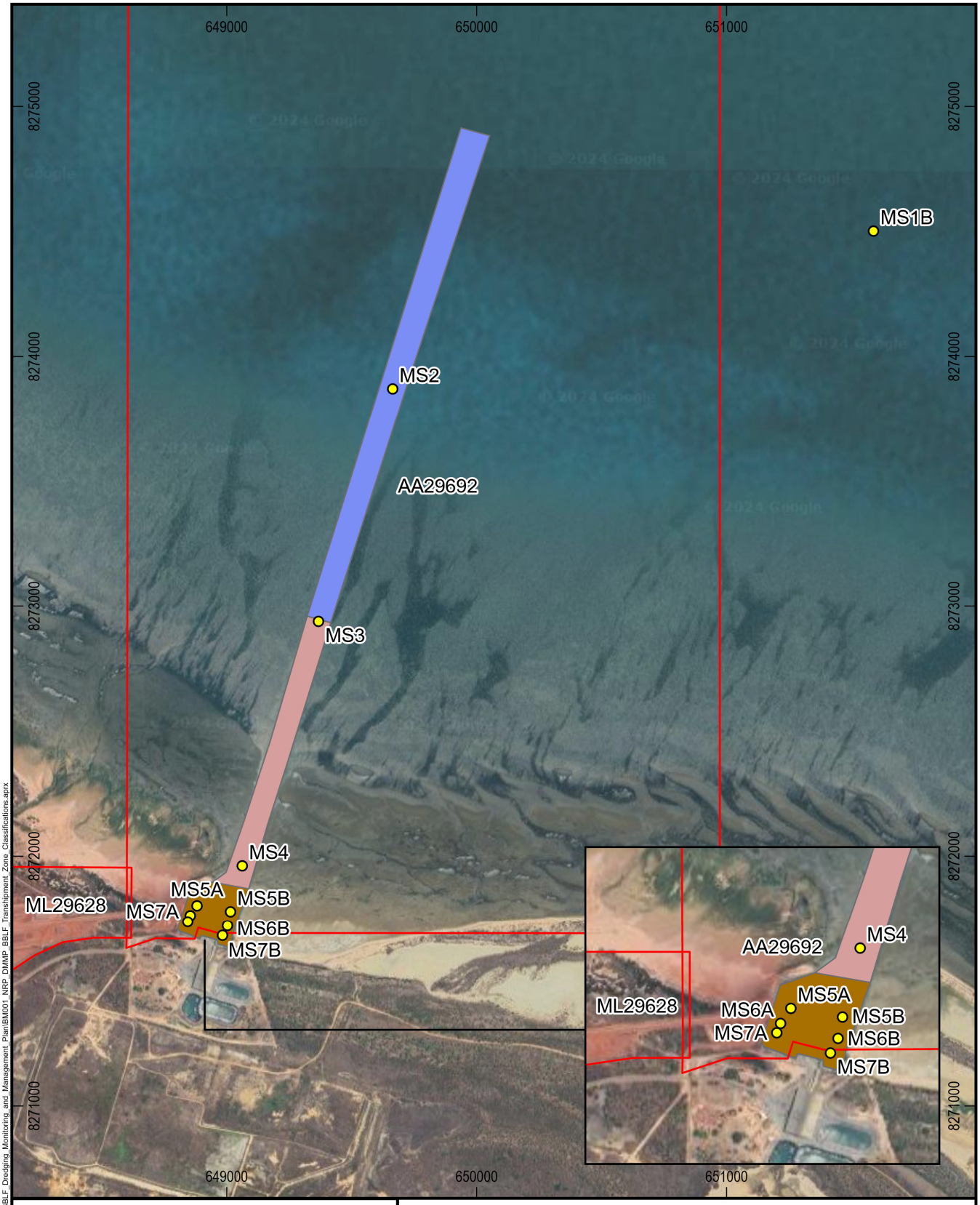
Site	Impact / control	Location description	Easting	Northing
MS1B	Control	Located furthest from dredging activities, NE of BBLF	651587	8274500
MS2	Impact	Channel: Between MS3 and MS1B	649663	8273869
MS3	Impact	Channel	649366	8272937
MS4	Impact	Channel: Within mouth of swing basin.	649061	8271960
MS5A	Impact	Swing basin NW	648880	8271800
MS5B	Impact	Swing basin NE	649014	8271776
MS6A	Impact	Swing basin W	648853	8271760
MS6B	Impact	Swing basin E	649002	8271719
MS7A	Impact	Swing basin SW	648843	8271735
MS7B	Impact	Swing basin SE	648982	8271680

Dilute acid extract of metals analysis for bioavailable fraction <63 µm was undertaken on the following parameters: Al, Mn, Fe, Co, Ni, Cu, Zn, As, Ag, Cd, Sb, Hg and Pb. Historic marine sediment data has been used to understand the dredge material composition expected during the maintenance program and inform any handling/storage measures to reduce the potential risk to the surrounding environment.

The sample number 10 is considered appropriate to sufficiently characterise the material for the volume to be dredged. It is estimated that approximately 90,000 m^3 of sediment will be dredged. For maintenance dredging, a volume between 50,000 m^3 and 500,000 m^3 is considered a medium-sized project by the National Assessment Guidelines for Dredging (NAGD) (Australian Government, 2009). As recommended in the NAGD (Australian Government 2009), the BBLF transhipment zone has been classified into three areas based upon historic marine sediment quality data provided by MRM. Areas have been categorised as the following and are presented in **Figure 3-3**:

- Probably contaminated – Swing basin;
- Suspect – Inner transhipment channel; and
- Probably clean – Outer transhipment channel.

As outlined in the NADG (Australian Government 2009), should a robust monitoring dataset exist for the dredge site, the minimum number of sample locations recommended may be halved. Given this, a minimum of nine sample sites are recommended, which has been halved from 17, for a dredge program expecting to remove between 83,000 to 92,000 m^3 of potentially contaminated material. The annual marine sediment monitoring program which currently exists at the BBLF conducted by MRM monitors 10 sites across the transhipment zone and is considered to be sufficiently robust for informing this dredging program.



Path: S:\Projects\BM001 Nathan River\ArcGIS\Project_Files\Projects\BBLF_Dredging_Monitoring_and_Management_Plan\BM001_NRP_DMMP_BBLF_Transhipment_Zone_Classifications.aprx

Legend

- Marine Sediment Monitoring Sites (MRM BBLF)
- Tenement Boundaries

Transhipment Zone

- Probably Contaminated - Swing Basin
- Suspect - Inner Transhipment Channel
- Probably Clean - Outer Transhipment Channel

Source: Northern Territory Government (Department of Industry, Tourism and Trade) 2022, Nathan River Resources 2024, METServe 2024. Imagery - © OpenStreetMap and contributors

Nathan River Project

BBLF Transhipment Zone Classifications

0 200 400 800

Meters

Scale: 1:22,000 (A4)

15/04/2024

Datum: GDA2020
Projection: MGA53

FIGURE 3-3

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Mining & Energy Technical Services Pty Ltd

For each of the 10 marine sediment sampling sites from 2020 to 2023, the minimum, maximum and mean metal concentrations have been calculated and compared against the screening levels provided within the NADG **(Table 3-2)**.

The results summarised in **Table 3-4** to **Table 3-13** indicate that the sediments within the swing basin (represented by sample sites MS5A, MS5B, MS6A, MS7A, and MS7B) are typically elevated in zinc and lead and exceed the NADG Screening Level - High (NADG SL-High). The elevated concentrations of lead and zinc recorded within swing basin marine sediments are considered to be attributed to dust deposition and spillage of ore into the swing basin during MRM loading operations.

Table 3-2 NAGD Screening Levels

Contaminant - metals / metalloids (mg/kg dry weight)	NAGD SL	NAGD SL-High
Arsenic	20	70
Cadmium	1.5	10
Copper	65	270
Lead	50	220
Mercury	0.15	1
Nickel	21	52
Silver	1.0	3.7
Zinc	200	410

Table 3-4 Marine sediment results of MS1B (control)

MS1B	Al	Mn	Fe	Co	Ni	Cu	Zn	As	Ag	Cd	Sb	Hg	Pb
Units	**mg/kg (dry weight)**												
NAGD SL-High	**ND**	**ND**	**ND**	**ND**	**52**	**270**	**410**	**70**	**4**	**10**	**25**	**1**	**220**
NAGD-SL	**ND**	**ND**	**ND**	**ND**	**21**	**65**	**200**	**20**	**1**	**1.5**	**2**	**0.15**	**50**
Min	1,800	230	7,300	4.1	2.3	5.3	7.7	1.8	0.02	0.05	0.2	0.01	9.8
Max	2,600	300	9,100	4.8	2.7	7.6	8.9	4.7	0.02	0.05	0.2	0.01	12
Mean	2,200	267.5	8,075	4.5	2.5	6.15	8.25	3.43	0.02	0.05	0.2	0.01	10.95

ND: No data

Table 3-5 Marine sediment results of channel (MS2)

MS2	Al	Mn	Fe	Co	Ni	Cu	Zn	As	Ag	Cd	Sb	Hg	Pb
Unit	**mg/kg (dry weight)**												
NAGD SL-High	**ND**	**ND**	**ND**	**ND**	**52**	**270**	**410**	**70**	**4**	**10**	**25**	**1**	**220**
NAGD-SL	**ND**	**ND**	**ND**	**ND**	**21**	**65**	**200**	**20**	**1**	**1.5**	**2**	**0.15**	**50**
Min	2,500	330	11,000	5.1	2.7	8.5	23	2.6	0.03	0.06	0.2	0.01	18
Max	2,800	490	13,000	5.8	3.1	11	40	5.7	0.04	0.1	0.2	0.01	30
Mean	2,600	390	11,500	5.3	2.83	9.55	28.5	4.43	0.04	0.07	0.2	0.01	22

ND: No data

Table 3-6 Marine sediment results of channel (MS3)

MS3	Al	Mn	Fe	Co	Ni	Cu	Zn	As	Ag	Cd	Sb	Hg	Pb
Unit	**mg/kg (dry weight)**												
NAGD SL-High	**ND**	**ND**	**ND**	**ND**	**52**	**270**	**410**	**70**	**4**	**10**	**25**	**1**	**220**
NAGD-SL	**ND**	**ND**	**ND**	**ND**	**21**	**65**	**200**	**20**	**1**	**1.5**	**2**	**0.15**	**50**
Min	2,100	230	6,700	4	2.2	7.8	19	2.2	0.02	0.08	0.2	0.01	17
Max	3,200	340	14,000	5.3	3.2	14	52	4.5	0.04	0.17	0.2	0.01	34
Mean	2,575	282.5	10,450	4.65	2.7	10.78	34.5	3.38	0.03	0.12	0.2	0.01	25.75

ND: No data

Table 3-7 Marine sediment results of channel (MS4)

MS4	Al	Mn	Fe	Co	Ni	Cu	Zn	As	Ag	Cd	Sb	Hg	Pb
Units	**mg/kg (dry weight)**												
NAGD SL-High	**ND**	**ND**	**ND**	**ND**	**52**	**270**	**410**	**70**	**4**	**10**	**25**	**1**	**220**
NAGD-SL	**ND**	**ND**	**ND**	**ND**	**21**	**65**	**200**	**20**	**1**	**1.5**	**2**	**0.15**	**50**
Min	2,500	280	8,700	4	2.2	17	88	2	0.04	0.25	0.2	0.01	55
Max	3,200	330	13,000	5.2	3.1	28	250	4.6	0.05	0.71	0.2	0.01	190
Mean	2,725	302.5	10,225	4.83	2.75	21	149.5	3.8	0.05	0.43	0.2	0.01	104

ND: No data

Table 3-8 Marine sediment results of swing basin (MS5A)

MS5A	Al	Mn	Fe	Co	Ni	Cu	Zn	As	Ag	Cd	Sb	Hg	Pb
Units	**mg/kg (dry weight)**												
NAGD SL-High	**ND**	**ND**	**ND**	**ND**	**52**	**270**	**410**	**70**	**4**	**10**	**25**	**1**	**220**
NAGD-SL	**ND**	**ND**	**ND**	**ND**	**21**	**65**	**200**	**20**	**1**	**1.5**	**2**	**0.15**	**50**
Min	2,300	300	8,800	4	2.4	30	240	4.3	0.06	0.74	0.2	0.01	200
Max	3,300	350	12,000	4.6	3.4	41	430	6	0.08	1.2	0.2	0.01	350
Mean	2,725	325	10,700	4.3	2.85	35.75	330	5.2	0.07	0.97	0.2	0.01	257.5

ND: No data

Table 3-9 Marine sediment results of swing basin (MS5B)

MS5B	Al	Mn	Fe	Co	Ni	Cu	Zn	As	Ag	Cd	Sb	Hg	Pb
Units	**mg/kg (dry weight)**												
NAGD SL-High	**ND**	**ND**	**ND**	**ND**	**52**	**270**	**410**	**70**	**4**	**10**	**25**	**1**	**220**
NAGD-SL	**ND**	**ND**	**ND**	**ND**	**21**	**65**	**200**	**20**	**1**	**1.5**	**2**	**0.15**	**50**
Min	2,600	300	9,000	3.2	2.4	30	190	3.1	0.05	0.65	0.2	0.01	140
Max	3,200	360	16,000	4.4	2.8	35	350	5.5	0.07	0.97	0.2	0.01	270
Mean	2,775	332.5	12,000	4.03	2.63	32.25	265	4.5	0.058	0.83	0.2	0.01	200

ND: No data

Table 3-10 Marine sediment results of swing basin (MS6A)

MS6A	Al	Mn	Fe	Co	Ni	Cu	Zn	As	Ag	Cd	Sb	Hg	Pb
Units	**mg/kg (dry weight)**												
NAGD SL-High	**ND**	**ND**	**ND**	**ND**	**52**	**270**	**410**	**70**	**4**	**10**	**25**	**1**	**220**
NAGD-SL	**ND**	**ND**	**ND**	**ND**	**21**	**65**	**200**	**20**	**1**	**1.5**	**2**	**0.15**	**50**
Min	2,500	290	8,600	3.8	2.4	13	72	4.1	0.04	0.17	0.2	0.01	50
Max	3,000	350	13,000	6.2	3.3	37	330	5.4	0.06	0.99	0.2	0.01	270
Mean	2,650	320	10,350	5.05	2.88	28.5	258	4.83	0.06	0.71	0.2	0.01	180

ND: No data

Table 3-11 Marine sediment results of swing basin (MS6B)

MS6B	Al	Mn	Fe	Co	Ni	Cu	Zn	As	Ag	Cd	Sb	Hg	Pb
Units	**mg/kg (dry weight)**												
NAGD SL-High	**ND**	**ND**	**ND**	**ND**	**52**	**270**	**410**	**70**	**4**	**10**	**25**	**1**	**220**
NAGD-SL	**ND**	**ND**	**ND**	**ND**	**21**	**65**	**200**	**20**	**1**	**1.5**	**2**	**0.15**	**50**
Min	2,200	240	7,400	3.9	2.4	16	95	2.6	0.03	0.23	0.2	0.01	61
Max	2,600	420	14,000	6.1	2.8	37	300	5.9	0.07	0.97	0.2	0.01	220
Mean	2,375	345	10,525	4.55	2.55	29.5	226.25	4.38	0.06	0.69	0.2	0.01	167.8

ND: No data

Table 3-12 Marine sediment results of swing basin (MS7A)

MS7A	Al	Mn	Fe	Co	Ni	Cu	Zn	As	Ag	Cd	Sb	Hg	Pb
Units	**mg/kg (dry weight)**												
NAGD SL-High	**ND**	**ND**	**ND**	**ND**	**52**	**270**	**410**	**70**	**4**	**10**	**25**	**1**	**220**
NAGD-SL	**ND**	**ND**	**ND**	**ND**	**21**	**65**	**200**	**20**	**1**	**1.5**	**2**	**0.15**	**50**
Min	2,500	290	7,800	3.9	2.3	22	200	3.2	0.04	0.52	0.2	0.01	150
Max	2,600	360	17,000	5.9	2.9	47	470	6.4	0.07	1.4	0.2	0.01	320
Mean	2,550	330	13,700	4.48	2.68	34.25	302.5	4.78	0.058	0.92	0.2	0.01	230

ND: No data

Table 3-13 Marine sediment results of swing basin (MS7B)

MS7B	Al	Mn	Fe	Co	Ni	Cu	Zn	As	Ag	Cd	Sb	Hg	Pb
Units	**mg/kg (dry weight)**												
NAGD SL-High	**ND**	**ND**	**ND**	**ND**	**52**	**270**	**410**	**70**	**4**	**10**	**25**	**1**	**220**
NAGD-SL	**ND**	**ND**	**ND**	**ND**	**21**	**65**	**200**	**20**	**1**	**1.5**	**2**	**0.15**	**50**
Min	2,000	270	7,200	3.7	2.3	21	120	3.2	0.04	0.28	0.2	0.01	95
Max	2,600	340	15,000	5.2	2.7	33	330	9	0.06	1	0.2	0.01	400
Mean	2,275	297.5	12,050	4.28	2.55	26.75	242.5	5.18	0.05	0.74	0.2	0.01	231.3

ND: No data

Potential Acid Sulphate Soils (PASS)

Potential Acid Sulphate Soils (PASS) investigations completed by Western Desert Resources during the construction of the BBLF in 2012 included the collection and analysis of borehole soil samples from eight locations at the BBLF immediately adjacent to the swing basin (Cardno 2013). Analytical results did not indicate the presence of PASS material within landside areas of the BBLF. Along with this, no PASS material has been encountered during previous capital and maintenance dredging campaigns at the BBLF. PASS material is considered unlikely to occur within the accumulated marine sediments to be targeted by this dredging program, as the accumulated sediments have been deposited under aerobic conditions and are likely oxidised already. This dredging program is not expected to remove marine sediments deeper than the original design depth.

As a precaution, dredge spoil material will be sampled during the first week of dredging operations to assess the presence of PASS and the potential impact to the quality of discharge water. Details of the PASS testing program proposed are provided in **Section 6.2.5**. The monitoring will be undertaken in accordance with the Queensland Acid Sulfate Soil Technical Manual (Dear et al. 2014).

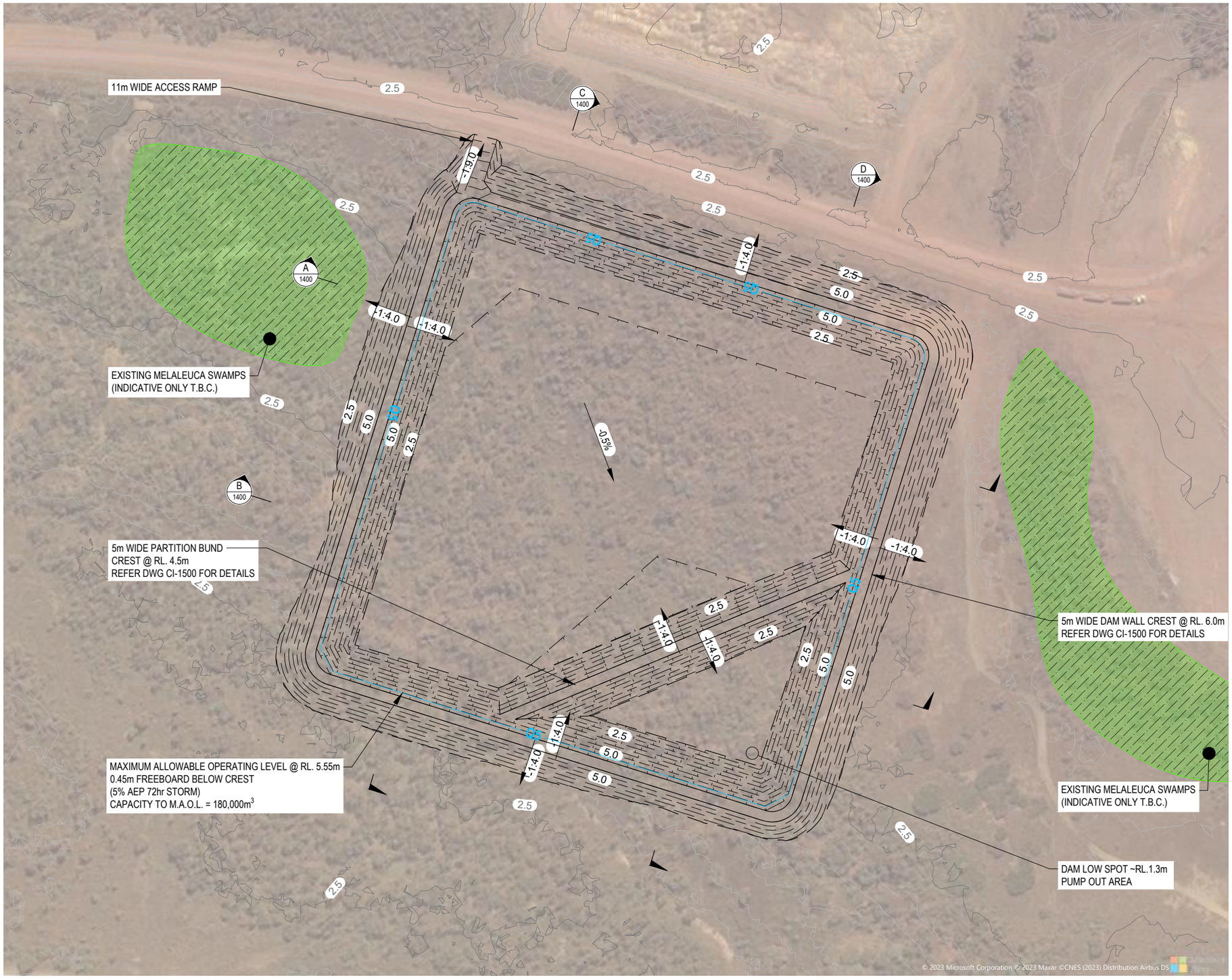
3.3 Dredge spoil disposal

NRR requires to construct an appropriate dredge spoil containment pond to handle and store the dredged material removed from the transhipment zone. There is an existing dredge spoil pond located on NRR's BBLF ML which was used to stored material from the 2020 dredge program. This existing spoil pond is small and has insufficient capacity to store the volume of material proposed for this dredge program. Hence, NRR is proposing to construct a new spoil pond within the BBLF ML to service the proposed dredge program and future maintenance dredging programs.

NRR engaged specialist engineers SLR and BLW Marine to develop a spoil pond design and location plan which is presented in **Figure 3-4**. **Table 3-14** summaries the design details of the proposed spoil pond (SLR 2024).

Table 3-14 Spoil Pond Design Details

Design Parameter	Description
Footprint Area	75,900 m^2
Capacity	180,000 m^3
Deposition Slurry	< 20% solids
Dredge discharge flow rate	≤ 2,000 m^3 / hour
Grading	Grade at minimum of 0.5% from northwest corner (dredge spoil discharge point) to southeast corner.
Embankment Wall Height	Varies from 1.9 m to 4.1 m above natural ground level.
Separation Bund Height	3 m
Design Criteria	1 in 20-year AEP, 72 hr storm
Catchment Area	6 ha
Full Storage Volume (FSL)	205 ML
Maximum Operating Volume (MOL)	180 ML



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LEGEND

- 2.5 — EXISTING GROUND CONTOURS (0.5m INTERVALS)
- EXISTING MELALEUCA SWAMPS
- 5.0 — DESIGN CONTOURS (0.5m INTERVALS)
- TOP OF BANK / DAM CREST
- BATTER TOE
- Q5 — MAXIMUM ALLOWABLE OPERATING LEVEL

GENERAL ARRANGEMENT PLAN

SCALE 1:2000

PLOT DATE 06-Oct-2023 12:55:59 PM

REVISIONS				
A	03/10/23	PRELIMINARY DESIGN ISSUE	DOT	
	DATE	DESCRIPTION	APPROVED	

0.0 20 40 60 80
METRES

SCALE 1:2000

DRAWN:	JM	DATE:	03/10/23
DESIGN:	JM	DATE:	03/10/23
DWG. CHECK:	AK	DATE:	03/10/23
DES. CHECK:	AK	DATE:	03/10/23
RESPONSIBLE PRINCIPAL SIGNATURE:	DANIELLE O'TOOLE	DATE:	03/10/23
RPEQ :			
RPEQ :			

SLR
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T: 61 7 4722 8000
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www.slrconsulting.com

CLIENT: NRR

PROJECT: BING BONG FACILITY DREDGE POND
PRELIMINARY ENGINEERING DESIGN

DRAWING TITLE: GENERAL ARRANGEMENT PLAN

SIZE: A3

STATUS: PRELIMINARY
NOT TO BE USED
FOR CONSTRUCTION PURPOSES

SCALE: 1:2000

DATUM: GDA94 - Z53

DRAWING NUMBER: 623.030222-CI-1100

REVISION: A

H:\Projects-SLR\623-TSV\623.030222.00001\NRR Bing Bong Dredge Pond Desi\06 SLR Data\01 CADGIS\CAD\Drawings\623.030222-CI-1100.dwg

Figure 3-4

The proposed spoil pond is separated into two basins; the main basin and the decant basin. The main basin will settle out and store the dredged marine sediment, whereas the decant basin will store seawater which will be separated from the dredged sediment. The main basin of the spoil pond will be designed with a 0.5% gradient sloping from the northwest to the southeast corner, assisting with the settlement of suspended sediments and fines from dredged seawater. The separation bund between the two basins will be constructed from a semi-permeable material (different to the compacted embankment walls and basin foundation), allowing water to diffuse through this bund into the decant basin. Water stored in the decant basin will be periodically discharged back to the swing basin should water quality of discharge water meet WDL trigger values.

NRR expects to deposit dredge material into the northwestern corner of the spoil pond at a maximum flow rate of 2,000 m^3/hr. This flow rate is anticipated to vary throughout the dredge program due to changes in settlement times, pond capacity and rainfall. Discharge of seawater from the decant basin of the pond back to the BBLF swing basin will occur on a periodic basis and will not exceed a discharge flow rate of 200 L/second. Approximately 450 ML of water is anticipated to be decanted and discharged back to the swing basin over the entirety of the dredge program. To detect any potential impacts to receiving waters associated with the discharge of decant water, a monitoring program has been developed and is further discussed in **Section 7.1**.

The spoil pond foundations and embankment walls will be sourced from locally available material should it be deemed appropriate for construction. Material proposed for foundation and embankment walls construction will be tested prior to construction and post-construction (in-situ), specifically for compaction. A series of compaction methods and tests will be implemented during the construction of the pond to ensure seepage from the pond is limited (see Section 6 of **Appendix A** for further details). Construction of the dredge spoil pond will be supervised by qualified and experienced civil and geotechnical engineers. In accordance with Variation of Authorisation 1062-01 conditions 39 to 45, the proposed dredge spoil pond will be reviewed and subsequently endorsed by an Independent Certifying Engineer (ICE), whereby an 'as-construction' report will be developed and submitted to DITT for approval prior to commission.

3.4 Scheduling

The construction of the proposed spoil containment pond is scheduled to commence in June/July 2024 subject to approvals. Construction of the spoil pond is expected to be completed within five weeks of commencement, with dredging activities to commence two weeks after the completion of the spoil pond and installation of the required dredging infrastructure. Maintenance dredging of the transhipment zone is expected to take approximately eight weeks not accounting for any delays.

The dredging vessel will operate 24 hours per day, seven days per week. Given the low tidal variation in the region, dredging will not be scheduled to coincide with any specific tidal movement. Given the dredge program will be completed at the start of the wet season, delays to the dredging operation are expected due to monsoonal or cyclonic weather conditions.

4 EXISTING ENVIRONMENTAL VALUES

The proposed maintenance dredging program will target a previously dredged area and is not expected to directly impact any intact environmental values. Therefore, this section focuses on describing the marine and coastal environmental conditions and environmental values surrounding the BBLF which may be potentially impacted by the proposed dredging activities.

4.1 Coastal morphology and bathymetry

The southwestern region of the Gulf of Carpentaria where the BBLF is located, is typified by relatively shallow depths with a coastline dominated by alluvial plains, tidal channels and river systems predominately comprising of clays and muds. The BBLF is relatively sheltered from prevailing winds and waves by West Island (part of the Sir Edward Pellew Group of Islands), which is located approximately 5 km offshore from the coast. The other islands in this group are located further to the east.

The coastline is characterised by low topographic relief, formed by deposition of quaternary marine deposits resulting in tidal inlets, beach flats and low beach ridges. The BBLF is located adjacent to a narrow beach berm, with low frontal and hind dune formation and extensive tidal mud flats, in a typical chenier formation. At higher elevations within the coastal zone, low, partially stabilised sand dunes are present, intersected in several locations by tidal channels (EcOz 2012).

4.2 Tidal range and currents

Tidal range in this region is approximately 0.50 m to 3 m. Tide timing is complex, varying from mixed semi-diurnal (i.e. two high tides of unequal height per day) to semi diurnal (i.e. two equal high tides per day) to diurnal (only one high tide per day). The combination of tidal currents and wave action are the primary cause of the mobilisation of bed sediments and sediment transport and mixing in the shallow coastal waters (EcOz 2012).

The McArthur River is the nearest large river to the BBLF that has the potential to influence water quality offshore from the BBLF. Large quantities of freshwater, sediments and nutrients flow into the Gulf during the wet season. These are largely trapped within the coastal boundary as there is limited exchange between the near-coastal waters and deeper waters within the central Gulf basin (DEWHA 2007a).

The interaction between prevailing dry season south-east trade winds from May to October, and moister north-westerlies during the wet season, combined with tidal flows, result in a slow clockwise movement of water around the coastal margins of the Gulf of Carpentaria (DEWHA 2007b). The surface current flows are shown in **Figure 4-1** below (BoM 2024).

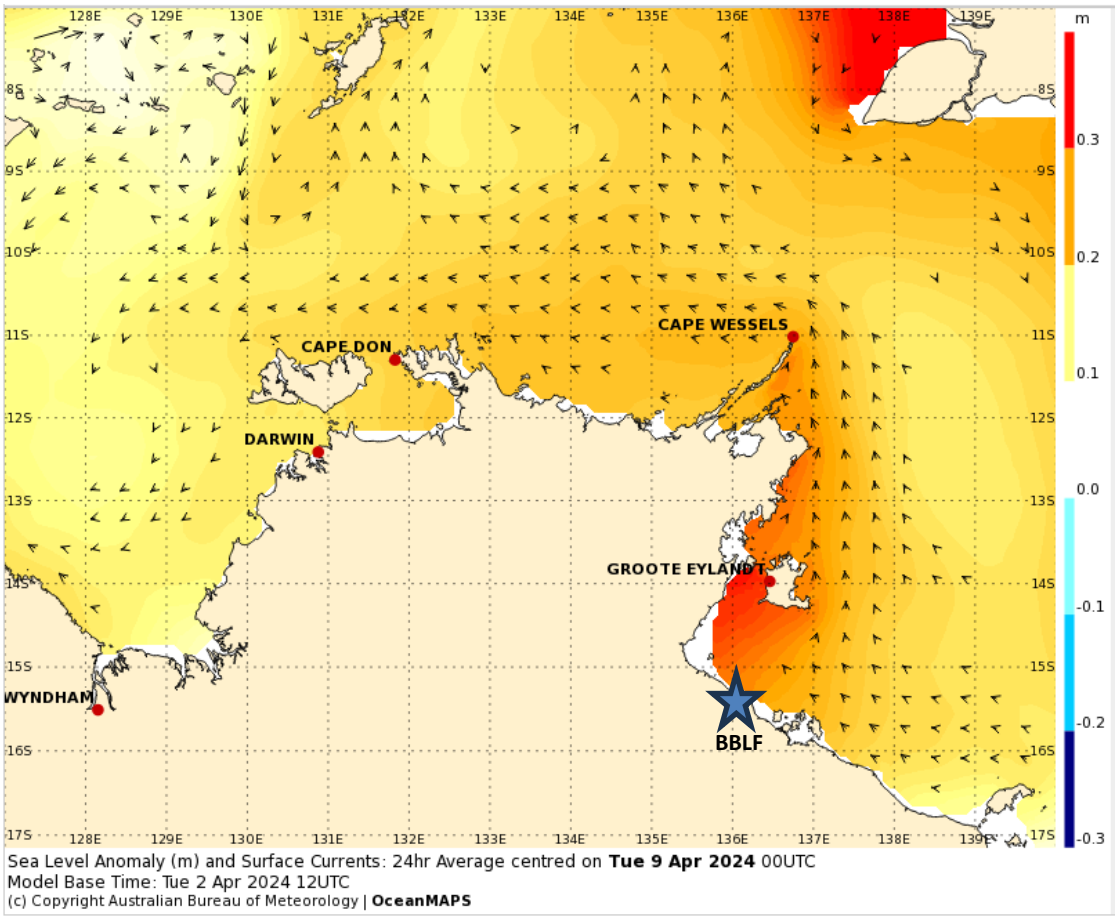


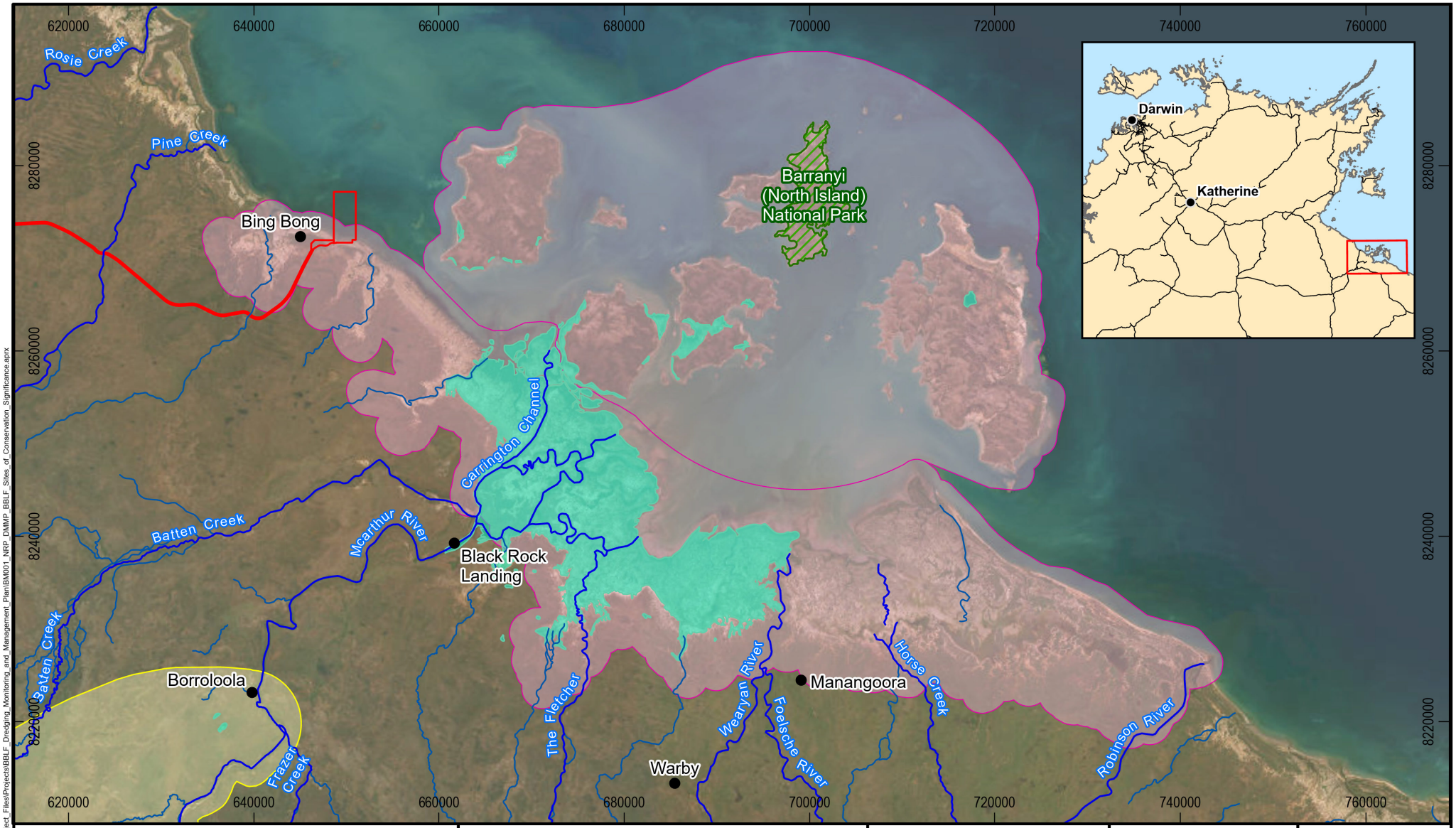
Figure 4-1 **Northern Territory, BBLF sea level and currents (BoM 2024)**

4.3 Sites of Conservation Significance

The McArthur River Coastal Flood Plain and the Sir Edward Pellew Island Group are declared NT Site of Conservation Significance (SOCS) (#34 and #33 respectively), located within the immediate vicinity of the BBLF. These sites in proximity to the BBLF are shown in **Figure 4-2**.

The McArthur River Coastal Flood Plain encompasses a vast area of open saline flats that are amongst the most extensive around the coast of the Northern Territory. The coastal flats are dissected by a series of tidal channels that form a large delta system around the mouth of the McArthur River. The mud flats support low chenopod shrublands, are dry for much of the year, and extend beyond extensive mangrove systems for up to five kilometres in places. The McArthur River coastal floodplain has outstanding conservation values and attracts very large aggregations of migratory shorebirds, including internationally significant numbers of many species (Pavey et al. 2009a).

The Sir Edward Pellew Group of Islands is located at the Mouth of the McArthur River, comprised of five Islands. The Pellew Islands have outstanding conservation values, including internationally significant sites for nesting marine turtles and colonial seabirds. Marine turtles frequent the waters around the islands, and some of the islands support high density nesting of Green and Flatback Turtles. Large numbers of seabirds aggregate to nest on islets and small islands, including more than 1% of the world population of Crested and Roseate Tern. The islands support an unusual mix of mammal species, five of which are listed as threatened (Brush-tailed Rabbit-rat, Northern Brush-tailed Phascogale, Northern Quoll, Carpentarian Antechinus), including the only Northern Territory location of the Canefield Rat. The Pellew group also provides important habitat for other rare or uncommon species and serves as an important refuge area for species threatened on the mainland (Pavey et al. 2009b).



Legend

- Town
- Major Drainage
- Minor Drainage
- National Park
- International Site of Conservation Significance
- National Site of Conservation Significance
- Important Wetlands
- Mineral Title

Source: Northern Territory Government (Department of Infrastructure Planning and Environment 2005; Department of Environment, Parks and Water Security 2021-2022; Department of Industry, Tourism and Trade 2022), Nathan River Resources 2024, METServe 2024, Earthstar Geographics.

Nathan River Project

Sites of Conservation Significance within the Proximity to the BBLF

0 5 10 20

Kilometers

Scale: 1:580,000 (A4)

15/04/2024

Datum: GDA2020
Projection: MGA53

FIGURE 4-2

METSERVE
Mining & Energy Technical Services Pty Ltd

Path: S:\Projects\BM001 Nathan River\ArcGIS\Project_Files\Projects\BBLF_Dredging_Monitoring_and_Management_Plan\BM001_NRP_DMMP_BBLF_Sites_of_Conservation_Significance.aprx

4.4 Marine habitats

The predominant marine communities outside of the BBLF transhipment zone are seagrass and other subtidal soft sediment communities. These are described in further detail below.

Seagrass communities

Seagrass communities are monitored by MRM on an annual basis in the vicinity of the BBLF between Pine Reef and West Island. Impacts to the benthic seagrass habitats can impact on fauna which heavily rely on these habitats such as dugong and fish species. Additionally, seagrass habitats in the region are known to be significant for Tiger Prawns, a commercially important species which the NT. At least two EPBC listed species are known to inhabit waters adjacent to the BBLF which feed directly on seagrass; Dugong (*Dugong dugon*) and the Green Turtle (*Chelonia mydas*) (EcOz 2012).

Results of annual seagrass surveys conducted during 2016 and 2017, suggest that the BBLF does not have a measurable impact on nearby seagrass communities. Overall, changes observed within the BBLF transhipment zone are consistent with the other areas (control sites located between 7-14 km to the east and north-west of BBLF), with the continued succession of seagrass species away from the pioneer species *Halophila ovalis* and *Halodule uninervis*, towards colonising species *S. isoetifolium* and *C. serrulata*. An increase in seagrass coverage and decrease in macroalgae coverage was observed across most sectors in 2017 when compared to 2016. Overall, survey results from 2017 indicate that operations at the BBLF are not having a measurable impact on seagrass communities (ERIAS 2018).

Intertidal communities

The soft sediment substrates present in the intertidal and subtidal zones fringing the BBLF are expected to provide habitat for a moderately diverse assemblage of invertebrates, including polychaete worms, bivalves, crustaceans and echinoderms. One study of benthic invertebrates in the sediments adjacent to the BBLF found 452 species (DEWHA 2008 cited in EcOz 2012).

4.5 Marine fauna

Marine fauna of conservation significance that occur in the Pellew Bioregion include threatened species of marine turtles and sawfish that are listed under the EPBC Act and / or *Territory Parks and Wildlife Conservation Act* (TPWC Act). Species known or likely to occur in proximity to the BBLF are summarised below.

Marine turtles

Four species of marine turtle have been recorded nesting in the bioregion where the BBLF is located (referred to as the Pellew Bioregion) (Chatto 2008). These species include the:

- Olive Ridley (*Lepidochelys olivacea*) - Endangered (EPBC Act) and Vulnerable (TPWC Act);
- Green (*Chelonia mydas*) - Vulnerable (EPBC Act) and Near Threatened (TPWC Act);
- Hawksbill (*Eretmochelys imbricata*) - Vulnerable (EPBC Act) and Vulnerable (TPWC Act); and
- Flatback (*Natator depressus*) - Vulnerable (EPBC Act) and Data Deficient (TPWC Act).

The Pellew bioregion is considered important for turtle nesting; however, the coastline near the BBLF is not suitable turtle nesting habitat given it is mostly inter-tidal mudflat abutting mangroves. There are some narrow sections of shallow sandy beach over 10 km to the north of the BBLF where a small amount of Flatback Turtle (*Natator depressus*) nesting has been recorded. This is considered to be the closest nesting site to the BBLF, > 10 km away from the BBLF.

Crocodiles

Estuarine crocodiles (*Crocodylus porosus*) are known to inhabit the regions surrounding the BBLF including estuarine waterways and offshore marine waters. As nesting occurs in rivers, there are no nesting habitats in the proximity to the BBLF.

Sawfish

There are three threatened species of sawfish listed as vulnerable under the EPBC Act and TPWC Act that have been recorded in the Gulf of Carpentaria. The Green Sawfish (*Pristis zijsron*) is likely to occur in the coastal waters surrounding the BBLF, with catch records indicating that the species inhabits all regions of the Gulf in low numbers and with a highly variable frequency of occurrence (Peverell 2005). The other two threatened sawfish species, Freshwater or Largetooth Sawfish (*Pristis pristis*) and Dwarf Sawfish (*Pristis clavata*) are less likely to occur in numbers due to the absence of suitable habitat and past records (EcOz 2012).

In addition to the threatened sawfish species, there are many inshore and offshore records of Narrow Sawfish (*Anoxypristis cuspidata*) with the Gulf region. During the study of the eastern Gulf of Carpentaria undertaken by Peverell (2005), this species was the most abundant both inshore and offshore, and in both the benthic and mid-layer depths. There are many records for the western Gulf near Groote Eylandt, and the species is commonly caught by prawn fishing boats (Laird 2017).

Dugong

The Dugong is a large marine mammal that forages on seagrasses and is listed as *migratory* under the EPBC Act and *near threatened* under the TPWC Act. The distribution of the species is closely correlated with the occurrence of seagrass beds (Groom et al. 2017). Seagrass beds occur immediately adjacent to the BBLF and more broadly across the region and are surveyed on an annual basis by MRM. Dugong surveys in and around the Sir Edward Pellew Islands, including the surrounding coastlines of the BBLF, have recorded the highest densities and population estimates for the NT (Groom et al. 2017). The species is likely to forage in the areas around the BBLF.

Dolphins

There are three dolphin species that are likely to occur in the waters surrounding the BBLF. These species include:

- Irrawaddy or Australian Snubfin Dolphin (*Orcaella brevirostris*) - Migratory (EPBC Act);
- Australian Humpback Dolphin (*Sousa chinensis*) - Migratory (EPBC Act); and
- Bottlenose Dolphin species (*Tursiops aduncus* and *Tursiops truncatus*) - Least Concern (TPWC Act).

5 BASELINE ENVIRONMENTAL MONITORING

The Gulf of Carpentaria has naturally high turbidity as a result of major inputs of fine sediments from river systems during the wet season. Coastal creeks are located 4 km east and 7 km west of the BBLF and the McArthur River mouth is located 30 km to the east. The deposition of sediment forms sand bars and mudflats which are a source of high turbidity throughout the year as sediments are re-suspended by wind/wave action and tidal movements. A study of light attenuation in the Northern Marine Region of Australia (Schroeder et al. 2009) found that near-shore regions show up to 50 % higher turbidity values during the wet season compared to the dry seasons, while the off-shore regions show up to 50 % higher turbidity values during the dry seasons compared to the wet season (EcOz 2012).

Marine waters surrounding the BBLF can be characterised with reference to seawater monitoring data collected as part of MRM's routine marine monitoring programs. An overview of existing marine water quality as relevant to the assessment, management and monitoring of dredging activities is presented below from monitoring data supplied by MRM.

The beneficial uses that are applicable to the coastal waters of, and surrounding, the BBLF are aquatic (marine) ecosystem protection, recreational water quality and aesthetics. Given the previous dredging programs which have occurred at the BBLF and the industrial activities in which it facilitates, the default water quality guideline values (DGVs) considered to be relevant are ANZECC / ARMCANZ (2000) 95% species protection in marine water for slightly to moderately disturbed ecosystems.

5.1 Marine water quality

Marine water quality of the BBLF and surrounds are routinely monitored by MRM via the use diffuse gradients in thin films (DGT). DGTs are a sampling technique which can provide *in situ* measurement of labile metal-species concentrations in aquatic systems (INAP 2002, and Simpson & Batley 2016). In a DGT device, dissolved analyte species diffuse through a thin hydrogel layer and become trapped in a gel, typically impregnated with a chelex resin that selectively accumulates the metals of interest (Simpson & Batley 2016). MRM's DGT monitoring program currently includes six monitoring locations which are monitored on a quarterly basis.

NRR intends to utilise existing DGT monitoring data collected during periods of no dredge activity (between 2022 and 2024) as baseline data. Details on the DGT monitoring locations are outlined in **Table 7-3** and locations presented in **Figure 7-2** in **Section 7.3**.

Physico-chemistry

Physico-chemical parameters are collected at each DGT monitoring site upon deployment during MRM's routine DGT monitoring program using a multi-parameter water quality probe. Field parameters collected between August 2022 and March 2023 are provided in **Table 5-2** and have been compared to the applicable ANZECC default trigger values for tropical marine waters (ANZECC, 2000). Data provided in **Table 5-2** are considered to be reflective of baseline conditions given no dredging activities occurred over this monitoring period.

Table 5-2 Field water quality data collected by MRM at DGT sites (2022-2023)

Monitoring Site	Date	Temp	Field pH	Field EC	DO	ORP
Unit		°C	pH Units	µS/cm	% saturation	mV
95% DGV		ND	8.0 – 8.4	ND	< 90%	ND
DGT1	August 2022	24.6	7.78	61,065	106.3	212
	November 2022	30.5	7.59	57,498	93.4	224
	March 2023	29.9	7.05	37,306	91.4	276
DGT2	August 2022	24.2	7.90	60,792	104.1	206
	November 2022	30.5	7.87	57,705	94.6	202
	March 2023	30.2	7.54	37,537	93.1	191
DGT3	August 2022	26.3	7.62	62,230	91.3	229
	November 2022	30.6	7.57	58,443	80.7	258
	March 2023	29.2	6.50	28,620	77.4	246
DGT4	August 2022	26.6	7.70	62,444	99.7	215
	November 2022	32.5	7.91	60,358	98.3	213
	March 2023	29.6	6.53	29,925	91.1	278
DGT5	August 2022	24.7	7.84	60,415	104.1	205
	November 2022	30.6	7.96	57,569	91.0	119
	March 2023	29.7	7.74	47,194	96.8	159
DGT6	August 2022	23.7	7.88	60,545	103.6	174
	November 2022	31.0	8.23	58,754	98.4	174
	March 2023	30.0	7.53	46,275	94.5	223

Metals

DGT laboratory analysis includes DGT-labile Zn, Pb, Cd, Co, Cu, Ni, Mn and Fe. Results which are considered to be reflective of baseline conditions at the BBLF (no dredging activity) are summarised in **Table 5-3** and compared to the ANZECC (2000) 95% species protection DGV limit in marine waters for slightly to moderately disturbed ecosystems.

Results showed that all analytes (Mn, Fe, Co, Ni, Cu, Zn, Cd, Pb) were within the relevant ANZECC (2000) 95% DGV for marine waters. Each monitoring result presented in **Table 5-3** is an average across three replicates collected during the specific monitoring period.

To account for the bio-accumulating nature of Cd, Ni and Zn, ANZECC (2000) recommends that the 99% species protection level DGV is used for slightly to moderately disturbed systems, to protect key species from chronic toxicity. DGT monitoring data during this period for Cd, Ni and Zn remained within the ANZECC (2000) 99% species protection DGV for marine waters.

Table 5-3 summarises DGT monitoring data from August 2022 to March 2023 with comparison to 95% species protection DGV (refer to **Appendix D** for all DGT data).

Table 5-3 Results summary of DGT monitoring

Monitoring Site	Date	Mn	Fe	Co	Ni	Cu	Zn	Cd	Pb
Unit		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
LoR		0.01	0.03	0.01	0.02	0.01	0.2	0.005	0.005
95% DGV		ND	ND	1.0	7*	1.3	3.3*	0.7*	4.4
DGT1	August 2022	4.00	3.92	0.03	1.14	0.12	0.13	0.01	0.01
	November 2022	1.84	2.53	0.02	<0.20	0.07	<0.40	0.01	0.02
	March 2023	3.11	13.36	0.03	0.16	0.11	0.45	0.01	0.01
DGT2	August 2022	4.20	3.46	0.03	1.59	0.11	0.21	0.01	0.01
	November 2022	2.12	5.09	0.02	<0.20	0.07	<0.40	0.01	0.01
	March 2023	1.49	8.79	0.02	0.14	0.09	0.33	0.01	0.01
DGT3	August 2022	6.64	2.77	0.06	<0.50	0.43	3.07	0.02	0.20
	November 2022	5.37	2.55	0.04	<0.20	0.15	1.40	0.02	0.12
	March 2023	7.46	2.57	0.05	0.14	0.11	2.38	0.02	0.06
DGT4	August 2022	5.38	7.00	0.05	0.66	0.16	1.03	0.01	0.09
	November 2022	4.14	1.51	0.04	<0.20	0.07	0.44	0.01	0.06
	March 2023	4.13	4.93	0.04	0.13	0.09	0.77	0.01	0.02
DGT5	August 2022	2.66	3.94	0.02	<0.50	0.13	0.17	0.01	0.01
	November 2022	1.19	4.50	0.02	<0.20	0.11	0.51	0.01	0.01
	March 2023	1.74	16.32	0.02	0.13	0.10	<0.20	0.01	0.02
DGT6	August 2022	2.06	3.81	0.02	<0.50	0.11	0.14	0.01	0.01
	November 2022	1.67	4.58	0.02	<0.20	0.08	<0.40	0.01	0.00
	March 2023	2.25	12.20	0.02	0.12	0.08	0.28	0.01	0.01

Notes: * 99% DGV species protection used for slightly to moderately disturbed systems to account for bioaccumulation.

5.2 Sediment quality

Existing sediment quality has been discussed in **Section 3.3** above.

6 POTENTIAL IMPACTS AND MITIGATION MEASURES FOR PROPOSED ACTIVITIES

There are several potential direct and indirect impacts that are typically associated with typical marine dredging activities. Direct impacts from dredging are most likely to occur at the location where the dredge interacts with the seafloor and/or the area where spoil is stored (NT EPA 2013). Indirect impacts are associated with the effects of suspended sediments generated by dredging, in a plume that affects a larger area around the site of activity, creating a raised level of sediment accretion and/or turbidity exceeding the natural tolerances of benthic habitats over time. Indirect impacts from dredging can affect ecological processes resulting in impacts ranging in severity from 'irreversible' to 'readily-reversible' (NT EPA 2013).

Potential impacts to environmental values associated with the proposed dredging activities have been assessed with reference to the following documents and information:

- NRR Mining Management Plan Amendment – BBLF Dredging (NRR 2024);
- NRR Mining Management Plan (NRR 2019);
- RBIOP EIS (EcOZ 2012); and
- MRM Independent Monitor Annual Reports.

6.1 Conceptual site model

A source-pathway-receptor (SPR) conceptual site model (CSM) have been developed for the proposed maintenance dredging program (**Table 6-1**). This CSM has been developed to identify potential direct and indirect impacts associated with the dredging program and is further discussed in **Section 6.2**.

Table 6-1 Maintenance dredging conceptual site model

Activity	Source	Pathway	Receptors
Dredging operations	- Turbidity / suspended sediments. - Metals and metalloids present in dredged sediments. - Hydrocarbons released from maintenance, refuelling and spills.	- Mobilisation in dredge plume. - Transported by tides and currents.	- Marine water quality - Benthic habitats (seagrasses) - Coastal habitats (mudflats and mangroves) - Marine fauna
Spoil placement and storage	- Saline leachate - Metalliferous and/or acidic leachates	- Seepage of contaminated water into soils. - Seepage or overflow of contaminated water to surface water or groundwater. - Failure of containment resulting in sediments released to land and water.	- Terrestrial vegetation - Marine water quality - Groundwater quality
Discharge of dredge spoil decant	- Turbidity / suspended sediments. - Metalliferous and/or acidic leachates.	- Mobilisation and release in decant water discharged to swing basin.	- Marine water quality/biota - Benthic habitats (seagrasses) - Coastal habitats (mudflats and mangroves)

6.2 Risk Assessment

6.2.1 Risk assessment method and outcomes

Following on from the conceptual site model, a high-level risk assessment was completed for the maintenance dredging program proposed for the BBLF. This risk assessment aimed to identify the potential environmental impacts associated with the dredging program, the corresponding initial risk of said impact, proposed management and mitigative controls, and the residual risk which is deemed to remain once mitigative controls have been implemented. The full risk assessment for the maintenance dredging program proposed for the BBLF is included in **Appendix E** (Table 6).

The consequence (or severity) of each potential impact was assessed using the following criteria:

- Scale (extent);
- Intensity (including consideration of the receiving environment sensitivity to impact); and
- Duration and frequency.

Categories used to rate the consequence of each impact are provided in **Appendix E** (Table 1). Impact identification and analysis was informed by the project details provided in the MMP amendment and the various baseline and monitoring studies undertaken at the BBLF since it was developed by MRM.

The principles of qualitative risk management described in *AS/NZS 31000:2009 Risk Management – Principles and Guidelines* were used to assess inherent risk (without mitigation) and residual risk (with mitigation). Risk is a combination of the impact severity (consequence) and likelihood of the impact occurring. The likelihood and consequence categories adopted in the environmental risk assessment are provided in **Appendix E** (Table 2 and Table 3).

Measures to avoid, mitigate and manage impacts were identified, focussing on impacts with an inherent risk level of medium or above. Impacts with a low level of inherent risk were considered for further mitigation where routine controls would further contribute to risk minimisation. Measures were applied with the goal of reducing all risks to 'as low as reasonably practicable' (ALARP). ALARP is considered to be the point at which the cost involved in reducing the risk further would be grossly disproportionate to the benefit gained.

The likelihood and consequence ratings were combined to derive an overall risk rating using the matrix and risk level in **Appendix E** (Table 4 and Table 5 respectively).

6.3 Potential Impacts

The main impacts identified in the risk assessment provided in **Appendix E** along with specific mitigative measures proposed are discussed further below.

6.3.1 Coastal geomorphology and processes

It is not expected that the proposed dredging program will cause changes to currents and/or sediment deposition in addition to those already experienced in the previously dredged transhipment zone. The proposed maintenance dredging program aims to return the swing basin and transhipment channel to the original design depth of 3.23 m below LAT established during the capital dredging program and subsequent maintenance dredging activities. The previous capital dredging program was designed to allow good tidal flushing throughout the BBLF transhipment zone whilst limiting the impact to the surrounding environment (e.g. mudflats / coastal environment). Given the relatively small scale of this dredge program, the amount of deposited material which is proposed to be removed is unlikely to impact surrounding coastal geomorphology or hydrologic processes.

6.3.2 Benthic habitat removal

The area to be targeted by the proposed maintenance dredging program is confined to the previously dredged transhipment zone. Monitoring undertaken by MRM indicates that there is a lack of significant habitat for motile marine species, or seagrasses within the swing basin and the transhipment channel (ERIAS 2018). The NT EPA Marine Dredging Guidelines (NT EPA 2023) recognises that benthic biota may colonise previously dredged areas between maintenance events and may be removed in future maintenance dredging. However, further impacts on these directly-affected biota are not considered to be a key consideration in the assessment of maintenance dredging proposals. This is due to those direct impacts being largely unavoidable and recolonising biota being well-adapted to surviving within dynamic benthic habitats. The risk of benthic habitat removal associated with the proposed dredging activities is considered low given the lack of such habitat within the already disturbed transhipment zone.

6.3.3 Marine water quality

Marine water quality will be temporarily impacted by increased turbidity and potentially elevated dissolved metal concentrations. Dissolved metals may potentially mobilise into the water column during dredging given the high likelihood of metals within the upper marine sediments of the transhipment zone as a result of dust and ore spillages during ship loading. There is also potential for spillages of hydrocarbons during refuelling of the dredge vessel, and in a worst-case scenario equipment failure, grounding or collision.

Turbidity and heavy metals

In addition to the NT EPA's guidance on benthic biota being well-adapted to surviving dynamic benthic habitats, studies of the local assemblages of benthic invertebrates and seagrasses within the BBLF and surrounds have recorded naturally high resilience to turbid waters. This is primarily due to the high prevalence of seasonal monsoons and high cyclone activity within the Gulf of Carpentaria (ERIAS 2018). It has also been noted that seagrass communities in the closest proximity to the BBLF are demonstrating normal health and natural succession (ERIAS 2016 and 2018). Further to this, surveys conducted by MRM has concluded that there are no significant turbidity impacts associated with previous dredge maintenance programs or ongoing shipping operations at the BBLF (ERIAS 2018). Monitoring data available from previous BBLF dredge programs indicate that water quality impacts are expected to be localised. During the 2020 maintenance dredging program, turbidity did not exceed the 20 NTU trigger limit outside of a 50 m zone around the dredge vessel, and dissolved metal concentrations exceeding the ANZECC (2000) 95% level of species protection guidelines were not recorded outside of the swing basin (EcOz 2021).

The NT EPA Guidelines identifies two main sources of turbidity typically associated with dredging activities. These include:

- Physical interaction of dredging equipment with the seabed; and
- Spills of sediment-laden water from dredge barges.

Physical interaction of dredging equipment with the seabed causes sediment to mobilise into the surrounding water column at the dredge site. When all dredged material is not captured by the dredging equipment (e.g. fugitive loss from a CSD cutter head), a proportion is liberated into the surrounding water column as suspended sediment. Turbulence from propellers and movement of vessel hulls can also disturb and lift sediments into the water column where under-keel clearance is limited. Certain dredging methods require the storage and transport of dredged material from the dredged site via dedicated barges. This increases the risk and frequency of dredged material spills into the marine environment.

The proposed dredging activities are expected to increase turbidity in waters within the immediate vicinity of the dredge site for short periods of time during operations. To limit the magnitude and migration of turbidity plumes from the immediate dredge site, NRR has implemented control measures in the design of the dredge program to assist with this. One such design feature which aims to mitigate the magnitude of turbidity plumes is the selected dredge method of a CSD. CSD's are a commonly used method when dredging in sensitive environments given its less intensive interaction with the seabed.

This results in a significant reduction of turbidity plumes at the dredge site in comparison to other methods like backhoe dredge methods. In addition to this, the CSD method enables the dredge vessel to remain stationary (whilst the dredge head swings sideways) when dredging, avoiding the need to move around and potentially mobilise more sediment into the water column.

Another common source of turbidity associated with dredging activities, spills from dredge barges, is not considered to be relevant to NRR's proposed dredge program. As outlined in **Section 3.1**, from the cutter head of the dredge to the spoil pond discharge point, dredge material will be entirely contained within a welded HDPE pipeline in order to prevent any spills of dredge material back into the receiving waters. No dredge material will be stored on the dredge vessel, removing the risk of spilling dredged material into the marine environment.

NRR also intends to complete the proposed dredge program over the monsoonal wet season. During this time of year, turbidity within shallow, coastal waters such as the BBLF are naturally elevated due to high rainfall and contributions from surface water run-off. By scheduling the dredge program during periods of naturally high turbidity, additional turbidity associated with dredging is less likely to impact the marine environment, namely benthic communities. This sentiment is shared by the NT EPA who outline in the Marine Dredging Guidelines that Darwin Harbour dredging programs are typically scheduled over the wet season during periods of naturally elevated turbidity to lessen the potential impacts on the marine environment (NT EPA 2023).

Along with the dredge program design aiming to mitigate the potential impacts of turbidity generation, NRR has proposed an extensive water quality monitoring program to be conducted prior, during and at completion of the dredge program. This monitoring program will facilitate the pro-active detection of any adverse impacts to water quality associated with dredging activities. During dredging operations, turbidity will be frequently monitored at several locations surrounding the dredge site, whereby if trigger values are exceeded, dredging operations will be postponed until measures are implemented to reduce the turbidity plume. Further information on the proposed monitoring program is detailed in the **Section 7**.

The relatively small scale and short timeframe of the proposed maintenance dredging program will result in a localised and short-term impact to water quality. Given that there has not been an impact on seagrass or other benthic communities from activities at the BBLF to date, the maintenance dredging program poses a low risk of any significant impacts from elevated turbidity or metals in the wider marine environment.

Hydrocarbon spills

The likelihood of a major spill occurring is low given that relatively small amounts of fuel which are stored on the dredge vessel and/or handled during vessel refuelling. Release of large amounts of oil or fuel to the BBLF transhipment zone could result in a significant deterioration in marine water quality should emergency spill procedures not be implemented. However, due to the relatively small tidal range and weak currents at the BBLF, impacts on benthic ecology and marine assemblages could be minimised through the immediate implementation of emergency spill response procedures currently in-place at the BBLF. Minor releases of fuel or oil into the marine environment are unlikely to cause any long-term impact subject to the timely implementation of spill response.

6.3.4 Marine fauna

The BBLF transhipment zone is a disturbed ecosystem that does not provide significant areas of habitat for marine fauna. There are some areas of seagrass in close proximity to the BBLF, a habitat that is an important food source for a range of threatened and migratory marine species. There are also coastal mudflat and mangrove habitats, which are also recognised as important habitats. A range of marine fauna are known to utilise the marine waters surrounding the BBLF, but there is no known important feeding, breeding or nesting areas in close proximity that are likely to be impacted by the dredging.

Water quality

Increased turbidity and dissolved metal concentrations associated with dredging is expected to be localised, short-term in nature and is unlikely to cause long-term impacts to any marine fauna at the individual or population level. Many inshore cetacean species are known to be able to continue normal behaviour in turbid waters due to their habitat generally being located in shallow, turbid, inshore locations such as river mouths, estuaries and mangroves.

Species such as sea snakes, crocodiles and some syngnathids also inhabit areas that are naturally turbid and therefore are expected to also tolerate temporary increases in turbidity levels (Inpex 2011). Species such as Dugongs and Green Turtles may alter their behaviour to avoid turbidity plumes by moving to adjacent, unaffected habitats (Inpex 2011).

Physical injury

The likelihood of fauna injury is limited by the small extent of the dredging footprint and the effect of noise and turbid plumes, which generally discourage the presence of most species in close proximity to the active dredge vessel. CSD's are considered to have a lower risk profile than other common dredge methods (e.g. trailing suction hopper dredges), with limited mortalities reported associated with this operation of CSD dredges (Dickerson et al. 2004). Given the large size and slow speeds (approximately 2-3 knots) associated with dredge vessel, the risk of collision with marine megafauna is considered to be low.

Noise impacts

Noise from dredging operations can cause disruption to behaviours and possible short to medium term displacement. In the case of sudden start-ups of machinery, potential mortality or injury for noise sensitive species particularly fish and cetaceans. As the proposed dredging activities are targeting a heavily disturbed and operational port facility whereby noise impacts are already present, most marine fauna are likely to be habituated to a degree of noise. Dredging activities are not proposed within an area of critical habitat for dugongs, cetaceans, turtles or other species, nor is it expected to prevent migration of populations, or disrupt feeding on seasonally restricted seagrass species. Given the extensive areas of suitable habitat available outside the target dredging areas within the transhipment zone, displacement of animals from the BBLF for the short-period of dredging is considered to be the worst-case scenario.

Artificial lighting

Impacts from the dredging operation on turtle nesting behaviour are expected to be minimal owing to the distance to the closest known nesting beach, estimated to be a minimum of 10 km away, and absence of mating areas in the immediate vicinity of the dredge footprint.

Invasive marine species

There is a potential for exotic marine species to be introduced to waters in and around the BBLF through ballast water or on the dredging vessel hull. Introduction of marine pest species can potentially impact upon marine invertebrate assemblages through competition and predation, as well as cause problems with marine infrastructure through fouling. Discharge of ballast water within an unauthorised area is considered unlikely; however, NRR and the dredging contractor are required to comply with Australian Quarantine and Inspection Service (AQIS) procedures and NT monitoring procedures.

6.3.5 Coastal vegetation/habitats

Storage of dredged marine sediment in a land-based containment facility has the potential to produce saline, acidic (if PASS is present) or metalliferous drainage from drying spoil material. The potential for poor-quality leachate to enter the receiving environment from the spoil pond will be minimised by returning decant water to the swing basin via a WDL. Draining and decanting excess seawater from the spoil material for discharge back to the sea aims to minimise evaporative water loss from the spoil pond whereby excessive salts are not retained in the spoil sediment (NT EPA 2013). Along with this, the decant of seawater from spoil material will reduce the overall salinity captured within the dried sediments and moisture of the stored material, reducing the overall risk of seepage from the pond to the receiving environment.

The risk of impacts to vegetation surrounding the spoil pond from potentially increased salinity is considered low, as the littoral vegetation assemblages present are salt tolerant by nature (EcOz 2012). The existing dredge spoil storage pond has existed for approximately 11 years, since the construction of the BBLF, without record of significant vegetation dieback, indicating that the containment bunds and floor are operating as designed. Further to this, current monitoring of similar vegetation for impacts from the storage of dredge spoil and potential salinity at the nearby MRM operation, has concluded that the vegetation of the area is generally tolerant of high saline conditions (ERIAS 2016 and 2018).

The likelihood of the dredged material being PASS is considered low based on the fact that no PASS material was encountered during the capital dredging program and subsequent maintenance programs since. An assessment of PASS was undertaken as part of geotechnical investigations prior to construction of the BBLF and did not identify any materials that required management (Cardno 2013). As a precaution, the dredged material will be tested during the initial stages of the dredging program for PASS. Should dredge spoil material has PASS characteristics, material will be managed in accordance with the Queensland Acid Sulfate Soil Technical Manual (Dear et al. 2014). Any PASS material will be treated if required.

6.3.6 Groundwater

Impacts to groundwater from poor quality leachate from the proposed spoil pond are considered to be low. Historic water quality from groundwater monitoring bores at the BBLF indicate highly saline groundwater conditions. Monitoring bore, BBMB01, approximately 250 m away from the proposed spoil pond site recorded an electrical conductivity of 103,000 µS/cm in July 2023, significantly higher than the EC of seawater (~50,000 µS/cm). Given the highly saline nature of groundwater at the BBLF, there are limited beneficial uses for groundwater at the BBLF. Impacts on surrounding groundwater quality associated with spoil pond seepage are not expected to occur. Routine groundwater monitoring of level and quality will continue on a bi-annual basis allowing the detection of any significant changes in water quality.

6.3.7 Waste pollution

Rubbish and waste materials could potentially enter the marine environment as a result of poor housekeeping. Rubbish could potentially be blown off into surrounding waters during strong winds. This could potentially result in localised habitat degradation, and potential marine fauna mortality through entanglement and ingestion. The potential impacts of waste on the marine environment will be minimised through the implementation of waste management controls on the dredge and removal of wastes for disposal at the appropriate onshore facilities.

7 MONITORING PROGRAM

NRR propose to undertake water quality monitoring, dredge spoil discharge monitoring and visual drone monitoring throughout the maintenance dredging operations to ensure the early detection of potentially unacceptable impacts to the receiving environment. The monitoring programs detailed in **Section 7** will be conducted prior to, during and post dredging activities. **Table 7-3** below provides a summary of all monitoring proposed to be undertaken as part of the DMMP.

Monitoring of cumulative impacts to the broader marine environment associated with the operation of the BBLF (by both NRR and MRM) will continue to be monitored by MRM through the already implemented, routine monitoring programs. NRR will provide monitoring results to MRM to inform analysis of future monitoring data.

7.1 Discharge monitoring

In accordance with the NT Water Act, an application for a WDL must be accompanied by a proposed monitoring program designed to assess any potential impacts associated with the proposed waste discharge for approval by the NT Controller of Water. The monitoring program must include a compliance monitoring location whereby water quality trigger values are assigned against. Water quality trigger values are implemented as a compliance tool to assess potential environmental impact, and if exceeded, prompts investigation and action by the operator. Compliance trigger values are typically based upon published default guidelines should limited site-specific data exist to develop locally derived trigger values.

NRR have proposed a monitoring program which aims to fulfill the requirements of the Water Act for a WDL application and ensures that potential impacts to marine water quality associated with the discharge of decant water can be detected in a timely manner. The proposed monitoring program includes three monitoring locations: the decant basin within the dredge spoil containment pond (BBDSCP), the decant water discharge point (BBDP01), and the receiving waters / mixing zone within the BBLF swing basin (BBMZ01). Monitoring location details are summarised in **Table 7-1**, along with locations illustrated in **Figure 7-1**. **Table 7-2** summarises the parameters and monitoring frequencies for the proposed discharge monitoring program.

Table 7-2 also includes water quality trigger values which have been assigned to BBMZ01 given it is the proposed compliance monitoring point. The assigned trigger values are based upon the default values published by the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018). Trigger values for pH, dissolved oxygen and turbidity are based upon ANZECC's default trigger values for inshore marine environments for tropical Australia (ANZECC 2000). The proposed trigger values for metal and metalloids are based upon the ANZG's 95% species protection in marine waters for slightly to moderately disturbed ecosystems.

Table 7-1 Dredge spoil decant surface water monitoring locations

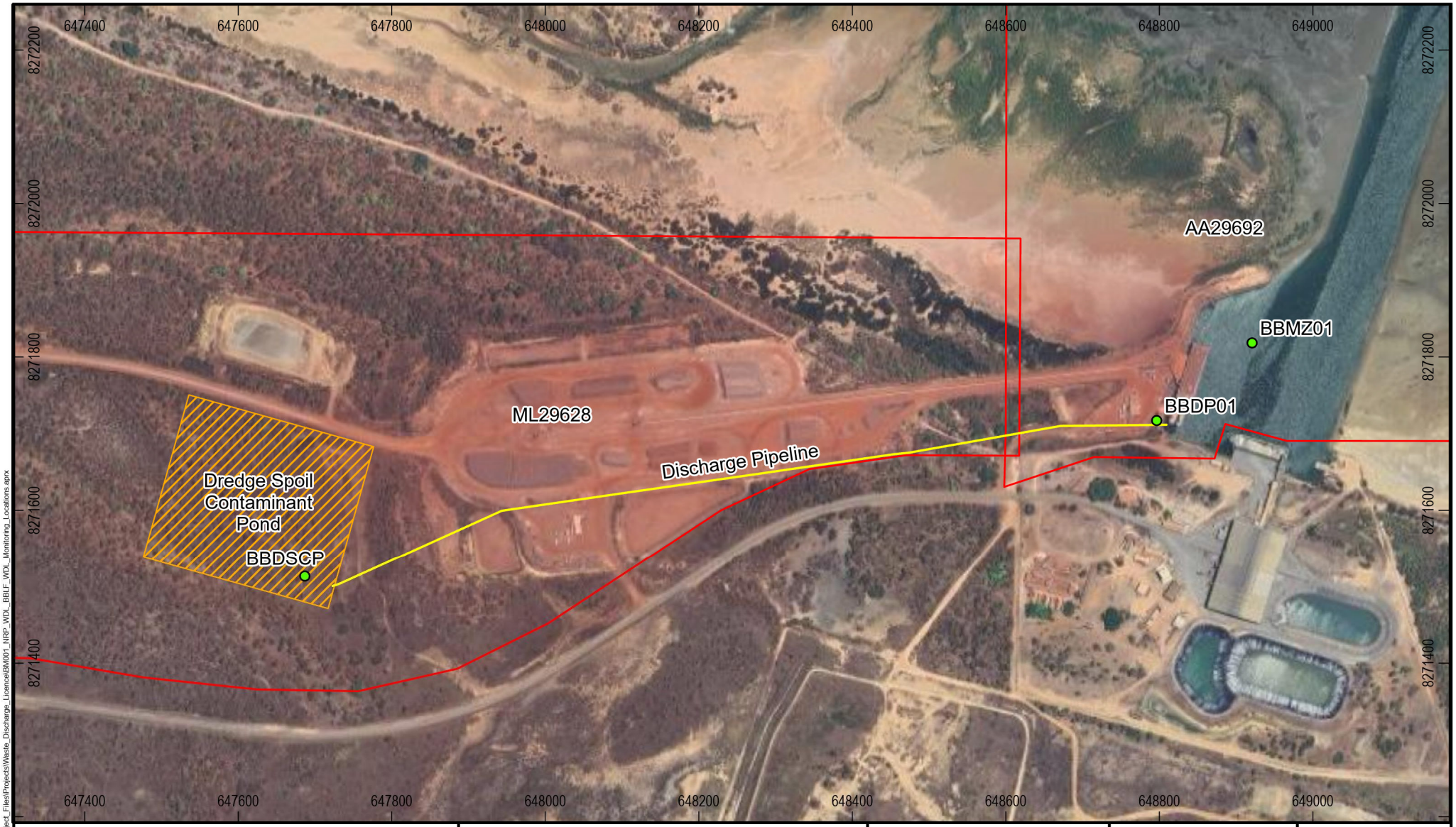
Monitoring Location	Description	Coordinates (GDA94 Z53)	
		Latitude	Longitude
BBDSCP	Decant basin located within the dredge spoil containment pond.	-15.6300	136.3777
BBDP01	Discharge point located south of the NRR BBLF wharf.	-15.6281	136.3881
BBMZ01	Located within the mixing zone of the swing basin (compliance point).	-15.6272	136.3892

Table 7-2 Proposed Discharge Monitoring Program

		Monitoring Locations			Trigger Values
Parameters	**Units**	**BBDSCP**	**BBDP01**	**BBMZ01**	**BBMZ01**
Field Measurements					
Flow	kL/day	-	C	-	-
Water Level	mb MOL	D	-	-	-
pH	pH units	D	D	B, W, A	8 – 8.4 [1]
Electrical Conductivity (EC)	µS/cm	D	D	B, W, A	-
Dissolved Oxygen (DO)	% saturation	D	D	B, W, A	<90 [1]
Temperature	°C	D	D	B, W, A	-
Turbidity	NTU	D	D	B, W, A	20 [1]
Metals/Metalloids					
Aluminium (Al)	µg/L Unfiltered & Filtered (0.45 µm)	W	W	B, W, A	-
Cadmium (Cd)		W	W	B, W, A	5.5 [2]
Cobalt (Co)		W	W	B, W, A	1 [2]
Copper (Cu)		W	W	B, W, A	1.3 [2]
Iron (Fe)		W	W	B, W, A	-
Lead (Pb)		W	W	B, W, A	4.4 [2]
Manganese (Mn)		W	W	B, W, A	-
Nickel (Ni)		W	W	B, W, A	70 [2]
Zinc (Zn)		W	W	B, W, A	15 [2]
Other					
Total Suspended Solids (TSS)	mg/L Unfiltered	W	W	B, W, A	-

A – the day immediately following cessation of discharge.
B – Immediately before dredging commences.
C – Continuous using flow meter.
D – Daily during first week of discharge, then weekly thereafter.
W – Weekly during discharge.
mb – Meters below.
MOL – Maximum operating level

[1] Default trigger value for tropical Australia, Marine inshore (ANZECC 2000).
[2] Trigger values based on 95% species protection for marine protection (ANZG 2018)



Legend

- Tenement Boundaries
- WDL Monitoring Locations
- Discharge Pipeline
- Dredge Spoil Contaminant Pond

Source: Northern Territory Government (Department of Industry, Tourism and Trade) 2022, Nathan River Resources 2024, METServe 2024. Imagery - © OpenStreetMap and contributors

Nathan River Project

WDL Monitoring Locations

**Infrastructure locations are approximate only. Not to scale.*

0 50 100 200

Meters

Scale: 1:7,000 (A4)

27/03/2024

Datum: GDA2020
Projection: MGA53

FIGURE 7-1

METSERVE
Mining & Energy Technical Services Pty Ltd

Path: S:\Projects\BM001 Nathan River\ArcGIS\Project_Files\Projects\Waste_Discharge_Licence\BM001_NRP_WDL_BBLF_WDL_Monitoring_Locations.aprx

7.2 Dredge Plume Turbidity Monitoring

As outlined in **Section 6.2.3**, turbidity levels are expected to be elevated within a localised zone surrounding the dredge site during operations. NRR has proposed the following turbidity monitoring with the intent to provide early indication of water quality impacts and to gather plume monitoring data for future maintenance dredging activities.

Turbidity monitoring using a calibrated multi-parameter water quality probe will be conducted at several locations downgradient and in the direction of the dredges' associated turbidity plume or flow of current where a turbidity plume is not visible. Turbidity monitoring will occur at a depth of 0.5 m and at several distance intervals away from the dredge vessel; 50 m, 100 m, 150 m and 200 m. Prior to plume monitoring commencing, an aerial survey using a drone will be done over the dredge to confirm the direction and magnitude of the turbidity plume (if exists).

During dredging operations, dredge turbidity plume monitoring will occur daily and will reduce to weekly if trigger values are not exceeded within the first week of dredging operations commencing. Monitoring will be undertaken regardless of tidal movement at the time. Results from a similar monitoring program conducted during the 2020 maintenance dredge operation highlighted that revolving water quality monitoring programs around tidal movements at the BBLF did not meaningfully impact results.

Environmental observations will be documented each day including wind speed and direction, rainfall, tidal movements, and dredging activity.

7.3 Marine Water Quality via DGT technique

NRR proposes to monitor marine water quality within the BBLF transhipment zone and surrounding receiving marine waters during dredging operations using DGTs. NRR will utilise water quality data collected through the existing DGT monitoring program implemented by MRM at the BBLF. The monitoring program to be implemented during dredging activities will utilise the same sampling procedure and monitoring locations to MRM's existing DGT monitoring program, ensuring a standardised and consistent monitoring approach which allows for the comparison of historic data and identification of potential impacts during dredging activities (independent of MRM monitoring). DGT monitoring location details are provided in **Table 7-3** and presented in **Figure 7-2**.

NRR proposes to deploy DGTs on two occasions: within the first week of dredging activities commencing and one month post dredging completion. Should monitoring data collected from the first DGT monitoring event show no impacts associated with the proposed dredging activity, the second DGT monitoring event (post-completion) is not considered necessary. This is a recommendation from monitoring conducted in 2020, whereby the post completion monitoring event did not add any value to the dredge monitoring program even though no exceedances were recorded in the first monitoring event.

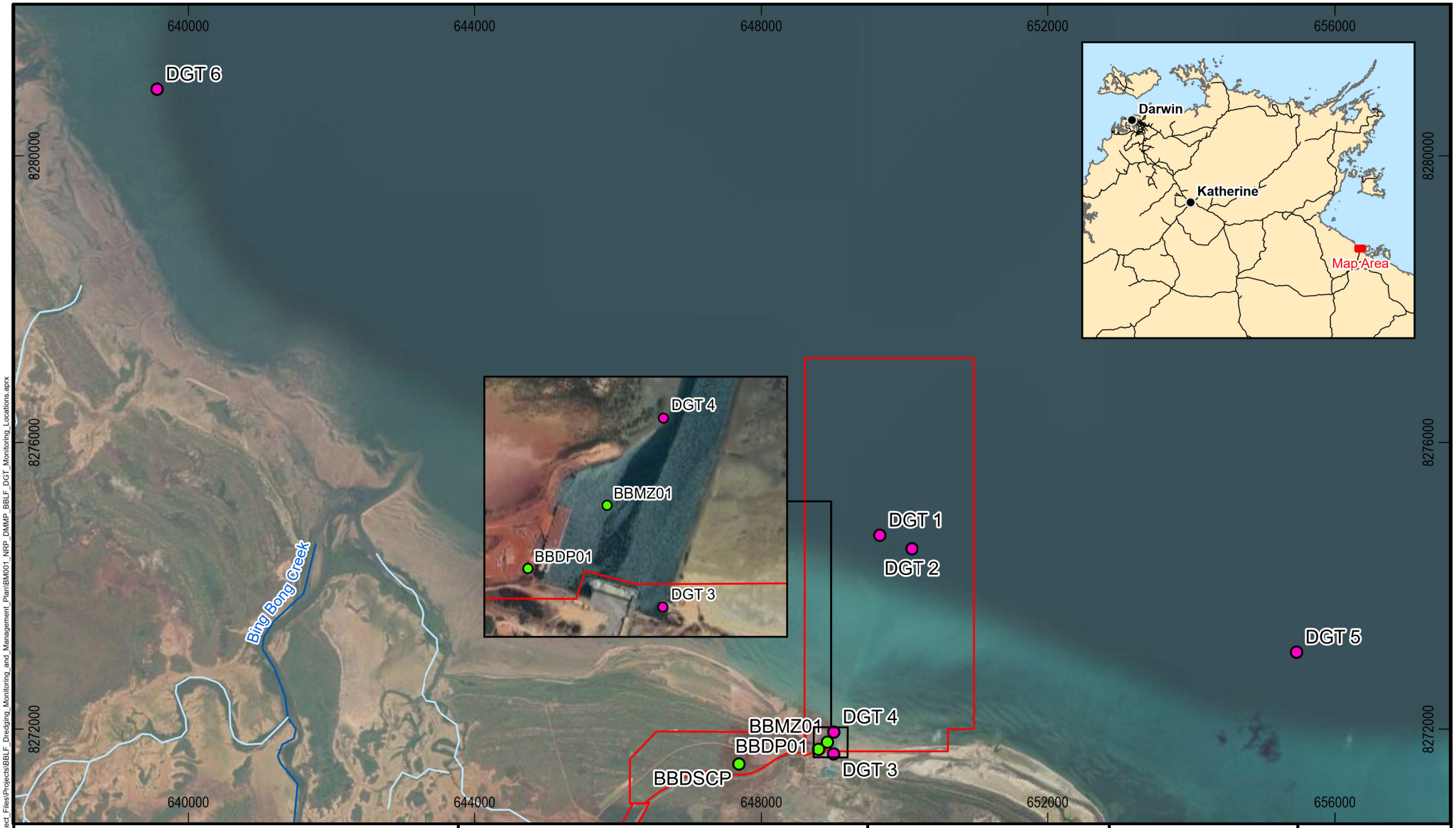
Monitoring data collected from the existing MRM DGT program between 2020 and 2023 (**Section 5**) will provide sufficient baseline data during which time no dredging activities have been undertaken to allow for comparison. Physico-chemical parameters will be recorded using calibrated multi-parameter water quality probes at each monitoring location when the DGTs are deployed. These parameters will include:

- pH;
- Electrical Conductivity (EC) (µS/cm);
- Temperature (°C);
- Dissolved Oxygen (% saturation);
- Oxygen Reduction Potential (ORP) (mV); and
- Turbidity (NTU).

Laboratory analysis will include DGT-labile Mn, Fe, Co, Ni, Zn, Cd and Pb. DGTs will be left in-situ over a six-day monitoring period +/- one day, whereby three DGT replicates are undertaken at each DGT monitoring location per monitoring event. Numerous environmental observations during the monitoring period are recorded should it be needed during data interpretation. These include: wind speed and direction, rainfall, tidal range, dredging activities.

Table 7-3 MRM DGT Monitoring locations

Monitoring Location	Description	Impact	Easting (GDA94 Z53)	Northing (GDA94 Z53)
DGT 1	Located approximately 2.8 down gradient of swing basin mouth (DGT4), at moorings 150m either side of the navigational channel markers and north-west of DGT2.	Impact – within channel	649650	8274704
DGT 2	Located approximately 2.8 km down gradient of swing basin mouth (DGT4), at moorings, 150m either side of the navigational channel markers and east of DGT1.	Impact – within channel	650099	8274515
DGT 3	Swing basin, south-west corner mooring	Impact – within swing basin	649006	8271652
DGT 4	Swing basin, mooring near the narrowing of the entrance channel	Impact – within swing basin	649009	8271957
DGT 5	East of BBLF	Reference (up current of BBFL swing basin impacts).	655464	8273072
DGT 6	NW of BBLF	Impact - down gradient	639562	8280928



Legend

- DGT Monitoring Locations
- Discharge Monitoring Locations
- Minor Drainage
- Streams
- Mineral Title

Source: Northern Territory Government (Department of Industry, Tourism and Trade) 2022, Nathan River Resources 2024, METServe 2024. Imagery - Earthstar Geographics, © OpenStreetMap and contributors.

Nathan River Project

DGT Monitoring Locations

0 0.5 1 2

Kilometers

Scale: 1:75,000 (A4)

15/04/2024

Datum: GDA2020
Projection: MGA53

FIGURE 7-2

METSERVE
Mining & Energy Technical Services Pty Ltd

Path: S:\Projects\BM001 Nathan River\ArcGIS\Project_Files\Projects\BBLF_Dredging_Monitoring_and_Management_Plan\BM001_NRP_DMMP_BBLF_DGT_Monitoring_Locations.aprx

7.4 Dredge Plume Drone Monitoring

NRR proposes to implement routine drone monitoring of the dredge site during operations. Such monitoring was implemented throughout the 2020 dredge program and proved to be helpful in identifying the magnitude of the dredge plume and its direction, particularly useful for turbidity plume monitoring (**Section 7.2**). Drone monitoring is proposed to occur on a weekly basis during dredging activities. The aerial drone survey will focus over the dredging operations within the swing basin, transhipment channel and channel outlet into the Gulf. An example of images captured from the 2020 dredge program monitoring are presented in **Figure 7-3**, showing a localised plume close to the dredge vessel.

Figure 7-3 Dredge plume monitoring from 2020

7.5 Visual Inspections

Visual inspections of critical dredge infrastructure will be conducted on a daily basis to ensure infrastructure is in good condition, working correctly and is not causing environmental harm. Infrastructure subject to daily inspections include:

- Dredge vessel to ensure good housekeeping on board, including spill kits;
- Pipeline infrastructure to ensure no leaks or spills have occurred;
- Swing basin, channel and adjacent shore line for evidence of hydrocarbon sheen or waste/rubbish;
- Dredge spoil containment cell to ensure:
    - Spoil containment pond wall integrity is maintained (no geotechnical failures of bunding or seepage);
    - Maximum operating level (MOL) is maintained;
    - Suitable deposition of spoil and settlement of decant water prior to discharge of decant water; and
    - Outer bund walls and vegetation surrounding the containment cell to detect seepage or spills.

Photographs will be provided, and observations presented within the operational dredging monitoring daily inspections report.

Table 7-3 Summary of proposed dredge monitoring programs

Monitoring Program	Objective	Number of sites	Location	Frequency	Parameters
Discharge Water Quality Monitoring	Compliance with WDL conditions	Three	As per **Table 7-1** and **Figure 7-1**.	As per **Table 7-2**.	Physico-chemistry: • pH; • Temperature (°C); • EC (µS/cm); • DO (%); and • Turbidity (NTU). Laboratory analysis: • Al, Cd, Co, Cu, Fe, Pb, Mn, Ni, and Zn.
Dredge Plume Turbidity Monitoring	Extent and magnitude of plume generated by dredging activity.	Four	At 50, 100, 150 and 200 m distance increments from the dredge vessel in the direction of plume/current at a 0.5 m depth.	Prior to commencement of operations: Daily for one week at two locations (one within the swing basin and another in the transhipment channel). Daily during dredging operations reducing to weekly for the duration of the program should no exceedances be recorded.	Turbidity (NTU)
Marine Water Quality Monitoring via DGTs	Monitoring of marine water quality during dredging activities.	Six	As per **Figure 7-2** and **Table 5-1**.	Two monitoring events: 1st : after the first week of dredging activities, insitu for 406 days. 2nd: Within one month of dredge program completion should the 1st	Physico-chemistry: • pH; • EC (µS/cm); • Temperature (°C); • DO (%); • ORP (mV); and • Turbidity (NTU).

				event outline exceedances of default trigger values.	Laboratory analysis (DGT-labile): • Mn, Fe, Co, Ni, Zn, Cd, Pb and Pb Isotope ratios.
Dredge Spoil	To further characterise dredge spoil material for PASS prior to discharge of decant water.	Four	Randomised locations within the dredge spoil contaminant pond.	One monitoring events within the first week of dredge deposition and prior to commencing discharge of decant water.	Potential Acid Sulfate Soils (PASS): • Chromium suite test
Drone Inspections	Dredge plume extent and magnitude.	One	BBLF transhipment zone and surrounding waters to the BBLF.	Weekly during dredging operation.	Aerial Photographs.
Visual Site Inspections	Early detection of potential environmental incidents or impacts.	Three	Inspections of the following infrastructure: • Dredge spoil contaminant pond; • Pipelines; and • Dredge vessel / dredging area.	Daily during dredging operations.	Photographs and observations.

8 ADAPTIVE MANAGEMENT

8.1 Adaptive Management Framework

NRR intends to adopt an adaptive management framework to minimise risks to the environment associated with the dredging activities. The framework aims to identify:

- Environmental objectives and routine management measures that will be implemented to achieve these objectives;
- Performance indicators that will be used to monitor environmental performance;
- Monitoring programs that will provide early warning of potentially unacceptable impacts;
- Trigger values for further investigation and management; and
- Corrective actions/adaptive management options that will be undertaken if monitoring indicates trigger values have been exceeded.

The NRR response process for trigger value exceedances is shown below in **Figure 8-1**. **Table 8-1** outlines the proposed framework pertaining to monitoring to be conducted for the dredging program.

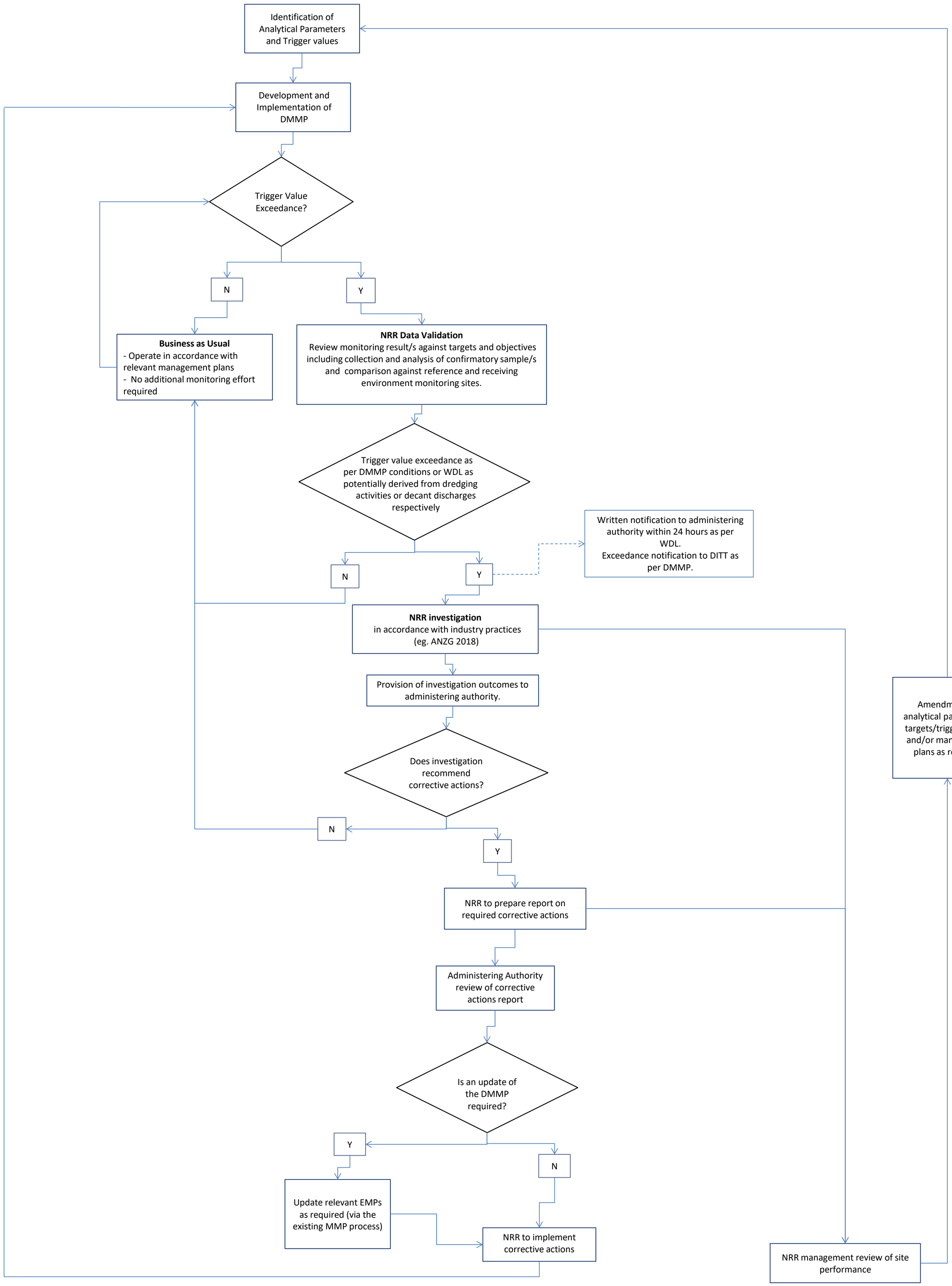


Figure 8-1 NRR Response Process for Trigger Value Exceedances

Table 8-1 BBLF Dredging Program Environmental Aspects and Impacts Register

Activity/Aspect/ Environmental Objective	Target	Routine management measures	Monitoring	Trigger and compliance point	Management Response, Monitoring, and Reporting
Activity/Aspect: Dredging plume **Objective**: To protect the marine ecosystem from adverse impacts to water quality associated with dredging	• Water quality impacts localised to within the swing basin and channel. • Water quality returns to normal operating concentrations when dredging ceases.	• Dredging process managed to minimise loss and dispersion of sediments. • Spoil disposal onshore within designated containment cells • Certified poly welding of spoil disposal pipeline to reduce split/leaking pipelines.	• Dredge plume turbidity monitoring • Marine water quality monitoring – bioavailable metals and physico-chemical parameters • Visual monitoring of plume extent by drone	• Turbidity >20 NTU based on ANZG 2018 guidelines, at 200m from dredge (based on localised impact within the swing basin). • Turbidity concentrations trending upwards over time. • Exceedance of 95% species protection guideline values for marine ecosystem (ANZG 2018) at impact DGT monitoring sites outside of swing basin. • Dredge plume visible outside the BBLF swing basin and channel.	• Use monitoring data from all sources and locations to confirm cause-effect relationship between water quality impact and dredging activities. • Reduce dredging rate to minimise sediment discharges if required. • Adjust dredging timing in consideration of tidal direction of plumes. • Increase frequency of turbidity monitoring to daily and sample at 50m intervals until the point at which turbidity is <20 NTU • Undertake follow-up DGT monitoring • Suspend dredging to allow investigation of alternative management strategies if turbidity trigger exceeded on three consecutive occasions or follow-up DGT monitoring shows ongoing exceedance of guidelines values.
Activity/Aspect: Dredging vessel interaction with marine fauna **Objectives**: To minimise the risk of physical injury to marine fauna due to vessel interaction. To minimise disturbance of marine species due to noise interaction	Nil incidents of injury to marine fauna No avoidable disturbance of marine species from underwater noise	• Compliance with all requirements of the NRP Marine Management and Monitoring Plan • Mandatory speed restriction of four knots inside the channel and swing basin • Mandatory go-slow zone of six knots outside channel and swing basin • All equipment is maintained in good operating condition. • All noise minimisation measures such as mufflers, special enclosures and sound-insulation mounts are fitted and working. Minimise the noise generation of equipment (thrusters and auxiliary plant) by switching them off when not used (i.e. avoid running on standby mode).	• Visual observation for the presence of dolphins, dugongs turtles prior to dredge start-up each day and during dredging activities.	• Marine fauna observed within 50m exclusion zone from dredge • Near misses or vessel strike of marine fauna	• Record sighting and notify vessel master. • Suspend operations temporarily until animal has moved outside of the exclusion zone • In the event of an injury or mortality, report to NT Parks and Wildlife and act on advice received.
Activity/Aspect: Decant water discharges **Objectives**: To protect the marine ecosystem from adverse impacts to water quality associated with discharge of decant water	• Water quality parameters at authorised discharge point BBMZ01 comply with WDL criteria	• Test dredged material to confirm absence of PASS within the first week of dredging • Discharge management in accordance with the WDL. • Containment cell managed to design volumes and MOL to prevent wall failure and/or overflows.	• Discharge monitoring • Visual inspection of spoil containment and surrounding areas	**Internal trigger** • Presence of PASS • Any exceedance of licenced water quality parameters due to high source levels. **WDL compliance triggers** • An exceedance of a trigger value on three consecutive sampling occasions for monitoring location BBMZ01 • An exceedance of the trigger value on a single occasion by three times or more for monitoring location BBMZ01. • Where discharge from all discharge events at the authorised discharge point:	• Conduct an attributability investigation to determine the likely cause for the elevated measures. • Treat and manage PASS to prevent discharge water acidity exceeding licenced parameters. • Reduce discharge flow rates from settlement pond. • Adjust timing of discharges to avoid ebb tides. • Temporarily suspend discharges to allow sufficient settlement time. • Reduce dredging rates to ensure maximum operational capacity of settlement pond is not exceeded. • Suspend dredging until sufficient capacity available in settlement pond. • Investigate additional source controls such as geotextile fabric / silt curtains within the settlement pond. • If the event is determined to be a non-compliance with the WDL the administering agency will be notified as soon as practicable and within 24 hours of first becoming aware of the non-compliance.

Activity/Aspect/ Environmental Objective	Target	Routine management measures	Monitoring	Trigger and compliance point	Management Response, Monitoring, and Reporting
				-contains any floating debris, oil, grease, petroleum hydrocarbon sheen, scum, litter or other objectionable matter - causes or generates odours which would adversely affect the use of surrounding waters - cause algal blooms in the receiving water - cause visible change in the behaviour of fish or other aquatic organisms in the receiving water - cause mortality of fish or other aquatic organisms - cause adverse impacts on plants - cause erosion at and immediately downstream of the authorised discharge point.	
Activity/Aspect: Overflows or seepage from spoil containment area **Objective**: To protect coastal vegetation and habitats from adverse impacts associated with overflows or seepage from spoil containment area	• No overflow, seepage or release of water or sediments to the surrounding land	• Spoil containment pond managed to design volumes and MOL to prevent wall failure and/or overflows.	• Visual monitoring of spoil containment and surrounding vegetation • Routine surface water and groundwater monitoring at BBLF in accordance with NRP Water Monitoring and Management Plan (WMMP).	• MOL is exceeded, seepage occurring and/or wall integrity compromised (i.e. erosion, slumping). • Split / leaking pipelines • Exceedance of site specific trigger values set for surface water and groundwater protection at BBLF	• Temporarily suspend dredging and discharge operations. • Implement spill response procedure to capture, contain any potentially contaminated material and divert discharges towards the swing basin. • Fix split/leaking pipes. • Undertake engineering assessment of spoil containment area and rectify. • Implement ongoing water quality and vegetation monitoring program around containment cell to detect changes (improvements or adverse impacts) over time.
Activity/Aspect: Hydrocarbon spills **Objective**: To protect the marine ecosystem from adverse impacts to water quality associated with hydrocarbon spills	• All hydrocarbons and hazardous materials are stores, handled and transported in accordance with best practice management and relevant Australian Standards • Spills are contained within the BBLF swing basin	• Dredging vessel procedures used for refuelling. • Shipboard Oil Pollution Emergency Plan implemented.	• Visual observations of hoses and sea surface during refuelling to identify spills or leaks	• Spill	• Implemented in the event that inspections identify a failure to meet performance targets. • An incident investigation will be undertaken and appropriate corrective actions documented. • Corrective actions will be appropriate to the size, nature and scale of the incident identified.
Activity/Aspect: Waste Management **Objective**: To protect the marine fauna from adverse impacts from inappropriate waste management	• No waste or rubbish entering the marine environment	• Appropriate collection and disposal of all vessel waste onshore in accordance with regulatory requirements (and by licensed waste contractor) and vessel operating procedures. • All materials and equipment on board vessels and plant are to be appropriately covered and/or stored to prevent waste overboard. • Dredge contractor to receive induction and training in relation to waste management procedures. • NRR Waste Management Plan implemented as required.	• The Waste Management Plan will detail the checks and controls to be in place at the BBLF. It will also describe the triggers for corrective actions, should the Waste Management Plan not be adhered to. • Visual inspections	• Presence of waste in the immediate area of the dredging operations that is directly attributable to the dredging operations.	• Corrective actions to be taken in the event of non-compliance with the Waste Management Plan • Review of procedures • Dredging contractor to immediately rectify source of waste and prevent further waste entering the marine environment and initiate clean up.

9 COMPLIANCE MONITORING AND REPORTING

9.1 Project roles and responsibilities

Roles and responsibilities relating to the implementation of the DMMP are as follows:

HSET Superintendent

The NRR HSET Superintendent is responsible for the implementation of all on site work programs under the environmental policy and the EMS. The Superintendent will also oversee all occupational health and safety aspects of the operations.

Dredge contractor

The dredge contractor will:

- Adhere to the conditions of this DMMP;
- Provide appropriately qualified and training staff to conduct the dredging activities;
- Ensure dredge and pipelines are maintained and operated in accordance with manufacturer specifications and best practice at all times;
- Comply with all relevant Commonwealth and NT legislation;
- Ensure appropriate spill response equipment is fully stocked and available on the vessel;
- Report all incidents to the HSET Superintendent in accordance with the requirements of this DMMP; and
- Maintain records of compliance with the DMMP.

General Manager - BBLF

A dedicated General Manager for BBLF operations is based on the site, reporting directly to the NRR CEO.

The BBLF General Manager is responsible for the implementation of the BBLF DMMP. To maximise the effective implementation of the DMMP, the BBLF General Manager will be responsible for:

- Providing resources and equipment to meet objectives;
- Initiating reviews of the DMMP when required;
- Reporting non-compliances;
- Reporting environmental incidents;
- Implementing monitoring plans;
- Maintaining site records; and
- Daily/monthly reporting.

The BBLF General Manager will also be responsible for identifying training needs so that all BBLF personnel receive an appropriate level of training to understand and implement the requirements of the DMMP. To achieve this, they will use a combination of training and communication tools including:

- Site induction: this will provide staff with an understanding of the environmental values of the site, the MMMP framework and a general overview of the objectives of the MMMP. The induction will provide staff with an understanding of their general environmental duty, incident reporting requirements and required standards of environmental performance.
- Toolbox talks: the toolbox talks will communicate specific aspects of the MMMP relevant to the activities being undertaken that day. They will inform the operational methodology and provide staff with appropriate management strategies to manage potential environmental impacts.
- Reference hard copies of the DMMP available in the BBLF main office.

BBLF Personnel

All staff have a general environmental duty as outlined in section 12 of the *Waste Management and Pollution Control Act 1998* (WMPC Act). This means that all staff are responsible for the actions they take that affect the environment.

Staff will be responsible for:

- Carrying out environmental management activities as directed by the BBLF General Manager;
- Routine vessel servicing and inspections;
- Observing and informing the BBLF General Manager regarding general environmental performance of the DMMP;
- Notifying the BBLF General Manager of any environmental incidents;
- Notifying the BBLF General Manager of any trigger value exceedances;
- Notifying the BBLF General Manager of any sightings of marine megafauna;
- Notifying the BBLF General Manager of any non-conformances; and
- Participating in induction processes and daily toolbox talks to build a suitable understanding of site environmental values.

9.2 Inductions, training and communications

Environmental training will be facilitated through site inductions and toolbox talks. The site induction will be provided to all staff and include the following:

- Identification of site environmental values;
- An understanding of the requirements of this DMMP;
- Roles and responsibilities of site personnel;
- Environmental emergency response procedures;
- Site environmental controls;
- Environmental incident identification and response; and
- The potential consequences (for both NRR and individuals) of not meeting environmental obligations/responsibilities.

The NRR Safety Department will log site visitors and maintain database of site inductions completed. Records of all training and induction will be maintained and be available for inspection.

9.3 Compliance monitoring, record keeping and reporting

Compliance monitoring and reviews

Weekly compliance reviews will be undertaken by NRR in accordance with the DMMP requirements during the dredging operations. The reviews incorporate analysis of monitoring data and inspections to assess compliance of the Dredge Contractor. Monitoring data will be analysed to determine whether any of the triggers identified in **Sections 7** have been exceeded.

If at any time it becomes apparent that control measures are inadequate and/or non-compliance with the DMMP is occurring then corrective actions will be implemented as specified in **Section 8**. If the DMMP is considered to be inadequate then the relevant part/s of the plan will be revised to ensure potential impacts are properly addressed. Any major change to the DMMP will be subject to DITT approval.

Record keeping

The following records will be maintained by the Dredge Contractor:

- Induction and training register;
- Daily inspection records for dredging activities;
- Evidence of compliance with marine pest management requirements;
- Marine fauna sightings log book; and
- Incident reports and corrective active records.

NRR will appoint an appropriate and qualified environmental contractor will undertake monitoring activities outlined in **Section 7**.

Reporting

Internal reporting requirements include daily reporting of dredging activities, decant discharges, monitoring and results, and identification of any non-conformances with the monitoring programs.

External reporting is required as a condition of the WDL and annual EMR. Exceedance of the trigger values will be reported to DITT as soon as reasonably practicable. NRR will ensure any reporting requirements conditioned by the WDL will be adhered to.

9.4 Emergency contacts and incident response

Non-conformance incidents will be documented in accordance with NRR's Incident Reporting Procedure.

All environmental incidents will be reported to DITT as soon as practicable in accordance with section 29 of the MM Act and the DITT Reporting Guidelines.

All environmental incidents which trigger the environmental harm thresholds, associated with dredging activities, will be reported to the NTEPA under section 14 of the WMPC Act. Notification must be received by the NT EPA within as soon as practicable (in any case within 24 hours of becoming aware of the incident).

Incident investigation and reporting will be promptly undertaken to identify and evaluate the immediate and contributory causes and enable timely and effective corrective actions to be implemented.

Any incident / disturbance to cultural heritage sites will be reported to the AAPA and /or NT Heritage Branch as soon as practicable in accordance with section 14 of the *NT Aboriginal Sacred Sites Act and NT Heritage Act.*

Emergency contacts are provided in **Table 9-1.** The NRP's Emergency Response Plan, provided in **Appendix C**, which covers operations at the BBLF is currently implemented and will continue to be for the duration of the proposed dredging activities.

Table 9-1 Emergency Contact Information

Name	Description	Contact Details
NRR		
Simon Peat	Chief Executive Officer	Simon.peat@nathan-river.com 0418 124 024
Krysten Roberts	General Manager - BBLF	Krysten.roberts@nathan-river.com 0419 004 936
McArthur River Mining		
Adam Hatfield	Business Strategy Manager	Adam.hatfield@glencore.com.au 0428 859 783
MRM Processing Operations	-	(08) 8975 8179
Emergency Response Team	-	0407 937 130
Other		
Northern Territory Environmental Protection Authority (NT EPA)	Waste, Pollution and Control Team. Pollution Hotline	pollution@nt.gov.au 08 8924 4218 1800 064 567
Northern Territory Department of Environment, Parks and Water Security (DEPWS)	Water Resources	waste@nt.gov.au
NT Work Safe	Accident notifications, general enquiries and complaints	ntworksafe@nt.gov.au 1800 019 115
Northern Land Council (NLC)	Legal Branch	08 8920 5157
NT Parks and Wildlife Service (NPWS) – Limmen National Park	Katherine Region	08 8973 8888
NT Police Service	Emergency Non-emergency	000 131 444

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APPENDIX A – BING BONG DREDGE POND DETAILED DESIGN REPORT (SLR 2024)

Concept Design Report

Nathan River Resources Bing Bong Dredge Pond – Preliminary Engineering Design

NRR Equipment Pty Ltd

47 Callatina Road
Hawthorn, Victoria, 3122

Prepared by:

SLR Consulting Australia

12 Cannan Street, South Townsville QLD 4810,
Australia

SLR Project No.: 623.030222.00001

6 October 2023

Revision: 1.0

Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
1.0	6 October 2023	Jack Daly / Alfred Krebs	Danielle O'Toole	Danielle O'Toole

Basis of Report

This report has been prepared by SLR Consulting Australia (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with NRR Equipment Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

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Appendices

1.0 Introduction

1.1 Overview

SLR Consulting Australia (SLR) was engaged by Nathan River Resources (NRR) for the provision of engineering design services for the new dredge pond at Bing Bong Loadout Facility (BBLF).

Results of an initial assessment indicated that due to the required capacity, raising the existing dredge pond would result in a dam footprint that would breach the northern extent of the NRR lease boundary. As a result, SLR has undertaken a concept design of a new dredge pond facility to enable dredge spoil to be deposited.

This Report should be read in conjunction with the engineering drawings, as listed in **Table 1** and attached in **Appendix A**.

Table 1 Drawing List

Drawing Number	Drawing Name
623.030222-CI-1000	DRAWING SCHEDULE AND LOCALITY
623.030222-CI-1001	GENERAL NOTES
623.030222-CI-1100	GENERAL ARRANGEMENT PLAN
623.030222-CI-1200	SETOUT PLAN
623.030222-CI-1300	EARTHWORKS PLAN
623.030222-CI-1400	CROSS SECTIONS
623.030222-CI-1500	TYPICAL DETAILS

2.0 Background Information

2.1 Objectives

Based on discussions with NRR, the requirement of the dam is as follows:

- Capacity of the order of 180,000 m^3.
- Locally sourced material is to be used to form any new embankments.

Information in italics in the following **Sections 2.2** to **2.5** has been taken from the Nathan River Resources Mining Management Plan for the BBLF (Authorisation – 0965.01), dated October 2020.

2.2 Topography

The BBLF is located on the Gulf coast within the Yiyintyi Range – Bing Bong "G6" geomorphic province as described by Aldrick and Wilson (1990, 1992), which consists of very low relief, almost flat coastal terraces; level to very gently undulating plains; broad or narrow fluvial corridors, swamps and low-lying areas; broad depositional floodplains; tidal mud flats with channels and estuaries; coastal sand sheets, dunes and cheniers. The geology of the area is characterised by scattered rugged areas of Proterozoic sandstones and Tertiary sediments (i.e., the IBRA "Gulf Coastal" bioregion).

2.3 Surface water

The BBLF is within the Rosie Creek Catchment (5,000 km^2), on the dunes and beach ridges adjacent to tidal mud flats along the coastline of the Gulf. The main drainage lines, Mule Creek to the east and Bing Bong Creek to the north, are not within the Loadout Facility area. The majority of BBLF drainage enters the marshland system.

There are no major fresh surface waterbodies in the immediate vicinity of the BBLF, with the closest major systems being Bing Bong Creek ~10 km to the west and Mule Creek to the east approximately ~10 km away.

2.4 Groundwater

The area surrounding the BBLF is affected by saline groundwater, which extends inland for a distance of 10 km or more in this area (Zarr 2009). A registered bore (RN25711) located approximately 4.5 km to the south of the BBLF has a standing water level of 8 m below ground level and yield of 3 L/s (Zarr 2009).

There are no formally nominated groundwater management areas, in or near the BBLF, nor are there any known existing users.

Recent groundwater readings adjacent to the dredge spoil dam range from RL 0.33m to RL 1.76m. The base of the dredge spoil dam is between RL 1.0m to RL 2.5m.

2.5 Dredge Spoil Characteristics

An assessment of the risk of acid sulfate soil was undertaken as part of geotechnical investigations prior to construction of the BBLF, and it was concluded that there is a negligible risk of formation of acid sulfate soils associated with the material that is excavated at the BBLF site (WDR 2013).

Nonetheless sediment testing will be undertaken to identify potential acid sulfate soils (PASS), and material will be handled in accordance with the Northern Territory Land Suitability Guidelines (Department of Lands, Planning and the Environment 2013), and the relevant recommendations outlined in 'Acid Sulfate Soils of the Darwin Region' (Land and Water Division Department of Natural Resources, Environment the Arts and Sport 2008).

3.0 Basis of Design

3.1 Reference Information

In preparing this Concept Design Report SLR has relied on information provided by NRR as follows:

- Aerial survey of the site (dated 8th March 2023).
- Previous geotechnical information developed by SLR (SLR 2021).
- Monitoring bore reports.
- Groundwater monitoring data.
- Publicly available vegetation mapping.

3.2 Concept Design Assumptions

In order to undertake the concept design of the proposed dredge pond SLR have relied on a number of engineering assumptions including the following:

- Groundwater levels are no higher than 1.0m below ground level.
- No rock is present within 1.0m below ground level.
- The materials on site are suitable for re-use in construction of the proposed pond embankments.
- The proposed pond footprint does not intercept significant flora and fauna that is not identified on publicly available maps.
- The proposed inlet pipes will be placed in the north-western corner of the new dredge pond.
- No detailed wave allowance calculation was conducted.

This Concept Design Report relies on a number of engineering assumptions relating to geotechnical and geohydrological site conditions. It is recommended that in order to reduce the number of potential risks associated with these assumptions that further technical studies be carried out prior to construction.

3.3 Considerations for Dam Siting

The proposed pond site is proximate to Melaleuca swamps directly west and east of the site. Site personnel noted that swamp areas act as low points and are covered by 0.5m of water throughout the year therefore hindering constructability and ability to excavate.

SLR propose the dam footprint will be situated on the higher ground between the two swamp areas as presented in **Drawing No. 623.030222-CI-1100** attached in **Appendix A**.

3.4 Concept Design Parameters

Key dam design parameters relating to the proposed design is presented in **Table 2** with the design drawings attached in **Appendix A**.

Table 2 Key Concept Design Parameters

Parameter	Value
General	
Footprint Area	75,900m^2
Capacity	180,000m^3
Top Water Level	RL 5.55m
Deposition slurry	<10% solids
Access Ramp	11m wide (1V:9H) located on NW corner
Basin	
Cut volume	47,525m^3
Fill volume	57,125m^3
Grading	Grade at minimum of 0.5% from northwest corner (dredge spoil deposition point) to southeast corner.

Parameter	Value
External Embankments	
Height	Varies from 1.9m to 4.1m
Crest Elevation	RL 6.0m
Crest Width	5m
Crest Length	~960m
Side Slopes	1V:4H
Separation Bund	
Height	3.0m
Crest Elevation	RL 4.5m
Crest Width	5m
Crest Length	~180m
Side Slopes	1V:4H

4.0 Consequence Category Assessment (CCA)

The Northern Territory does not have specific criteria for dam design, hence the CCA has been undertaken using Australian National Committee on Large Dams *Guidelines on the Consequence Categories for Dams* (ANCOLD 2012).

The consequence category has been assessed based on an 'initial level' assessment, against the criteria outlined in **Table 3** which is extracted from Table 3 of (ANCOLD 2012) which is based on Total Population at Risk (PAR).

Table 3 Consequence Categories Based on PAR

Population at Risk	Extent of Damage and Loss			
	Minor	Medium	Dire	Catastrophe
<1	Very Low	Low	Significant	High C
>1 to <10	Significant (Note 2)	Significant (Note 2)	High C	High B
>10 to <100	High C	High C	High B	High A
>100 to <1,000	(Note 1)	High B	High A	Extreme
>1,000		(Note 1)	Extreme	Extreme

1. With a PAR in excess of 100, it is unlikely damage will be minor. Similarly, with a PAR in excess of 1,000 it is unlikely damage will be classified as medium.
2. Change to 'High C' where there is the potential of one or more lives being lost.

The following sections assess the PAR and extent of damage or loss to allow the CCA to be established. All tables contained in the following sections are extracted from (ANCOLD 2012).

4.1 Flood Inundation and PAR

To establish total PAR an initial flood inundation assessment has been undertaken. This has involved establishing an initial flood inundation assessment based on a 'Sunny Day' failure condition, completed as per Appendix A2 in (ANCOLD 2012).

This assessment can be used when there is little doubt as to the population at risk and the cost of higher-level assessments deemed unnecessary, commensurate to the initial level assessment. The assessment includes a site inspection and review of topographic and hydrological data.

Any habitable dwellings and major infrastructure (e.g., roads, bridges, and railway lines) within a height of ½ of the dam embankment height is recorded and located on a topographic contour map of the downstream area. In this instance given the relatively flat terrain, the flood water would be expected to flow predominantly north toward the Gulf however some could spread out across site. Given the remote location of the site, the approximate capacity of 180ML is unlikely to impact on any nearby infrastructure, hence inundation is not considered a risk.

4.2 Extent of Damage and Loss

The extent of the damage and loss has been assessed against **Table 4** to **Table 7**.

Table 4 Total Infrastructure Costs

Type	Minor	Medium	Major	Catastrophic
See Below	<$10M	$10M to $100M	$100M to $1B	>$1B

Explanatory Notes for Infrastructure Costs

Type	Description
Residential	*Total number of houses affected, some destroyed, and others damaged.*
Commercial	*Including businesses and agriculture. e.g., retail, manufacturing, resources.* *Loss of stock and/or produce as a direct result of the flood wave.*
Community infrastructure	*Such as roads, railways, power, communications, gas, water supply, sewerage, irrigation, drainage, schools, hospitals, community facilities and public buildings.*
Dam replacement or repair cost	*Repairs to the embankment or wall and appurtenant works which will return the dam to its previous level of service.*

Considering that the cost of dam replacement or repair is significantly less than $10M the extent of damage and loss is assessed as **Minor**.

Table 5 Impact on Dam Owner's Business

Impact	Minor	Medium	Major	Catastrophic
Importance to the business	Restrictions needed during dry periods	Restrictions needed during peak days and peak hours	Essential to maintain supply	Dissolution of business/entity
Effect on services provided by the owner	Minor difficulties in replacing services	Reduced services are possible with reasonable restrictions	Severe restrictions would be applied for at least one year	Services cannot be replaced or cannot get services from another source
Effect on continuing credibility	Some reaction but short lived	Severe widespread reaction	Extreme discontent	Total loss of confidence and credibility
Community reaction and political implications	Some reaction but short lived	Severe widespread reaction	Extreme discontent	Total loss of confidence and credibility
Impact on financial viability	Able to absorb in one financial year	Significant impact in the long term	Severe to crippling in the long term	Bankruptcy
Value of water in the storage	Can be absorbed in one financial year	Loss of invoice for at least 1 year	Loss of income for more than 1 year	Bankruptcy

Explanatory Notes for Dam Owner's Business

Type	*Description*
Importance to the business	*Loss of storage is likely to affect the service provided to some degree.* *It may be appropriate to increase the severity level because of the importance of the reservoir. However, a less vital water resource may lead to a reduction of the severity of the cost of replacement or cover.*
Effect on the services provided by the owner	*Water supply, power or recreational facility is no longer available or disrupted to a proportion of the community supplied by the agency.*
Effect on continuing credibility	*Standing or reputation of the organisation in the community.*
Community reaction and political implications	*There may be community objective to replacement of the dam. Also, the relationship between the dam owner and local, state and federal legislation.*
Impact on financial viability	*Economic and legal liability; ability to meet the costs of repairs and damage; ability to meet claims from others.*
Value of water in the storage	*Loss of income from the loss of stored water.*

The impact across all fields for the Dam Owner Business is assessed as **Minor**, except for Importance to Business which is **Medium**.

Table 6 Health and Social Impacts

Type	Minor	Minimum	Major	Catastrophic
Human health	<100 people affected	100 to 1000 people affected	>1000 people Heated for greater than one month	>10,000 people affected for a year or more
Loss of services to the community	<100 people affected	100 to 1000 people affected	>1000 people affected for greater than one month	>10,000 people affected for a year or more
Cost of emergency management	<1000 person days	1000 to 10,000 person days	>10,000 person days	>100,000 person days
Dislocation of people	<100 person months	100 to 1000 person months	>1000 person months	>10,000 person months
Dislocation of businesses	<20 business months	20 to 200 business months	>200 business months and some business failures	Numerous business failures
Employment affected	<100 jobs lost	100 to 1000 jobs lost	>1000 jobs lost	>10,000 jobs lost
Loss of heritage	Local facility	Regional facility	National facility	International facility
Loss of recreational facility	Local facility	Regional facility	National facility	International facility

Explanatory Notes for Health and Social Impacts

Type	Description
Human health	*Human health could be affected by:* • *contamination of drinking water* • *failure or lack of water supplies, sewage treatment works, power.* *Contamination of services such as food, health, recreation areas and facilities caused by the uncontrolled release of sewage, industrial or toxic waste as a result of a daybreak.*
Loss of services to the community	*Loss of gas/power/communications and transport. Distribution of medical supplies, food, especially perishable food items.*
Cost of emergency management	*Police, Emergency Services and volunteers will incur a cost both directly and indirectly.*
Dislocation of people	*People whose homes are destroyed or damaged will need to be re-housed or billeted for various times.*
Dislocation of businesses	*Businesses will be prevented from trading in the short term and may be affected in the long term.*
Employment affected	*Loss of employment.*
Loss of heritage	*Historic sites, both pre- and post-European settlement.*
Loss of recreational facility	Many communities rely, to various degrees, on bodies of water for boating, fishing and other recreational aspects, including visual relief. Other recreational facilities may be located downstream of the reservoir, e.g., golf course, sports grounds.

The impact across all fields for Health and Social Impacts is assessed as **Minor**.

Table 7 Environmental Impacts

Type	Minor	Medium	Major	Catastrophic
Area of impact	<1km	<5km	<20km	>20km
Duration of impact	<1 year	<5 years	<20 years	>20 years
Stock and fauna	Discharge from Dam break would not contaminate water supplies used by stock and fauna.	Discharge from Dam break would contaminate water supplies used by stock and fauna. Health impacts not expected.	Discharge from dam break would contaminate water supplies used by stock and fauna with contaminant uptake.	Discharge from dam break would contaminate water supplies used by stock and fauna with contaminant uptake and measurable health impacts expected.
Ecosystems	Discharge from dam break is not expected to impact ecosystems. Remediation possible.	Discharge from dam break would have short term impacts on ecosystems with natural recovery expected after one wet season. Remediation possible.	Discharge from dam break would have significant impacts on ecosystems with normal recovery expected after several wet seasons. Remediation possible over many years.	Discharge from dam break would have significant permanent impacts on ecosystems. Remediation involves altered ecosystems.
Rare and endangered species	Species exist but minimal damage expected. Recovery within one year.	Species exist with losses expected to be recovered over a number of years.	Rare and endangered species will be severely impacted Recovery will take many years.	Endangered species will be lost from the area. Permanent loss of species will occur.

Explanatory Notes for Environmental Impacts

Type	Description
Areas of impact	*Land damaged by dam failure exclusive of land prone to natural flooding. For tailings dams, the damage will relate to the toxicity of the material in relation to both area of impact and the depth of penetration of the toxic materials.*
Duration of impact	*Habitats may take a long time to recover (e.g., substantial erosion, deposition of Hood borne materials). The duration of the impact will also relate to the toxicity of discharged material (e.g., saline, tailings, sewerage, cold water, deoxygenated water).*
Stock and fauna	*Stock and fauna may ingest contaminated water/fodder. Stock may need to be removed from the area or destroyed. Contaminants may cause damage in relation to reproduction cycle. The impact on stock and fauna may not be immediately identified unless testing of food source is carried out.*
Ecosystem	*Includes organisms and non-living components which interact to form a stable system. Consideration should be given to their environment, habitat, breeding grounds and food chain.*

Type	Description
Rare and endangered species	*Information can be gained from state and federal government agencies in relation to areas known to contain rare and endangered Hora and fauna.*

Mapping of the surrounding environment to establish sensitive areas has been undertaken using NT Government, Department of Environment, Parks and Water Security – Natural Resources Maps (NR MAPS) – the output is provided in **Appendix B** and indicates that within the proposed footprint of the dam this is:

- No significant flora.
- No wetlands.
- No sites of botanical significance.

Based on the mapping the following environmental impact assessment has been made:

- Area of impact: <1 km – **Minor**
- Duration of impact: <1 year – **Minor**.
- Stock and fauna: Discharge from dam break would not contaminate water supplies used by stock and fauna – **Minor**.
- Ecosystems: Discharge from dam break would have short term impacts on ecosystems with natural recovery expected after one wet season. Remediation possible – **Medium**.
- Rare and endangered species: Species exist but minimal damage expected. Recovery within one year – **Minor**.

4.3 Consequence Category Assessment

Based on the initial assessment, the **PAR is <1** and highest rated extent of damage or loss is **Medium**. The consequence category assessment is therefore **LOW** as summarised in **Table 8**.

Table 8 Consequence Category Assessment

Population at Risk	Extent of Damage and Loss			
	Minor	Medium	Dire	Catastrophe
<1	Very Low	**Low**	Significant	High C
>1 to <10	Significant (Note 2)	Significant (Note 2)	High C	High B
>10 to <100	High C	High C	High B	High A
>100 to <1,000	(Note 1)	High B	High A	Extreme
>1,000		(Note 1)	Extreme	Extreme

1. With a PAR in excess of 100, it is unlikely damage will be minor. Similarly, with a PAR in excess of 1,000 it is unlikely damage will be classified as medium.
2. Change to 'High C' where there is the potential of one or more lives being lost.

5.0 Storm Storage Allowance

5.1 Catchments

The dredge pond has been conceptually designed as an above ground Turkey's Nest structure for the disposal of dredge spoil material produced at the loading facility. As this structure will have no contributing external catchment, the catchment area is limited to the surface area of the storage, which is approximately 6ha.

5.2 Maximum Operating Level (MOL)

A risk-based approach has been undertaken in accordance with the *Guidelines on Tailings Dams; Planning, Design, Construction, Operation and Closure* (ANCOLD 2019) in order to develop an appropriate MOL. The MOL has been adopted to minimise the risk of an uncontrolled release over the crest and as a trigger to maintain pond level.

To determine the minimum required freeboard, the following scenario was assessed:

- Depth below the spillway crest required to contain the full volume of catchment rainfall from a 1 in 20-year AEP 72-hour storm event[1].

The rainfall depth for a 20-year 72 hour storm event at Bing Bong was determined to be 427mm. No catchment losses were allowed for in the calculation. The total volume of rainfall over the catchment was then calculated.

The MOL calculation results for the pond are summarised in **Table 9**.

Table 9 Summary of MOL Results

Facility	NRR Dredge Pond
Design criteria	1 in 20-year AEP, 72-hour storm
Rainfall depth (mm)	427
Catchment area (ha)	6
Full supply volume (ML)	205
1 in 20-year AEP, 72-hour storm volume (ML)	26
1 in 20-year AEP, 72-hour storm depth below crest (m)	0.45
MOL (RL m)	5.55
MOL Volume (ML)	180

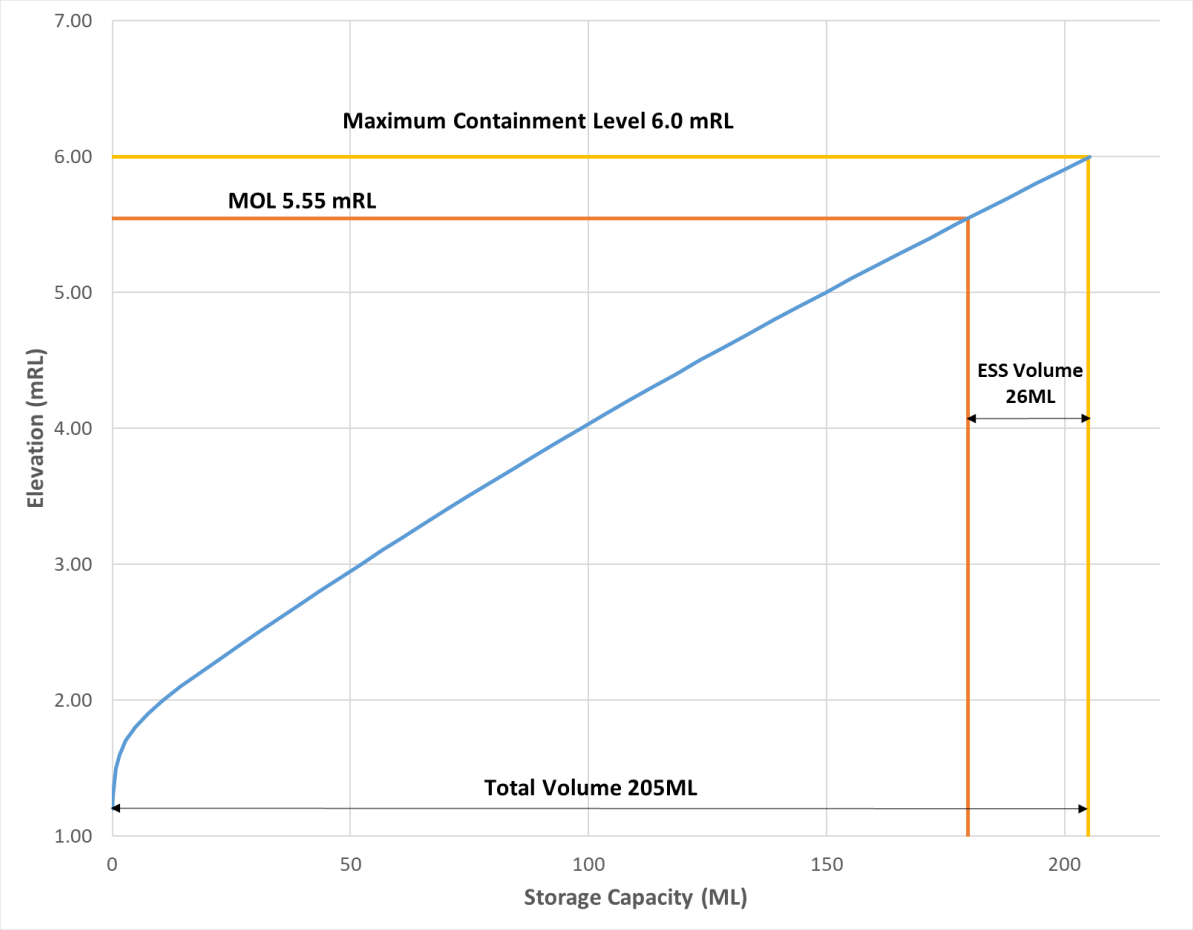
An MOL marker is to be located adjacent to the pump at the NRR dredge pond, the water level in the pond must be maintained below the level indicated on the marker.

5.3 Storage / Elevation Data

The storage volume elevation characteristics for the proposed Dredge Pong arrangement and the MOL are presented in **Figure 1**.

[1] Equivalent to the Extreme Storm Storage as per the Guidelines on Tailings Dams; Planning, Design, Construction, Operation and Closure 2019, ANCOLD.

Figure 1 Dredge Pond Stage Storage Curve



6.0 Construction Quality Control

6.1 Basin Floor

A cut to fill approach is recommended to form the basin floor.

The aim of the basin design is to have a moderately smooth, consistently graded floor over which deposited dredge spoil can flow, depositing sediment as it goes. The concept design takes into account slurry being pumped from the northwest corner toward the separation embankment in the southeast corner where clean water is to be pumped out of the pond.

6.2 Embankment Foundation

Whilst no minimum bearing pressure (i.e., foundation strength) is required for the basin itself, the foundation area supporting the proposed new embankment will need to be of sufficient strength to support the overlying construction of the embankment.

Proof roll using (preferably) a 10 to 12 tonne static smooth drum roller to be undertaken and to be assessed by suitably qualified site personnel. If required, compact using the 10 to 12 tonne mass to achieve the target Density Ratio, at a moisture content of +/- 2% of Optimum Moisture Content. After completion of foundation compaction, place the embankment fill material to the required thicknesses. Compact the materials in layers not exceeding the prescribed compacted thickness to the required minimum density ratios at a moisture content of -2% to +2% of optimum.

6.3 Trial Pad/s

Given the temporary nature of the dam, the testing requirement during construction has been proposed to be reduced to facilitate a relatively rapid construction program. As such, trial pad/s shall be constructed to determine the optimal layer thickness and number of passes and suitable moisture conditioning to achieve the required compactive effort.

Ideally, the trial pad/s shall be constructed within the proposed embankment foundation area.

Trial pads should aim for estimating the following:

- Optimal layer placement depth.
- Moisture conditioning required.
- Number of passes with a smooth drum roller (preferably 10 to 12 tonne) with no vibration.

During the construction of the trial pad, proof roll observation, Nuclear Densometer (ND) testing, and Dynamic Cone Penetrometer (DCP) testing shall be undertaken at each compacted layer to establish the optimal parameters above, to be taken forward for construction.

A target minimum compactive effort to 98% maximum dry density of standard compaction has been nominated for each compacted layer.

6.4 Containment and Separation Embankments

As nominated above, the construction of both the containment and decant embankments shall require a minimum compactive effort to 98% maximum dry density of standard compaction. Proof roll observation, ND testing, and DCP testing shall be undertaken at the start and on completion of embankment construction. Proof roll observation and DCP testing shall be carried out for the rest of the construction program.

As a guide the following construction methodology and compactive effort is assumed per embankment lift:

- Suitable material to be placed in loose layer thickness not exceeding 300mm.
- Blend between drier and over-moist materials, if required. Moisture added if required.
- Allow 6 to 8 passes of a smooth drum roller with no vibration (preferably 10 to 12 tonne).
- DCP testing at 50m intervals to be undertaken, to compare strength against the trial pad outcomes.

6.4.1 Containment Embankment Materials

The excavated material may be suitable for use as fill provided that there is not a significant organic content and that it is able to conform to the specified testing requirements as determined by the trial pads.

7.0 Limitations

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8.0 Bibliography

ANCOLD. 2012. “Australian National Committee on Large Dams - Guidelines on the Consequence Category for Dams.”

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Appendix A Design Drawings and Technical Specifications

Concept Design Report

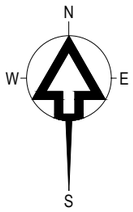
Nathan River Resources Bing Bong Dredge Pond – Preliminary Engineering Design

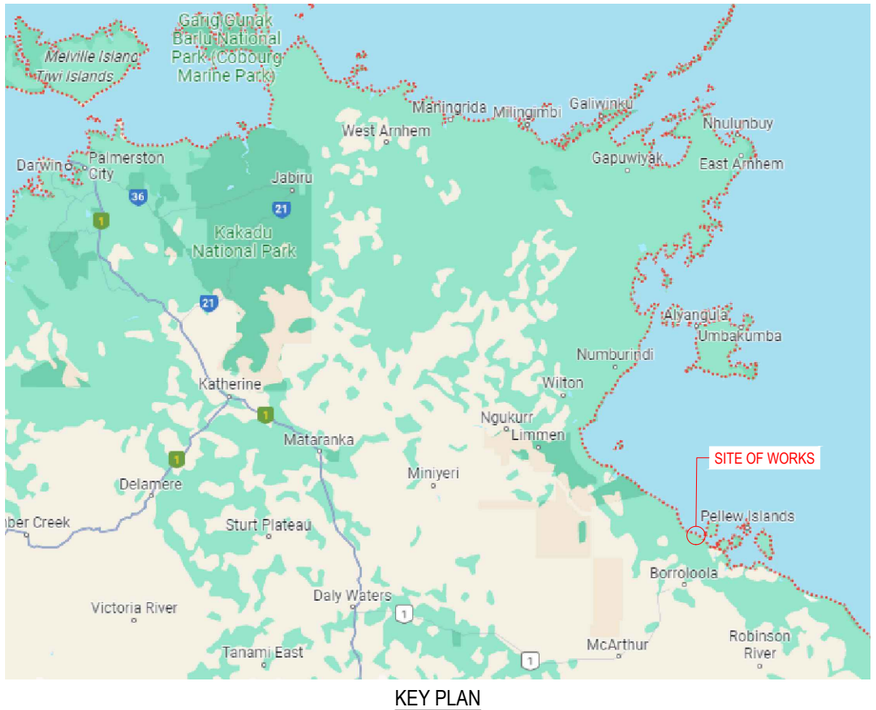
NRR Equipment Pty Ltd

SLR Project No.: 623.030222.00001

6 October 2023

NATHAN RIVER RESOURCES (NRR)
BING BONG FACILITY DREDGE POND
PRELIMINARY ENGINEERING DESIGN





KEY PLAN
SCALE N.T.S.

LOCALITY PLAN
SCALE 1:100000

PROJECT DRAWING SCHEDULE	
SHEET NUMBER	SHEET TITLE
623.030222-CI-1000	DRAWING SCHEDULE AND LOCALITY PLAN
623.030222-CI-1001	GENERAL NOTES
623.030222-CI-1100	GENERAL ARRANGEMENT PLAN
623.030222-CI-1200	SETOUT PLAN
623.030222-CI-1300	EARTHWORKS PLAN
623.030222-CI-1400	CROSS SECTIONS
623.030222-CI-1500	TYPICAL DETAILS

PLOT DATE 06-Oct-2023 12:55:45 PM

REVISIONS				
A	03/10/23	PRELIMINARY DESIGN ISSUE		DOT
	DATE	DESCRIPTION		APPROVED

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METRES

SCALE 1:100000

DRAWN:	JM	DATE:	03/10/23
DESIGN:	JM	DATE:	03/10/23
DWG. CHECK:	AK	DATE:	03/10/23
DES. CHECK:	AK	DATE:	03/10/23
RESPONSIBLE PRINCIPAL SIGNATURE:	DANIELLE O'TOOLE	DATE:	03/10/23
RPEQ :			
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CLIENT: NRR

PROJECT: BING BONG FACILITY DREDGE POND PRELIMINARY ENGINEERING DESIGN

DRAWING TITLE: DRAWING SCHEDULE AND LOCALITY

SIZE: A3

STATUS: PRELIMINARY NOT TO BE USED FOR CONSTRUCTION PURPOSES

SCALE: 1:100000

DATUM: GDA94 - Z53

DRAWING NUMBER: 623.030222-CI-1000

REVISION: A

H:\Projects-SLR\623-TSV\623.030222.00001NRR Bing Bong Dredge Pond Desi\06 SLR Data\01 CAD\GIS\CAD\Drawings\623.030222-CI-1000.dwg

GENERAL

G1 ALL DIMENSIONS ARE IN METRES AND ALL LEVELS ARE IN METRES RELATIVE TO AUSTRALIAN HEIGHT DATUM (AHD) UNLESS NOTED OTHERWISE. CO-ORDINATE SYSTEM IS GDA94 ZONE 53.

G2 ALL DIMENSIONS AND SETTING OUT SHALL BE VERIFIED ON SITE BY THE CONTRACTOR BEFORE COMMENCING WORK. DO NOT OBTAIN DIMENSIONS BY SCALING FROM THE DRAWINGS.

G3 ANY DETAILS OF EXISTING SERVICES SHOWN ON THE DRAWINGS ARE NOT TO BE TAKEN AS INDICATING ALL EXISTING SERVICES OR LOCATIONS. IT IS THE CONTRACTORS RESPONSIBILITY TO ADEQUATELY INFORM THEMSELVES AS TO THE LOCATION OF ANY AND ALL SERVICES. THE CONTRACTOR SHALL EXERCISE DUE CARE WHEN UNDERTAKING ANY EXCAVATION. WHERE AN EXISTING SERVICE IS DAMAGED BY THE CONTRACTOR FOR ANY REASON WHATSOEVER, THE CONTRACTOR SHALL BEAR ALL COSTS AND ANY DELAYS FOR REPAIRING AND/OR DISCONNECTING THE SERVICES AS WELL AS ANY ASSOCIATED COSTS (E.G. DAMAGES, CLEAN UP, ETC.).

G4 SOURCE DATA FOR DESIGN PROVIDED BY NRR.

ENVIRONMENTAL

EN1 TEMPORARY EROSION AND SEDIMENT CONTROL (ESC) MEASURES SHALL BE PROVIDED IN ACCORDANCE WITH THE RELEVANT NRR MANAGEMENT PLAN AND PROCEDURE.

EN2 THE CONTRACTOR SHALL ENSURE THAT ALL ESC MEASURES ARE COMPLIANT WITH THE ABOVE STANDARDS.

EN3 THE CONTRACTOR AND ANY SUB-CONTRACTORS SHALL BE INFORMED OF THEIR RESPONSIBILITIES IN MINIMISING THE POTENTIAL FOR SOIL EROSION AND POLLUTION OF DOWNSLOPE LANDS AND WATERWAYS IN THE ABOVE STANDARDS.

EARTHWORKS

E1 STRIP THE WORK AREA OF ALL GRASS, VEGETATIVE MATTER, FIBROUS ROOTS AND LOOSE MATERIAL AND HANDLE IN ACCORDANCE WITH NRR RELEVANT MANAGEMENT PLAN AND PROCEDURE.

E2 ESTABLISH EARTHWORK EXCESS STOCKPILES IN HEIGHTS NOT GREATER THAN 2 METRES.

E3 CREATE SEPARATE STOCKPILES FOR DIFFERENT SOIL TYPES. DO NOT MIX SUB-SOIL WITH TOPSOIL. PROVIDE ADEQUATE WATERING, DRAINAGE AND EROSION CONTROL.

E4 DO NOT ALLOW TRAFFIC ON STOCKPILES.

E5 ALL EXCAVATION SURFACES SHALL BE STRIPPED AS SPECIFIED AND LEVELLED TO TOLERANCES OF +0mm / -50mm OF THE DESIGN LEVELS.

E6 ALL FINAL SURFACES SHALL BE CONSTRUCTED AS SPECIFIED, AND LEVELLED TO TOLERANCES OF +25mm / -0mm OF THE DESIGN LEVELS.

E7 PERMANENT CUT EXCAVATION BATTERS FOR EARTHWORKS SHOULD BE GRADED NO STEEPER THAN 4(H):1(V).

E8 THE EXCAVATED PROFILE AND ALL AREAS WHICH WILL RECEIVE FILL SHALL BE PROOF ROLLED PRIOR TO PLACEMENT OF FILL. USE STATIC SMOOTH WHEELED ROLLERS OR SIMILAR WITH A MASS OF NOT LESS THAN 10 TONNES OR A LOAD INTENSITY UNDER EITHER FRONT OR REAR AXIS OF NOT LESS THAN 5 TONNES. PROOF ROLL IMMEDIATELY FOLLOWING COMPLETION OF COMPACTION.

E9 ALL EARTHWORKS FILL OPERATION SHALL BE UNDERTAKEN UNDER LEVEL 1 SUPERVISION BY COMPETENT EXPERIENCED PERSONNEL.

DAM EMBANKMENT

EM1 GENERAL FILL SHALL BE PLACED IN NEAR HORIZONTAL LAYERS NOT EXCEEDING 300mm THICK, COMPACT TO 98% MAXIMUM DRY DENSITY AT -2 TO +2% OMC.

EM2 COMPACTED SURFACES SHALL BE SCARIFIED AND WETTED AT THE START OF EACH DAY AND AFTER ANY CONSTRUCTION HIATUS AND PRIOR TO THE PLACEMENT OF ADDITIONAL LAYERS.

DRAINAGE AND DEWATERING

D1 PROVIDE ADEQUATE STANDBY DEWATERING EQUIPMENT IN CRITICAL AREAS WHERE FAILURE OF THE SYSTEM COULD LEAD TO DANGER TO LIFE OR DAMAGE TO PARTIALLY COMPLETED STRUCTURES

D2 DISPOSE OF THE WATER FROM THE WORK IN A SUITABLE MANNER IN ACCORDANCE WITH ENVIRONMENTAL REQUIREMENTS AND WITHOUT DAMAGING THE WORKS OR ADJACENT PROPERTY. NO WATER SHALL BE DRAINED INTO WORK BUILT OR UNDER CONSTRUCTION WITHOUT THE PRIOR CONSENT OF THE SUPERINTENDENT

D3 CONTRACTOR IS RESPONSIBLE FOR ENSURING SITE IS LEFT IN A CONDITION THAT ALLOWS ADEQUATE DRAINAGE OF SURFACE WATER WHENEVER UNATTENDED.

DISPOSAL OF SURPLUS AND UNSUITABLE MATERIALS

DM1. DISPOSE OF ALL SURPLUS AND UNSUITABLE MATERIALS IN ACCORDANCE WITH NRR SPECIFICATIONS.

DM2. UNSUITABLE MATERIAL INCLUDES:

- ALL EXCAVATED MATERIAL WHICH DOES NOT SATISFY THE REQUIREMENTS FOR USE IN CONSTRUCTION OF THE WORKS (MATERIALS WHICH VISIBLY HEAVE WHEN TRAFFICKED BY EARTHWORKS PLANT, OR SUBGRADES WITH ASSESSED CBR OF LESS THAN 2%)
- ALL DISUSED MATERIALS RESULTING FROM CLEARING (SUCH AS TREES, STUMPS, BRUSH, FENCING AND STRUCTURAL DEBRIS); AND
- ALL RUBBISH.

PLOT DATE 06-Oct-2023 12:55:49 PM

REVISIONS

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DES. CHECK:	AK	DATE:	03/10/23
RESPONSIBLE PRINCIPAL SIGNATURE:	DANIELLE O'TOOLE RPEQ : RPEQ :	DATE:	03/10/23

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CLIENT: NRR

PROJECT: BING BONG FACILITY DREDGE POND
PRELIMINARY ENGINEERING DESIGN

DRAWING TITLE: GENERAL NOTES

SIZE: A3

STATUS: PRELIMINARY
NOT TO BE USED
FOR CONSTRUCTION PURPOSES

SCALE: N/A

DATUM: GDA94 - Z53

DRAWING NUMBER: 623.030222-CI-1001

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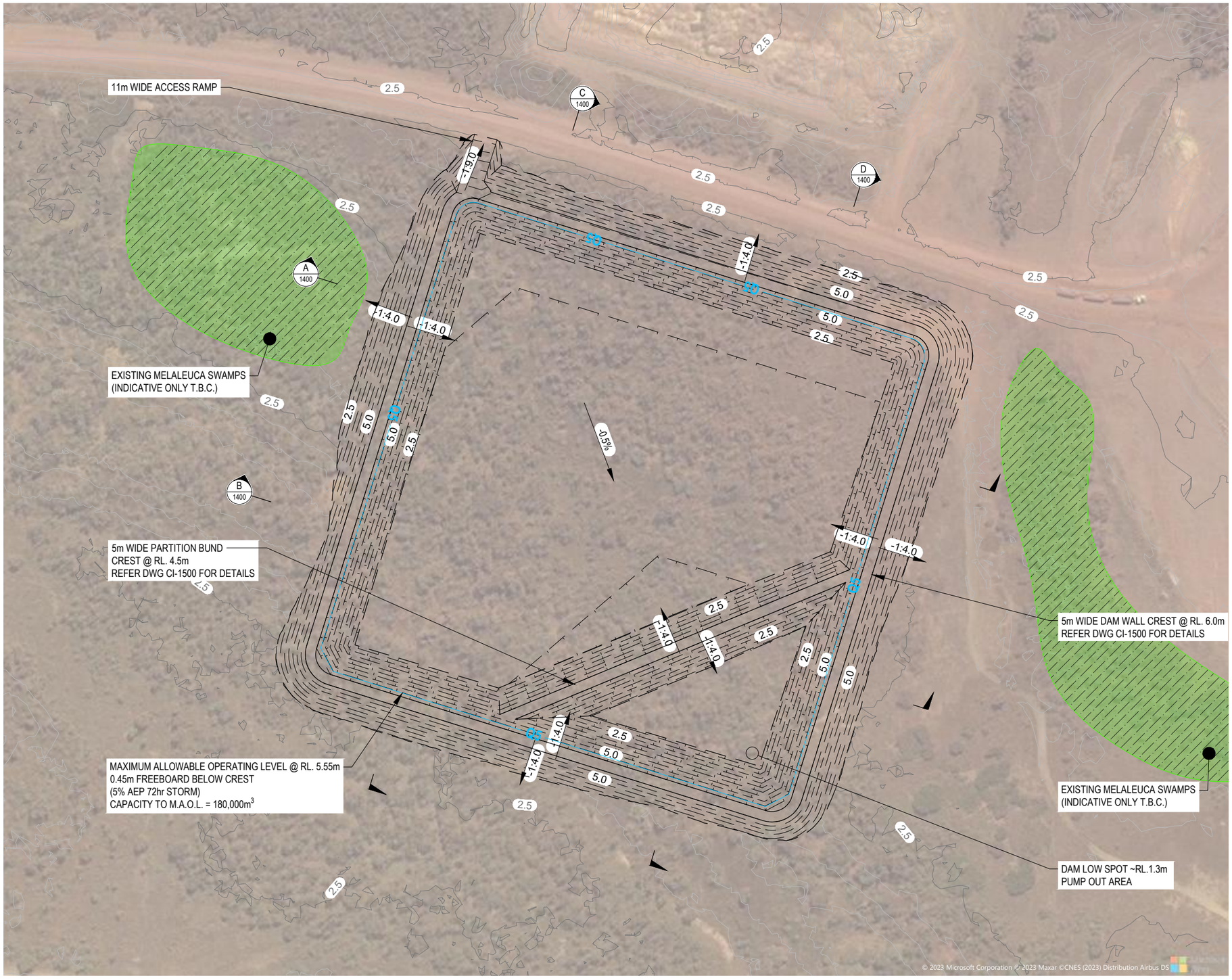

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LEGEND

- 2.5 — EXISTING GROUND CONTOURS (0.5m INTERVALS)
- EXISTING MELALEUCA SWAMPS
- 5.0 — DESIGN CONTOURS (0.5m INTERVALS)
- TOP OF BANK / DAM CREST
- BATTER TOE
- Q5 — MAXIMUM ALLOWABLE OPERATING LEVEL

GENERAL ARRANGEMENT PLAN

SCALE 1:2000

PLOT DATE 06-Oct-2023 12:55:59 PM

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	DATE	DESCRIPTION		APPROVED

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SCALE 1:2000

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DWG. CHECK:	AK	DATE:	03/10/23
DES. CHECK:	AK	DATE:	03/10/23
RESPONSIBLE PRINCIPAL SIGNATURE:	DANIELLE O'TOOLE	DATE:	03/10/23
RPEQ :			
RPEQ :			

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CLIENT: NRR

PROJECT: BING BONG FACILITY DREDGE POND
PRELIMINARY ENGINEERING DESIGN

DRAWING TITLE: GENERAL ARRANGEMENT PLAN

SIZE: A3

STATUS: PRELIMINARY
NOT TO BE USED
FOR CONSTRUCTION PURPOSES

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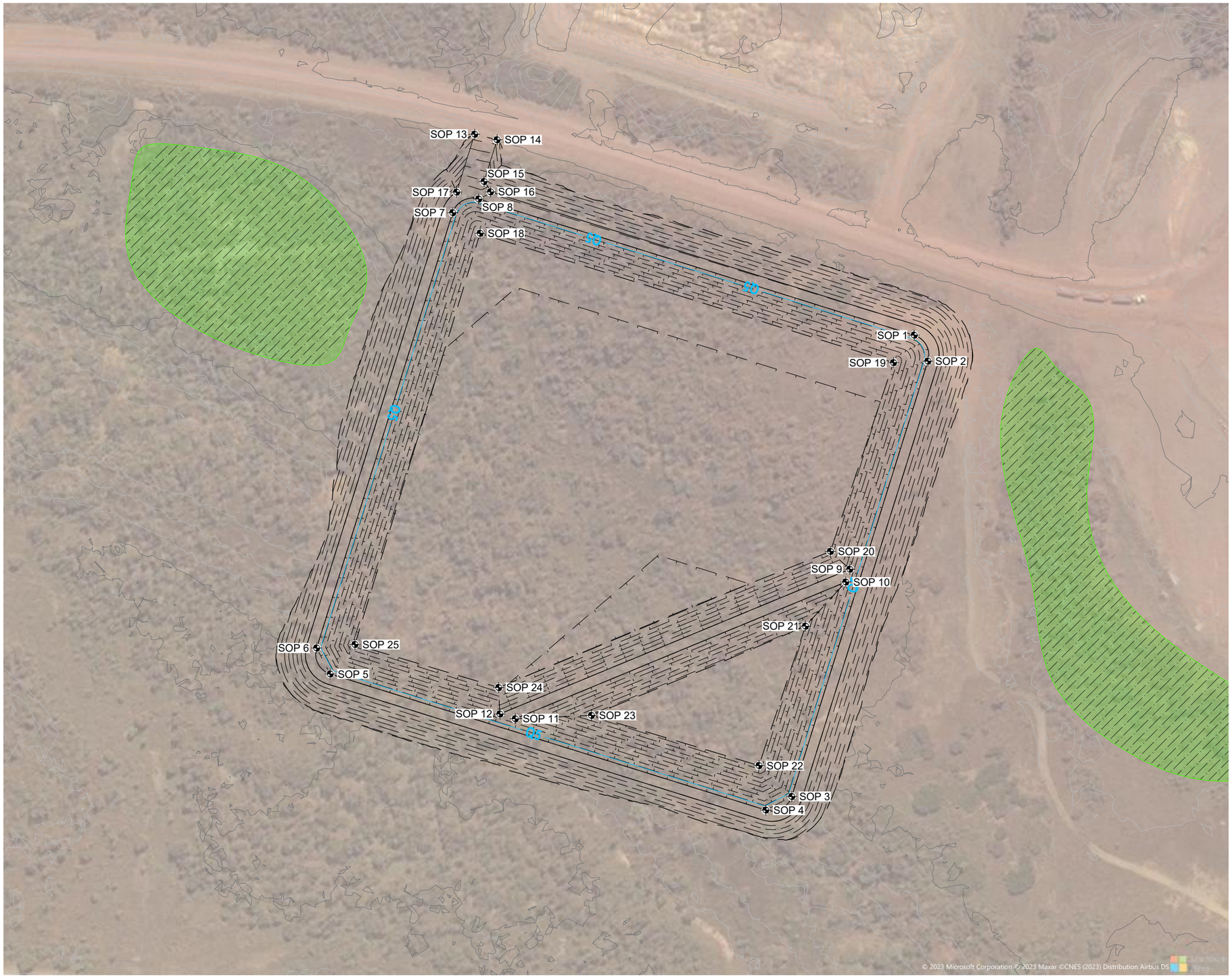

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SOP REF	EASTING	NORTHING	ELEVATION
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SOP 2	647,736.21	8,271,660.31	6.00
SOP 3	647,670.57	8,271,450.29	6.00
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SOP 10	647,696.62	8,271,553.75	4.50
SOP 11	647,537.21	8,271,487.78	4.50
SOP 12	647,529.76	8,271,490.11	4.50
SOP 13	647,517.61	8,271,769.77	2.70
SOP 14	647,528.42	8,271,767.10	2.75
SOP 15	647,522.14	8,271,746.95	5.04
SOP 16	647,525.26	8,271,741.96	5.91
SOP 17	647,508.89	8,271,741.85	6.00
SOP 18	647,520.22	8,271,722.00	2.11
SOP 19	647,719.64	8,271,659.61	2.10
SOP 20	647,689.21	8,271,568.52	1.63
SOP 21	647,677.17	8,271,532.47	1.44
SOP 22	647,654.78	8,271,465.20	1.12
SOP 23	647,573.94	8,271,489.42	1.37
SOP 24	647,529.19	8,271,502.83	1.51
SOP 25	647,459.84	8,271,523.61	1.72

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- 2.5 — EXISTING GROUND CONTOURS (0.5m INTERVALS)
- EXISTING MELALEUCA SWAMPS
- 5.0 — DESIGN CONTOURS (0.5m INTERVALS)
- TOP OF BANK / DAM CREST
- BATTER TOE
- Q5 — MAXIMUM ALLOWABLE OPERATING LEVEL

SETOUT PLAN

SCALE 1:2000

REVISIONS				
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	DATE	DESCRIPTION	APPROVED	

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SCALE 1:2000

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DESIGN: JM	DATE: 03/10/23	
DWG. CHECK: AK	DATE: 03/10/23	
DES. CHECK: AK	DATE: 03/10/23	
RESPONSIBLE PRINCIPAL SIGNATURE: DANIELLE O'TOOLE	DATE: 03/10/23	
RPEQ :		
RPEQ :		

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CLIENT: NRR

PROJECT: BING BONG FACILITY DREDGE POND PRELIMINARY ENGINEERING DESIGN

DRAWING TITLE: SETOUT PLAN

SIZE: A3

STATUS: PRELIMINARY NOT TO BE USED FOR CONSTRUCTION PURPOSES

SCALE: 1:2000

DATUM: GDA94 - Z53

DRAWING NUMBER: 623.030222-CI-1200

REVISION: A

PLOT DATE: 06-Oct-2023 12:56:10 PM

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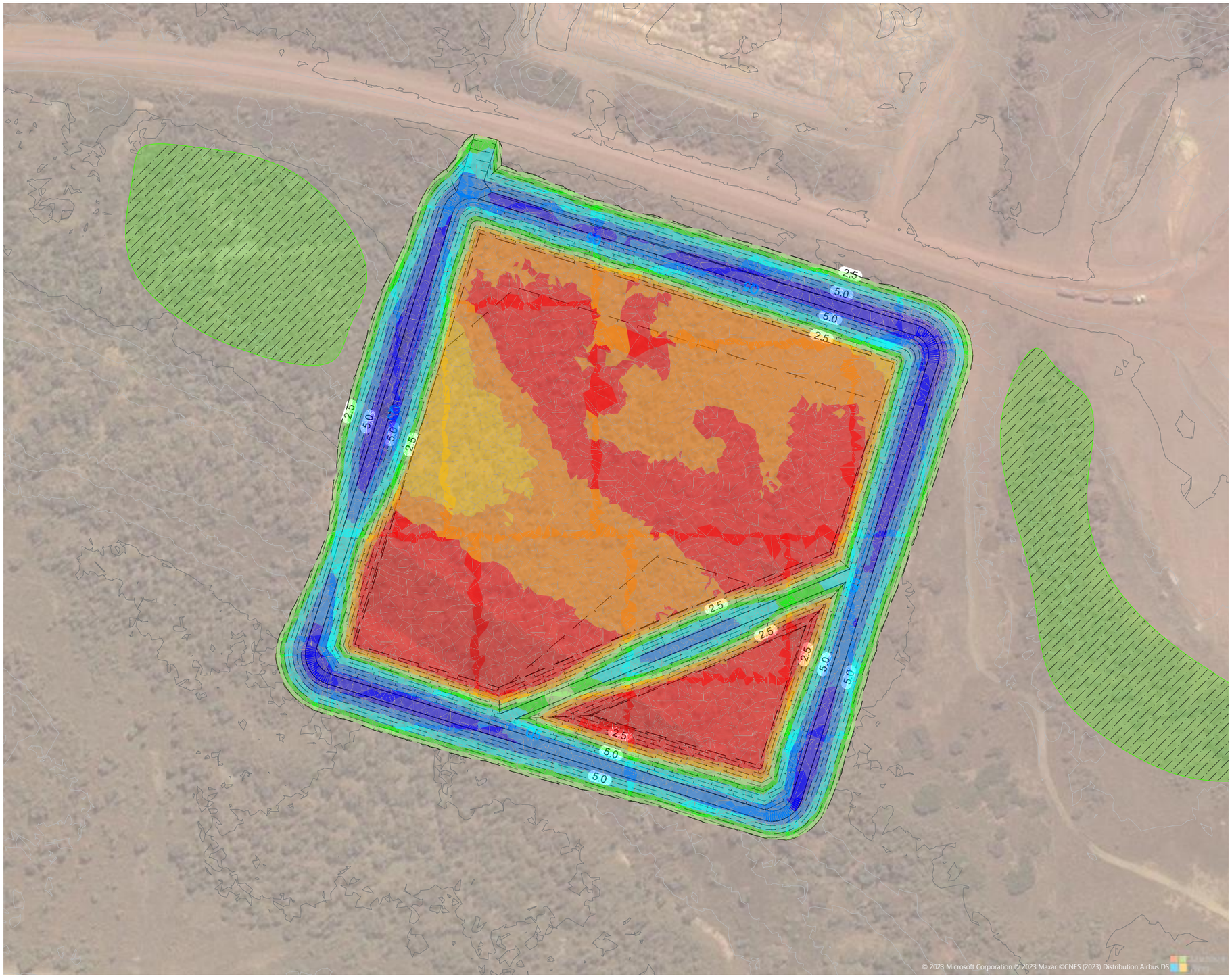

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LEGEND

- 2.5 — EXISTING GROUND CONTOURS (0.5m INTERVALS)
- EXISTING MELALEUCA SWAMPS
- 5.0 — DESIGN CONTOURS (0.5m INTERVALS)
- TOP OF BANK / DAM CREST
- BATTER TOE
- Q5 — MAXIMUM ALLOWABLE OPERATING LEVEL

EARTHWORKS DEPTHS				
NO.	MIN. EL.	MAX. EL.	AREA	COLOUR
1	-2.89m	-2.00m	4967.62m²	
2	-2.00m	-1.00m	18393.70m²	
3	-1.00m	-0.50m	16112.85m²	
4	-0.50m	0.00m	4317.51m²	
5	0.00m	0.50m	4412.59m²	
6	0.50m	1.00m	4501.52m²	
7	1.00m	2.00m	9250.58m²	
8	2.00m	3.00m	8572.24m²	
9	3.00m	4.00m	5307.29m²	
10	4.00m	4.13m	66.80m²	

EARTHWORKS VOLUMES	
2D FOOTPRINT AREA	75,900m^2
CUT VOLUME	47,525m^2
FILL VOLUME	57,125m^2

EARTHWORKS PLAN

SCALE 1:2000

PLOT DATE 06-Oct-2023 12:56:38 PM

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	DATE	DESCRIPTION	APPROVED	

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METRES

SCALE 1:2000

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DESIGN:	JM	DATE: 03/10/23
DWG. CHECK:	AK	DATE: 03/10/23
DES. CHECK:	AK	DATE: 03/10/23
RESPONSIBLE PRINCIPAL SIGNATURE:	DANIELLE O'TOOLE	DATE: 03/10/23
RPEQ :		
RPEQ :		

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CLIENT: NRR

PROJECT: BING BONG FACILITY DREDGE POND
PRELIMINARY ENGINEERING DESIGN

DRAWING TITLE: EARTHWORKS PLAN

SIZE: A3

STATUS: PRELIMINARY
NOT TO BE USED
FOR CONSTRUCTION PURPOSES

SCALE: 1:2000

DATUM: GDA94 - Z53

DRAWING NUMBER: 623.030222-CI-1300

REVISION: A

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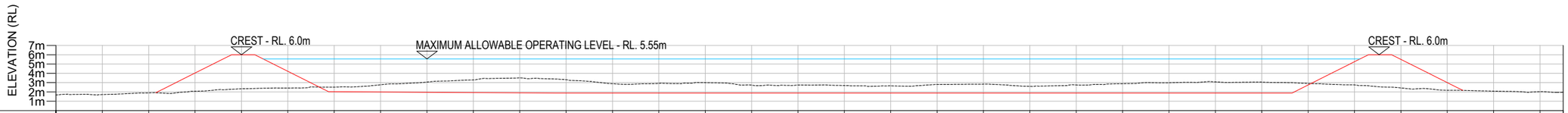

CHAINAGE (m)	DESIGN SURFACE (RLm)	ORIGINAL GROUND (RLm)	DEPTH (m)
10.00		1.72	
20.00		1.90	
30.00	4.03	2.08	1.95
40.00	6.00	2.34	3.66
50.00	4.22	2.42	1.80
60.00	2.02	2.52	-0.49
70.00	1.99	2.77	-0.77
80.00	1.96	3.06	-1.10
90.00	1.93	3.29	-1.36
100.00	1.90	3.51	-1.60
110.00	1.88	3.31	-1.43
120.00	1.88	2.88	-1.00
130.00	1.88	2.92	-1.04
140.00	1.88	2.99	-1.11
150.00	1.88	2.73	-0.85
160.00	1.88	2.73	-0.85
170.00	1.88	2.69	-0.81
180.00	1.88	2.65	-0.77
190.00	1.88	2.80	-0.92
200.00	1.88	2.84	-0.96
210.00	1.88	2.60	-0.71
220.00	1.88	2.75	-0.87
230.00	1.88	2.88	-1.00
240.00	1.88	2.98	-1.10
250.00	1.88	3.08	-1.20
260.00	1.88	3.05	-1.17
270.00	2.75	2.91	-0.16
280.00	5.25	2.76	2.49
290.00	5.50	2.43	3.07
300.00	3.00	2.18	0.82
310.00		2.09	
320.00		2.02	
325.00		1.96	

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SCALE - V 1:500
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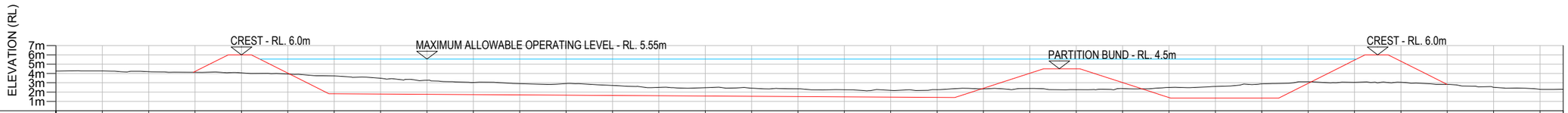

CHAINAGE (m)	DESIGN SURFACE (RLm)	ORIGINAL GROUND (RLm)	DEPTH (m)
10.00		4.27	
20.00		4.19	
30.00	4.22	4.12	0.09
40.00	6.00	4.06	1.94
50.00	4.03	3.94	0.10
60.00	1.82	3.73	-1.92
70.00	1.79	3.48	-1.70
80.00	1.76	3.27	-1.52
90.00	1.73	3.03	-1.30
100.00	1.70	2.91	-1.21
110.00	1.67	2.91	-1.25
120.00	1.64	2.71	-1.07
130.00	1.61	2.50	-0.89
140.00	1.58	2.47	-0.89
150.00	1.55	2.41	-0.86
160.00	1.52	2.35	-0.83
170.00	1.49	2.25	-0.76
180.00	1.46	2.18	-0.72
190.00	1.43	2.26	-0.84
200.00	2.41	2.33	0.08
210.00	4.02	2.38	1.64
220.00	4.50	2.26	2.24
230.00	3.01	2.38	0.64
240.00	1.41	2.49	-1.09
250.00	1.35	2.61	-1.26
260.00	1.35	2.88	-1.54
270.00	2.93	3.11	-0.17
280.00	5.43	3.05	2.39
290.00	5.32	3.05	2.27
300.00		2.82	
310.00		2.51	
320.00		2.30	
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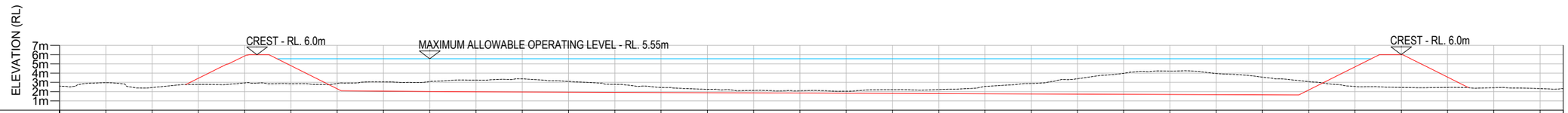

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20.00		2.44	
30.00	3.44	2.77	0.67
40.00	5.86	2.94	2.92
50.00	4.81	2.86	1.95
60.00	2.31	2.88	-0.57
70.00	2.05	3.05	-1.00
80.00	2.00	3.09	-1.09
90.00	1.97	3.24	-1.27
100.00	1.95	3.38	-1.43
110.00	1.93	3.10	-1.17
120.00	1.92	2.79	-0.87
130.00	1.90	2.45	-0.56
140.00	1.88	2.25	-0.37
150.00	1.86	2.13	-0.27
160.00	1.84	2.09	-0.25
170.00	1.82	2.04	-0.22
180.00	1.80	2.21	-0.41
190.00	1.79	2.22	-0.44
200.00	1.77	2.56	-0.79
210.00	1.75	2.88	-1.14
220.00	1.73	3.39	-1.66
230.00	1.71	3.97	-2.26
240.00	1.69	4.21	-2.52
250.00	1.67	3.96	-2.29
260.00	1.65	3.56	-1.91
270.00	2.18	3.08	-0.90
280.00	4.68	2.56	2.12
290.00	6.00	2.45	3.55
300.00	3.57	2.46	1.11
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SCALE - V 1:500
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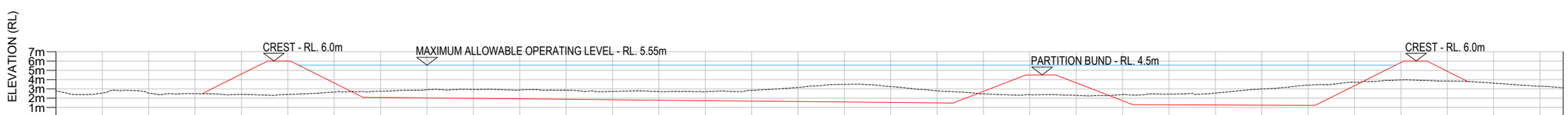

CHAINAGE (m)	DESIGN SURFACE (RLm)	ORIGINAL GROUND (RLm)	DEPTH (m)
10.00		2.55	
20.00		2.56	
30.00		2.49	
40.00	4.60	2.42	2.19
50.00	6.00	2.40	3.60
60.00	3.65	2.65	0.99
70.00	2.08	2.76	-0.68
80.00	2.03	2.91	-0.88
90.00	1.98	2.95	-0.96
100.00	1.93	2.89	-0.96
110.00	1.88	2.86	-0.98
120.00	1.84	2.73	-0.90
130.00	1.79	2.72	-0.93
140.00	1.74	2.70	-0.96
150.00	1.69	2.84	-1.16
160.00	1.64	3.15	-1.51
170.00	1.59	3.49	-1.90
180.00	1.54	3.25	-1.71
190.00	1.49	2.79	-1.30
200.00	2.74	2.47	0.27
210.00	4.50	2.37	2.13
220.00	3.66	2.30	1.36
230.00	1.74	2.40	-0.66
240.00	1.28	2.44	-1.16
250.00	1.27	2.56	-1.29
260.00	1.25	3.00	-1.75
270.00	1.23	3.40	-2.17
280.00	3.34	3.72	-0.38
290.00	5.84	3.96	1.88
300.00	4.91	3.84	1.07
310.00		3.62	
320.00		3.29	
325.00		3.12	

REVISIONS				
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	DATE	DESCRIPTION		APPROVED

PLOT DATE 06-Oct-2023 12:56:50 PM

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DESIGN:	JM	03/10/23
DWG. CHECK:	AK	03/10/23
DES. CHECK:	AK	03/10/23
RESPONSIBLE PRINCIPAL SIGNATURE:	DANIELLE O'TOOLE	03/10/23
RPEQ :		
RPEQ :		

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CLIENT: NRR

PROJECT: BING BONG FACILITY DREDGE POND
PRELIMINARY ENGINEERING DESIGN

DRAWING TITLE: CROSS SECTIONS

SIZE: A3

STATUS: PRELIMINARY
NOT TO BE USED
FOR CONSTRUCTION PURPOSES

SCALE: 1:500 & 1:1000

DATUM: GDA94 - Z53

DRAWING NUMBER: 623.030222-CI-1400

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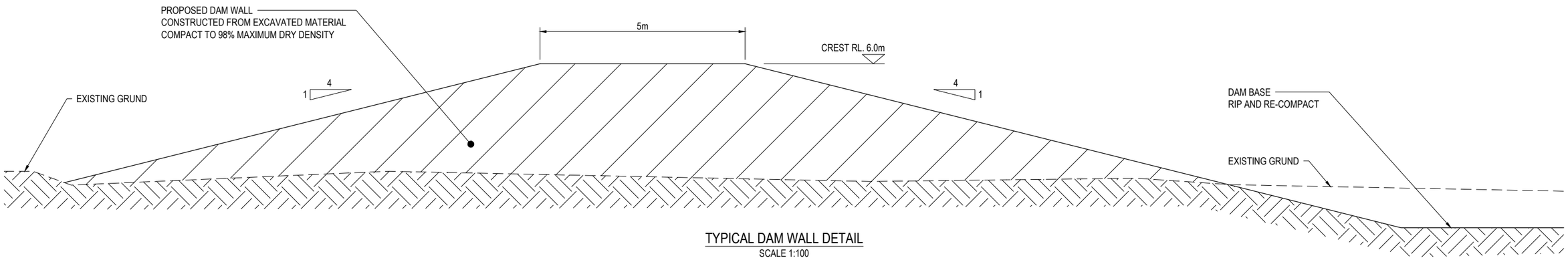

TYPICAL DAM WALL DETAIL
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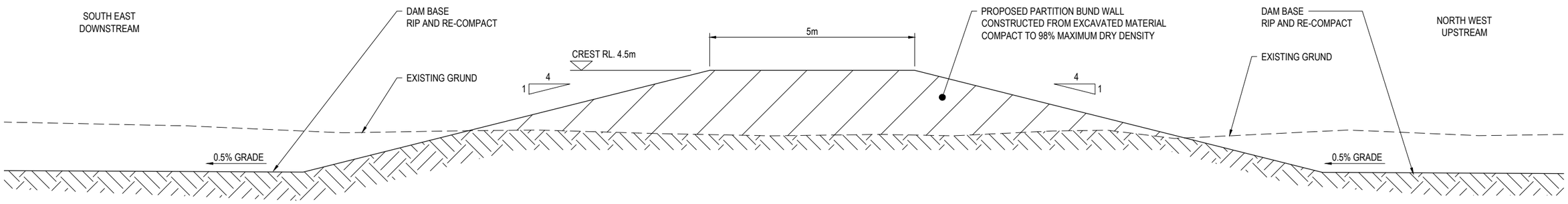

TYPICAL PARTITION BUND DETAIL
SCALE 1:100

PLOT DATE 06-Oct-2023 12:56:56 PM

REVISIONS				
	A	03/10/23	PRELIMINARY DESIGN ISSUE	DOT
		DATE	DESCRIPTION	APPROVED

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METRES
SCALE 1:100

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DESIGN: JM	DATE: 03/10/23	
DWG. CHECK: AK	DATE: 03/10/23	
DES. CHECK: AK	DATE: 03/10/23	
RESPONSIBLE PRINCIPAL SIGNATURE: DANIELLE O'TOOLE	DATE: 03/10/23	
RPEQ :		
RPEQ :		

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www.slrconsulting.com

CLIENT: NRR

PROJECT: BING BONG FACILITY DREDGE POND
PRELIMINARY ENGINEERING DESIGN

DRAWING TITLE: TYPICAL DETAILS

SIZE: A3

STATUS: PRELIMINARY
NOT TO BE USED
FOR CONSTRUCTION PURPOSES

SCALE: 1:100

DATUM: GDA94 - Z53

DRAWING NUMBER: 623.030222-CI-1500

REVISION: A

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Appendix B Environmental Mapping

Concept Design Report

Nathan River Resources Bing Bong Dredge Pond – Preliminary Engineering Design

NRR Equipment Pty Ltd

SLR Project No.: 623.030222.00001

6 October 2023

Bing Bong Sediment Pond Protected Matters

June 17, 2021

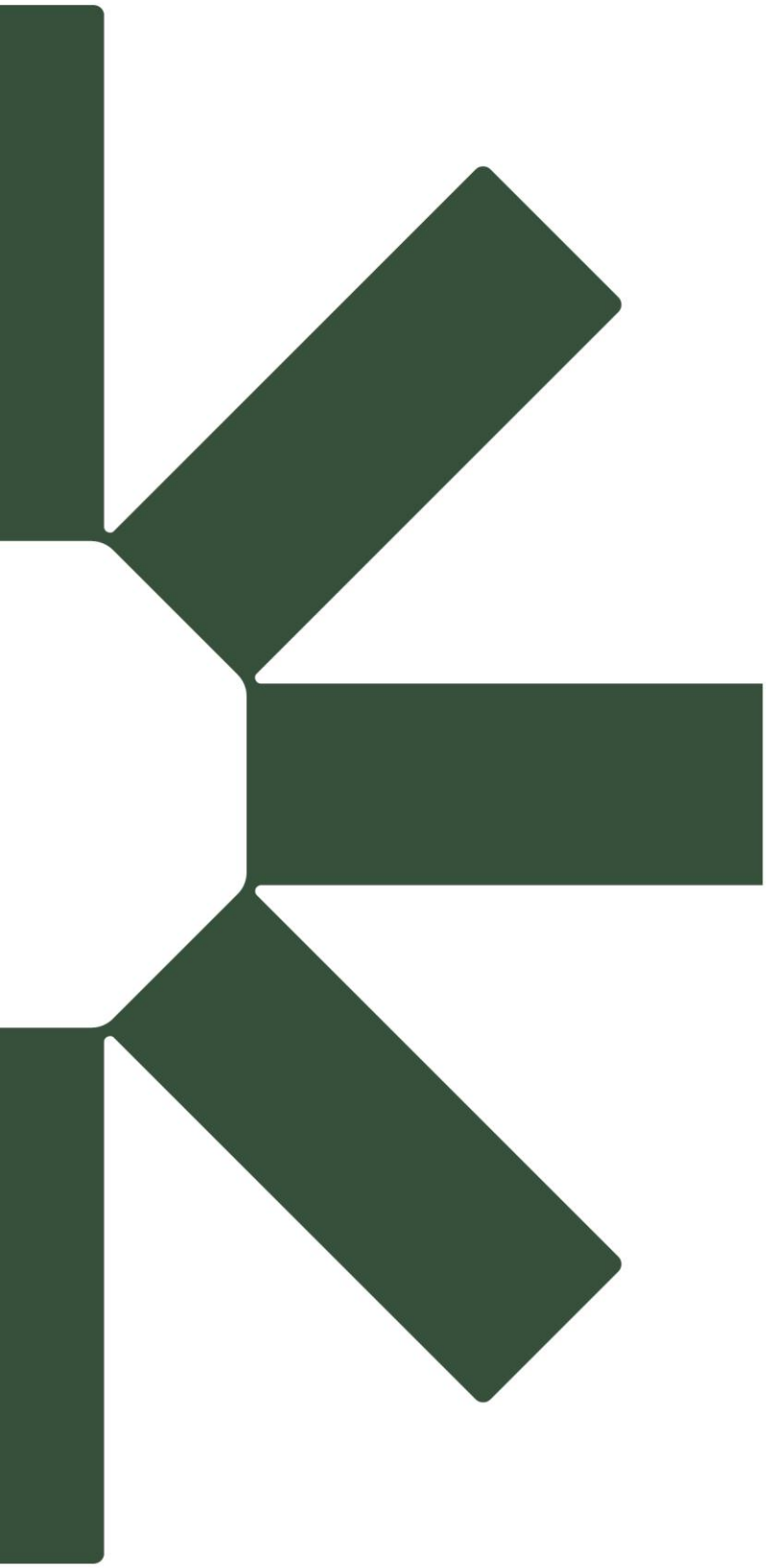
1:36,112

0 0.3 0.6 1.2 mi

0 0.5 1 2 km

- Protected Areas
- Ramsar Wetlands
- Nationally Important Wetlands
- Commonwealth Heritage Places
- World Heritage Properties
- National Heritage Places
- Regional Forest Agreements
- Natural Resource Management Regions
- Great Barrier Reef Marine Park

Map produced by the Department of Agriculture, Water and the Environment.



Making Sustainability Happen

APPENDIX B – NRP MARINE MANAGEMENT AND MONITORING PLAN

Nathan River Resources

MARINE MANAGEMENT AND MONITORING PLAN

(Sea Turtles, Dolphins and Dugongs)

NATHAN RIVER PROJECT

November 2019

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

This Marine Management and Monitoring Plan (MMMP) has been prepared to manage risks to significant marine species (including dugongs, sea turtles and dolphins) during ore transport activities associated with the operation of the Nathan River Project's Bing Bong Loading Facility (BBLF).

The Dugong is listed as migratory under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) and Near Threatened under the Northern Territory (NT) *Territory Parks and Wildlife Conservation Act* (TPWC Act). Dugongs are large marine mammals that forage as individuals or pairs on seagrasses. They inhabit sheltered coastal waters and estuaries where seagrasses form extensive colonies. Shallow waters, such as sand banks and estuaries are used for calving. Dugongs are highly mobile, moving daily with the tides and executing long migrations (100-600 km) in response to seasonal conditions. Potential seagrass beds are mapped within the BBLF region; therefore it is possible for the species to be affected by activities associated with the BBLF.

Six species of marine turtle inhabit the oceans and coastlines of northern Australia. These species vary in their habitat requirements, ranging from shallow coastal waters with sandy floors to coral reefs, seagrass beds and open and pelagic waters. Shallow, protected waters along coastlines with soft, sandy floors are used as shelter by all species and unimpeded access to suitable sandy beaches with limited or no light exposure is required for successful nesting. Islands off the coast of the Northern Territory are known to be important breeding and nesting sites for some species.

The six turtle species' status classification under EPBC Act and TPWC Act are as follows:

- Loggerhead - Endangered (EPBC Act) and Vulnerable (TPWC Act);
- Olive Ridley - Endangered (EPBC Act) and Vulnerable (TPWC Act);
- Green - Vulnerable (EPBC Act) and Near Threatened (TPWC Act);
- Hawksbill - Vulnerable (EPBC Act) and Vulnerable (TPWC Act);
- Flatback - Vulnerable (EPBC Act) and "Data Deficient" (TPWC Act); and
- Leatherback - Endangered (EPBC Act) and Critically Endangered (TPWC Act).

A National Turtle Nesting Area is located on West Island approximately 10km east of the BBLF; therefore it is possible for the species to be affected by proposed activities.

Coastal waters in northern Australia support ten species of dolphins:

- Australian Humpback Dolphin (*Sousa sahulensis*)–Migratory (EPBC Act) and Data Deficient (TPWC Act);
- Bottlenose Dolphin (*Tursiops truncatus*)–Least Concern (TPWC Act);
- Spotted Bottlenose Dolphin (*Tursiops aduncus*)–Least Concern (TPWC Act);
- Australian Snubfin Dolphin (*Orcaella heinsohni*)–Migratory (EPBC Act) and Data Deficient (TPWC Act);
- Killer Whale (*Orcinus orca*)–Migratory (EPBC Act) and Data Deficient (TPWC Act);
- False Killer Whale (*Pseudoica crassidens*)–Data Deficient (TPWC Act);
- Risso's Dolphin (*Grampus griseus*)–Data Deficient (TPWC Act);
- Spotted Dolphin (*Stenella attenuata*)–Data Deficient (TPWC Act);

- Spinner Dolphin (*Stenella longirostris*)–Migratory (EPBC Act) and Data Deficient (TPWC Act); and
- Melon-headed Whale (*Peponocephala electra*)–Data Deficient (TPWC Act).

Habitats vary between species but may include open water, estuaries and shallow coastal waters around offshore islands and the mainland. Australian Humpback Dolphins, Bottlenose Dolphins and Australian Snubfin Dolphins frequently utilise waters within 20 km of the coast. All ten species are protected as cetaceans under the EPBC Act, and four are further protected as migratory species under the EPBC Act. Most of these species of dolphin are listed as Data Deficient under the TPWC Act.

Eight potential operation-related impacts/hazards on these marine species have been identified, including:

- Water and sediment quality and the related impacts on habitat quality;
- Direct mortality from marine vessel strikes;
- Acoustic pollution and disturbance;
- Introduction of invasive marine species;
- Introduction of rubbish/waste;
- Light pollution;
- Exclusion from access to important habitat during critical life history stages; and
- Disease and loss of fitness.

The likelihood and potential consequences of each potential impact, once mitigation measures were accounted for, were assessed in accordance with standard risk assessment and management methodologies. The risk assessment identified a low to medium residual risk to marine species for each of the potential impacts identified.

An extensive suite of management and mitigation measures (controls) is provided to specifically address each of these operational related impacts/hazards. Some of these key controls, in terms of their likely effectiveness on managing high inherent risks, medium residual risks and/or addressing multiple risks, include:

- Marine fauna observations;
- BBLF operating procedures (including reporting of stranded marine megafauna); and
- Vessel operating procedures (including speed restrictions and compliance with pre-determined transit routes).

By applying these management measures, NRR aims to meet the following performance targets:

- Compliance with existing regulatory obligations including NT Department of Primary Industry and Resources (DPIR) Authorisation No. 0965-01 and Commonwealth EPBC Approval No. EPBC 2012/6242;
- Minimisation of any potential impacts to marine fauna as far as reasonably practicable; and
- Compliance with NRR's Environment Policy, which includes the intent of preventing negative impact on the environment and the community.

1. INTRODUCTION

1.1 Overview and Scope

This Marine Management and Monitoring Plan (MMMP) has been developed in response to Recommendation 10 of NT EPA's Assessment Report 70, and is designed to manage potential risks to marine megafauna (including the dugong, sea turtle and dolphin) during ore transport activities associated with the operation of the Nathan River Project's Bing Bong Loading Facility (BBLF). In developing this MMMP, NRR Services Pty Ltd (NRR) has also taken into consideration the relevant Commonwealth EPBC Approval conditions relating to the operation of the BBLF including marine vessel speed restrictions and regulatory reporting requirements in the event of any injury to, or mortality of, marine fauna.

This MMMP provides information about the ecology of the dugong, sea turtles and dolphins, identifies the potential impacts that may occur in the context of the operation of the BBLF and proposes management and monitoring strategies to mitigate the potential impacts identified.

This MMMP has been developed as a supporting document to NRR's 2018-2019 MMP and forms part of NRR's overall Environmental Management System (EMS).

1.2 Previous Work Completed

A number of previous BBLF marine risk assessments have been undertaken by the original Project proponent (Western Desert Resources (WDR)) including:

- Initial risk assessments as part of the 2012 Roper Bar Iron Ore Project Environmental Impact Statement (EIS); and
- A series of subsequent BBLF marine risk workshops (conducted in 2013), which included a more detailed identification and assessment of the Project's marine risks.

Refer to Section 9 and 10 below for a summary of the 2013 marine risk assessment work including risk identification and assessment outcomes, and proposed management, mitigation and monitoring controls. Note that this 2013 assessment was based on an expanded Project scope compared to that proposed by NRR in 2019-2020 including consideration of:

- BBLF construction-related risks, whereas NRR risks will be related to operational activities only; and
- An operational intensity of up to 3 million tonnes per annum (Mtpa) of direct-shipping ore (DSO) being barged/shipped from the BBLF, whereas NRR's proposed barging/shipping intensity will be a nominated 1 Mt over the period of the Mining Management Plan (MMP), which is one half to one third the intensity of the activities that the WDR risk assessment assessed.

2. PROJECT DESCRIPTION

2.1 Overview

NRR operates an existing loadout facility at Bing Bong and has previously received DPIR authorisation (Authorisation No. 0965-01) to undertake Stage 1 activities (as defined in Schedule 1 of Authorisation No. 0965-01), including the transfer of minerals to barges. With the approval of Stage 2 activities (as defined in the 2018-2019 MMP), which include the recommencement of mining activities at the Roper Bar mine, there will be an increase in ore transport, and an associated increase in the number of barge movements between the BBLF and the offshore ore carriers. The mooring locations of the ore carriers are shown in **Figure 2-1.** These are located approximately 18 nautical miles offshore, at a water depth of approximately 12 m.

2.2 Location

NRR's BBLF is located adjacent to McArthur River Mine's existing load-out facility, which has operated on the site since the mid-1990s. The facility services the McArthur River Mine (situated approximately 100 km to the south) and is located on the south-western coast of the Gulf of Carpentaria. Therefore, there is existing marine traffic operating from the area.

Refer to Figure 2-1 for location details**.**

S:\Projects\BM001 Nathan River_MapInfo\Workspaces\MMMP\BM001_MMMP_Fig01_BingBong_A.wor

METSERVE
Mining & Energy Technical Services Pty Ltd

LEGEND

- Approximate Transhipment Anchorage Location
- Mining Lease

Data Source: Nathan River Resources (2018); Imagery - ESRI, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

Nathan River
Marine Management and Monitoring Plan

Bing Bong Loading Facility

150 0 150 300
Metres

Scale: 1:8,000 (A3)

29/11/2019

Datum: GDA94
Projection: MGA53

Figure 2-1

3. PURPOSE OF THE MARINE MANAGEMENT AND MONITORING PLAN

The purpose of this MMMP includes:

a). To comply with regulatory approval conditions including:

- NT DPIR Authorisation No. 0965-01, and specifically Schedule 1 Condition 19 (Marine Management and Monitoring), which states:
  - Vessels must not exceed a speed of 6 knots unless operating in the dredged channel and swing basin;
  - Vessels must not exceed a speed of 4 knots within the dredged channel and swing basin;
  - Any injury to, or mortality of, marine megafauna must be reported to the Minister [of Primary Industry and Resources] within one business day; and
  - Sightings and interactions with marine megafauna must be recorded. Records must include the type of marine megafauna, genus and species (if discernible), time, date, location and any action taken to avoid collisions with the megafauna.
- Commonwealth EPBC Approval No. EPBC 2012/6242, and specifically:
  - Condition 19 – "To protect marine turtles, dugong (Dugong dugon) and in-shore dolphins, vessels must not exceed a speed of 6 knots, unless otherwise stated";
  - Condition 20 – "Within the dredged channel and swing basin of the Port of Bing Bong vessels must not exceed a speed of 4 knots"; and
  - Condition 21 – "Any injury to, or mortality of, marine turtles, dugong (Dugong dugon) or in-shore dolphins must be reported to the [Australian Government Minister for the Environment] within one business day".

b). To provide NRR with sufficient controls and management strategies to minimise any potential impacts to marine fauna environmental values as far as reasonably practicable; and

c). To comply with NRR's Environment Policy, which includes the intent of preventing negative impact on the environment and the community.

To achieve this, the MMMP has drawn on the findings of:

- The WDR Roper Bar Iron Ore Project EIS, which was approved by the NT Government in 2012; and
- The WDR Roper Bar Iron Ore Project BBLF Marine Risk Workshops, undertaken in 2013.

Further to the above, this MMMP provides a management framework including:

- Roles and responsibilities;
- Monitoring requirements; and
- Auditing and reporting requirements.

4. ENVIRONMENTAL MANAGEMENT ROLES AND RESPONSIBILITIES

The number of employees working at the BBLF will vary according to the level of activity at the time, as follows:

- 20 land-based personnel during ship loading activities;;
- Three tugs with six crew each (total of 18 personnel) during ship loading activities; and
- When there are no shop loading activities occurring the marine crew is demobilised plus a portion of the land-based crew, with approximately 10 employees reaming on the BBLF site;

4.1 Marine Superintendent

A dedicated Marine Superintendent will be based on the site, reporting directly to the NRR CEO. The Marine Superintendent will be responsible for the implementation of the BBLF MMMP. To maximise the effective implementation of the MMMP, the Marine Superintendent will be responsible for:

- Providing resources and equipment to meet objectives;
- Initiating reviews of the MMMP when required;
- Reporting non-compliances;
- Reporting environmental incidents;
- Implementing monitoring plans;
- Maintaining site records; and
- Daily/monthly reporting.

The Marine Superintendent will also be responsible for identifying training needs so that all BBLF personnel receive an appropriate level of training to understand and implement the requirements of the MMMP. To achieve this, they will use a combination of training and communication tools including:

- Site induction: this will provide staff with an understanding of the environmental values of the site, the MMMP framework and a general overview of the objectives of the MMMP. The induction will provide staff with an understanding of their general environmental duty, incident reporting requirements and required standards of environmental performance.
- Toolbox talks: the toolbox talks will communicate specific aspects of the MMMP relevant to the activities being undertaken that day. They will inform the operational methodology and provide staff with appropriate management strategies to manage potential environmental impacts.
- Reference hard copies of the MMMP available in the main office.

4.2 Personnel

All staff have a general environmental duty as outlined in Section 12 of the WMPC Act 1998. This means that all staff are responsible for the actions they take that affect the environment.
Staff will be responsible for:

- Carrying out environmental management activities (including routine inspections) as directed by the Marine Superintendent;
- Routine vessel servicing and inspections;

- Observing and informing the Marine Superintendent regarding general environmental performance of the BBLF;
- Notifying the Marine Superintendent of any environmental incidents;
- Notifying the Marine Superintendent of any sightings of marine megafauna;
- Notifying the Marine Superintendent of any non-conformances; and
- Participating in induction processes and daily tool box talks to build a suitable understanding of site environmental values.

5. REPORTING

Reporting will consist of both internal and external reports. Internal reports will make up the majority of the reporting requirements and include daily and monthly reporting.

External reports will be required as a condition of approval, at the specific request of a key stakeholder, or after a notifiable environmental incident.

5.1 Required Reports

5.1.1 Marine Fauna Sighting Logbook

All staff have a responsibility, under Schedule 1 Condition 19 of NT DPIR Authorisation No. 0965-01, to report sightings of marine megafauna (dugongs, turtles and dolphins). These sightings are to be entered into a Marine Fauna Sighting Logbook, which has a format as shown in Table 5-1.

Table 5-1 Template for the Marine Fauna Sighting Logbook

Date	Time	Location (lat, long)	Species	No.	Actions taken to avoid collision	Was there an incident (Y/N)*

*In the event of an incident, an Incident Report is to be prepared by the Marine Superintendent

All columns of the logbook must be filled in for each fauna sighting. If the species is not known, identify to group (turtle, dugong and/or dolphin) or genus where possible. The sighting must be entered by the observer before the end of the work shift during which the sighting was made. The Marine Superintendent is responsible for entering the contents of the logbook into a digital version on at least a monthly basis.

5.1.2 Incident reports

In the event of an injury or death of marine megafauna, the Marine Superintendent is to be informed immediately. An incident report is to be prepared by the Marine Superintendent, in consultation with staff members involved in the incident. This report is to include the same details as are to be entered into the Marine Fauna Sighting Logbook, in addition to further details about the nature of the incident, the actions taken in an attempt to avoid the incident, and possible actions that could be taken in the future to avoid other such incidents.

The Marine Superintendent is to prepare the Incident Report on the day the incident occurred and, within 24 hours of the incident, inform the NT Minister of Primary Industry and Resources AND the Australian Government Minister for the Environment. This will be undertaken in accordance with NRR's incident reporting process, as described in Section 9.2.2 of the EMS.

All incidents are to be entered by the Marine Superintendent into an Incident Register.

5.1.3 Non-compliance Reports

Non-conformance incidents will be documented in accordance with NRR's Incident Reporting Procedure.

5.1.4 MMMP Audit Report

Audits of this MMMP will be undertaken annually or in accordance with specific regulatory approval conditions.

5.2 Document Control

NRR have a document control system for the implementation of the MMMP during the operation of the BBLF and the trans-shipment.

This MMMP and the Marine Fauna Sighting Logbook template are to be managed by the NRR Managing Director. No other staff are authorised to make changes to these documents.

Hard copies of the MMMP will be kept onsite. It is the responsibility of the Marine Superintendent to ensure that the latest version is being implemented.

6. ENVIRONMENTAL TRAINING

Environmental training will be facilitated through site inductions and tool box talks. The site induction will be provided to all staff and include the following:

- Identification of site environmental values;
- An understanding of the requirements of this MMMP;
- Roles and responsibilities of site personnel;
- Environmental emergency response procedures;
- Site environmental controls;
- Environmental incident identification and response; and
- The potential consequences (for both NRR and individuals) of not meeting environmental obligations/responsibilities.

7. EMERGENCY CONTACTS AND PROCEDURES

Emergency contacts and procedures are found in the following NRR documents:

- Plan of Operations;
- Health and Safety Management Plan; and
- Emergency Response Plan.

Where required, specialist advice will be sought from recognised marine fauna specialists.

7.1 Animal Sightings

In the event that marine megafauna are sighted, the observer should:

1) Record the time and location of the sighting;
2) Take measures to avoid collision with the fauna; and
3) Notify the Marine Superintendent.

The Marine Superintendent is then to enter details of the sighting into the Marine Fauna Sighting Logbook (see **Section 5.1.1**).

7.2 Animal Injuries

In the event that an animal is injured, tangled or otherwise in need of assistance, the observer is to immediately notify the Marine Superintendent, and the Marine Superintendent is to call the Northern Territory Marine Wildwatch hotline (1800 453 941) to seek advice on appropriate action. Under the guidance of the Marine Wildwatch experts, a rescue attempt may be deemed appropriate.

Following any emergency rescue attempts, the Marine Superintendent is to prepare an Incident Report in consultation with staff members involved in the incident (see **Section 5.1.2**). The Marine Superintendent is to prepare the Incident Report on the day the incident occurred and, within 24 hours of the incident, inform the NT Minister of Primary Industry and Resources AND the Australian Government Minister for the Environment.

All incidents are to be entered by the Marine Superintendent into an Incident Register.

7.3 Animal Mortalities

The Marine Superintendent is to be immediately notified of any deaths of marine megafauna. The Marine Superintendent is to prepare an Incident Report in consultation with staff members involved in the incident (see **Section 5.1.2**). The Marine Superintendent is to prepare the Incident Report on the day the incident occurred and, within 24 hours of the incident, inform the NT Minister of Primary Industry and Resources AND the Australian Government Minister for the Environment.

All incidents are to be entered by the Marine Superintendent into an Incident Register.

8. ENVIRONMENTAL VALUES

The following sub-sections provide details on identified environmental values relating to marine megafauna. The identification of these values will enable NRR to develop specific:

- Management measures, with the objective of minimising any potential impacts to such values as far as reasonably practicable; and
- Monitoring measures, designed to monitor the effectiveness of the management measures in achieving the set objective.

8.1 Dugongs

The Dugong is listed as migratory under the EPBC Act and Near Threatened under the TPWC Act. Dugongs are large marine mammals that forage as individuals or pairs on seagrasses. They inhabit sheltered coastal waters and estuaries where seagrasses form extensive colonies. Shallow waters, such as sand banks and estuaries are used for calving.

Dugongs are highly mobile, and move constantly in a search of seagrass beds and warm waters (Marsh *et al.* 2002). They move daily with the tides and can execute long migrations (100-600 km) in response to seasonal conditions (Gales *et al.* 2004; Marsh *et al.* 2002). Such migrations are more common in southern waters, where cool sea temperatures may make shallow waters less favourable for Dugongs in winter. In contrast to southern populations, Dugongs in the Gulf of Carpentaria do not exhibit major seasonal changes in distribution or abundance (Bayliss and Freeland 1989). Dugongs tend to move on from any one foraging area after five or six days, when 30% of the area has been grazed (Anderson and Birtles 1978).

Potential seagrass beds are mapped within the BBLF region; therefore it is possible for the species to be affected by activities associated with the BBLF.

8.2 Marine Turtles

Six species of marine turtle inhabit the oceans and coastlines of northern Australia. These species vary in their habitat requirements, ranging from shallow coastal waters with sandy floors to coral reefs, seagrass beds and open and pelagic waters. Shallow, protected waters along coastlines with soft, sandy floors are used as shelter by all species and unimpeded access to suitable sandy beaches with limited or no light exposure is required for successful nesting. Islands off the coast of the Northern Territory are known to be important breeding and nesting sites for some species.

The six turtle species' status classification under the EPBC Act and TPWC Act are as follows:

- Loggerhead (*Caretta caretta*) - Endangered (EPBC Act) and Vulnerable (TPWC Act);
- Olive Ridley (*Lepidochelys olivacea*) - Endangered (EPBC Act) and Vulnerable (TPWC Act);
- Green (*Chelonia mydas*) - Vulnerable (EPBC Act) and Near Threatened (TPWC Act);
- Hawksbill (*Eretmochelys imbricata*) - Vulnerable (EPBC Act) and Vulnerable (TPWC Act);
- Flatback (*Natator depressus*) - Vulnerable (EPBC Act) and "Data Deficient" (TPWC Act); and
- Leatherback (*Dermochelys coriacea*) - Endangered (EPBC Act) and Critically Endangered (TPWC Act).

A National Turtle Nesting Area is located on West Island approximately 10km east of the BBLF; therefore it is possible for the species to be affected by proposed activities.

8.3 Dolphins

Coastal waters in northern Australia support ten species of dolphins:

- Australian Humpback Dolphin (*Sousa sahulensis*) - Migratory (EPBC Act) and Data Deficient (TPWC Act);
- Bottlenose Dolphin (*Tursiops truncatus*) – Least Concern (TPWC Act);
- Spotted Bottlenose Dolphin (*Tursiops aduncus*) – Least Concern (TPWC Act);
- Australian Snubfin Dolphin (*Orcaella heinsohni*) – Migratory (EPBC Act) and Data Deficient (TPWC Act);
- Killer Whale (*Orcinus orca*) – Migratory (EPBC Act) and Data Deficient (TPWC Act);
- False Killer Whale (*Pseudoica crassidens*) – Data Deficient (TPWC Act);
- Risso's Dolphin (*Grampus griseus*) – Data Deficient (TPWC Act);
- Spotted Dolphin (*Stenella attenuata*) – Data Deficient (TPWC Act);
- Spinner Dolphin (*Stenella longirostris*) – Migratory (EPBC Act) and Data Deficient (TPWC Act); and
- Melon-headed Whale (*Peponocephala electra*) - Data Deficient (TPWC Act).

Habitats vary between species but may include open water, estuaries and shallow coastal waters around offshore islands and the mainland. Australian Humpback Dolphins, Bottlenose Dolphins and Australian Snubfin Dolphins frequently utilise waters within 20 km of the coast, and are the most likely cetaceans to be affected by the project. All of the ten species are protected as cetaceans under the EPBC Act, and four are further protected as migratory species under the EPBC Act. Most of these species of dolphins are listed as Data Deficient under the TPWC Act.

9. RISK IDENTIFICATION AND ASSESSMENT

9.1 Overview

A series of specialist panel marine risk workshops was conducted in 2013 by the original Project proponent (WDR). These workshops were held in Darwin and drew on the initial findings of the Roper Bar Iron Ore Project EIS as well as the knowledge and experience of the workshop participants. These participants comprised a cross-section of marine specialists from a number of organisations including:

- NT Environment Protection Authority;
- James Cook University;
- Charles Darwin University;
- NT Department of Land and Resource Management;
- Western Australia Department of Environment and Conservation;
- Monoora Marine Consultants; and
- GHD Consultants.

The workshops reviewed the original marine risks as identified in the EIS and further developed the Project's marine risk profile including identifying and assessing specific construction- and operations-phase risks as well as documenting management and monitoring measures in order to reduce the risks to acceptable levels.

As mentioned in Section 1.2 above, this 2013 assessment was based on a larger Project scope than that proposed by NRR in 2019-2020 and included consideration of:

- BBLF construction-related risks, whereas NRR risks will be related to operational activities only; and
- An operational intensity of up to 3 Mtpa of DSO being barged/shipped from the BBLF, whereas NRR's proposed barging/shipping intensity will be a nominated 1-1.5 Mtpa over the period of the MMP which is significantly less than the intensity of the activities (including barge trips) that the WDR risk assessment assessed.

9.2 Risk Identification

Risk is defined as the combined likelihood and consequence of a hazard occurring. Therefore, the first step in the risk assessment process was to identify the hazards that could potentially impact on marine species.

Eight such hazards were identified, either through degradation of habitat quality or via direct species impacts. These included:

- Reduced water and sediment quality;
- Direct mortality from marine vessel strikes;
- Acoustic pollution and disturbance;
- Introduction of invasive marine species;
- Introduction of rubbish/waste;
- Light pollution;
- Exclusion from access to important habitat during critical life history stages; and
- Disease and loss of fitness.

9.3 Risk Assessment

The risk assessment process was conducted in accordance with standard risk assessment and management methodologies including:

- AS/NZS ISO 31000:2009: Risk management - Principles and Guidelines (Standard);
- HB 203:2006: Environmental risk management - Principles and process (Guide); and
- HB 158:2010: Delivering assurance based on ISO 31000:2009 - Risk management - Principles and Guidelines (Guide).

9.3.1 Risk Framework

Each of the eight hazards identified in Section 9.2 above was analysed for likelihood and consequence and a risk ranking was developed for the inherent value.

9.3.1.1 Consequence Ratings

The following Consequence ratings were adopted. Note that these include environment, health and safety (to people) and financial consequence definitions. Some of the health and safety and financial definitions below may not be directly applicable to marine fauna.

Consequences		
1	Insignificant	No measurable impact on the environment. No injuries. Low-nil financial loss.
2	Minor	Minor, temporary environmental impact. No publicity likely and no stakeholder concerns. First aid treatment required. Medium-low financial loss.
3	Moderate	Substantial temporary or permanent minor, localised environmental damage. Stakeholder enquires (this may include government, unions or public). Medical attention required. High-medium financial loss.
4	Major	Substantial or permanent environmental damage. Prosecution possible. Loss of company credibility and high stakeholder interest. Permanent injuries. High financial loss.
5	Catastrophic	Widespread severe and permanent Environmental damage. Major stakeholder and media interest. Prosecution likely. Permanent injury or death. Extreme financial loss.

9.3.1.2 Likelihood Ratings

The following Likelihood ratings were adopted:

Probability/Likelihood			**Likelihood Criteria**
A	Rare	Practically impossible, will only occur in exceptional circumstances. Has never occurred in the industry.	0-1%
B	Unlikely	Could occur at some time but highly unlikely. Has occurred in the industry previously.	2-10%
C	Moderate	Might occur at some time. Has occurred previously in other companies associated with the same industry.	11-50%
D	Likely	Known to occur or will probably occur in most circumstances. Has occurred several times/year in other companies associated with the same industry.	51-90%
E	Almost Certain	Common or repeating occurrence. Is expected to occur several times/year in other companies associated with the same industry.	91-100%

9.3.1.3 Risk Ratings Matrix

The following risk ratings matrix was adopted:

		Consequence				
Likelihood		1	2	3	4	5
	A	1	3	6	10	15
	B	2	5	9	14	19
	C	4	8	13	18	22
	D	7	12	17	21	24
	E	11	18	20	23	25

Where:

Red = Extreme risk (Intolerable)

Orange = High risk (Intolerable or tolerable)

Yellow = Medium risk (Tolerable or acceptable)

Green = Low risk (Acceptable)

9.3.2 Risk Rating Outcomes

Table 9-1 summarises the outcomes of the risk assessment process (as it applies to marine biodiversity) for operational activities at the BBLF. As mentioned in Section 9.1, this assessment was based on a larger Project scope than that proposed by NRR in 2018-2019. Therefore, the below risk scores could be considered conservative (i.e., elevated compared to NRR's proposed scale of activity).

Table 9-1 Marine Biodiversity Risk Register

Aspect	Potential Hazard/Impact	Inherent Risk Score	Management Measures	Residual Risk Score
Habitat Quality	Spills from the loading and transporting of the ore, leading to: • Habitat smothering; and/or • Increase in turbidity.	M	• Dust control measures in accordance with Air Quality Management Plan; • Transfer stations and the barge loading and refuelling area will be fully enclosed and sheeted, with floors of transfer stations fully sealed and bunded; • Barge loading conveyors will be designed and constructed to relevant Australian Standards; • Visual inspection of berth decks for cracks or seal damage will be undertaken routinely; • BBLF procedures document and loading method statements stipulate that, during periods of heavy precipitation, operation will cease (emergency response see cyclone procedures) • Routine visual inspections to permit loads to be fully contained and avoid material spillage during loading, at both the loading facility and the transhipment anchorages	L

Aspect	Potential Hazard/Impact	Inherent Risk Score	Management Measures	Residual Risk Score
Habitat Quality	Spills (hydrocarbon) caused by grounding of the tug/barge or during refuelling activities, leading to: • Smothering of sea grass benthic/sessile organisms; • Impacts to mucous membranes of sensitive marine fauna; and/or • Impacts on Turtle nesting beaches.	M	• Fuel will be stored at the barge facility (2 x 45,000 L) – self bunded, 30 metres from the tug wharf; • Transfer stations and refuelling area will be fully enclosed and sheeted, with floors of transfer stations fully sealed and bunded; • The fuel pipeline will have an automatic cut-off valve to prevent large spills; • No refuelling will be undertaken during inclement weather conditions to minimise chance of a spill; • Standard operating procedures including appropriate training, visual monitoring of hoses and the sea surface, initial shutdown, and spill response procedures will be implemented; • Twice daily servicing and inspection of vessels and machinery to identify and address any leaks or other problems; • An emergency response plan has been developed and equipment supplied to deal with any spill that occurs including fuel handling and storage procedures; • Oil spill kits of sufficient capacity including booms and absorption materials will be on-board tugs/barges at all times, with a spill kit emergency response trailer also located at the on-shore facility; and • Automatic shut down on loss of pressure in the fuel system.	L
Habitat Quality	Underwater noise impacting marine fauna (only during loading) Barge loader, tug operations and/or loading of the vessel leading to: • Local habitat displacement; • Temporary threshold shift in hearing, and loss of	H	• Maintenance of onsite equipment; • Loading Facility Operating Procedure; • Correct fraction of ore, avoiding oversize through blast fragmentation;	M

Aspect	Potential Hazard/Impact	Inherent Risk Score	Management Measures	Residual Risk Score
	awareness; and/or • Behavioural changes.		• Compliance with speed restrictions; and • Other associated procedures (eg. ship operations).	
Habitat Quality	Introduction of invasive marine species	M	• Ships from international ports are required to exchange ballast water outside of Australia's territorial sea under the *Biosecurity Act 2015*; • Mandatory requirement that all ships comply with Australian regulatory requirements with respect to the management of ballast water (ie. any vessels originating from foreign ports, a hull inspection is required, or vessels that have been outside of Australian waters in the previous 12 months may also necessitate inspection.	L
Habitat Quality	Introduction of rubbish and waste into the marine environment	M	• Appropriate disposal of all loading facility and ship waste onshore in accordance with MMP and vessel operating procedures,	L
Species Impacts	Vessel strike on marine megafauna	H	• Mandatory speed restriction of four knots inside the channel and swing basin; • 10% under keel clearance; • Speed-restricted vessels; • Offshore six knots (mandatory go-slow zone of six knots); • Drivers of all marine vessels are to remain alert to marine megafauna and document all sightings with the Marine Superintendent; • Loading Facility Operating Procedure; • Small vessels to be fitted with propeller guards where possible.	L
Species Impacts	Light pollution leading to:	H	• Mooring buoys relocated over the horizon from any	L

Aspect	Potential Hazard/Impact	Inherent Risk Score	Management Measures	Residual Risk Score
	• Disorientation of megafauna; • Displace nesting areas; and/or • Aggregation of hatchlings and other marine fauna.		turtle nesting sites. • Consideration to fitting buoys with radar and light reflectors. • Light intensity reduced from a nominal range of three nautical miles to one nautical mile. Light colour changed from white to flashing yellow. • Change the light colour, intensity and flash frequency	
Species Impacts	Exclusion from an important habitat during critical life history stages (eg. calving/breeding) as a result of increased barge traffic	H	• Mandatory speed restriction of four knots inside the channel and swing basin; • Speed-restricted vessels; • Offshore six knots (mandatory go-slow zone of six knots); • BBLF Operating Procedure; • Dust control measures in accordance with Air Quality Management Plan; • An emergency response plan has been developed and equipment supplied to deal with any spill that occurs including fuel handling and storage procedures; • Oil spill kits of sufficient capacity including booms and absorption materials will be on-board tugs/barges at all times, spill kit emergency response trailer located at onshore facility; • Auto shut down on loss of pressure in the fuel system; • Trained and competent observers, appropriate record taking; and • Loading Facility Operating Procedure.	M
Species Impacts	Increased risk of disease and loss of fitness	H	• Mandatory reporting and monitoring of stranded marine megafauna as per BBLF procedures listed in	M

Aspect	Potential Hazard/Impact	Inherent Risk Score	Management Measures	Residual Risk Score
			Section 7; • Dust control measures in accordance with the Air Quality Management Plan; • Transfer stations and the barge-loading and refuelling area will be fully enclosed and sheeted, with floors of transfer stations fully sealed and bunded; • Routine visual inspections to loads to ensure these are fully contained and avoid material spillage during loading, at both the loading facility and the transhipment anchorages; • Fuel will be stored at the barge facility (2 x 45,000 L) – self bunded, 30 metres from the tug wharf; • The fuel pipeline will have an automatic cut-off valve to prevent large spills; • No refuelling will be undertaken during inclement weather conditions to minimise chance of a spill; • An emergency response plan has been developed and equipment supplied to deal with any spill that occurs including fuel handling and storage procedures; • Oil spill kits of sufficient capacity including booms and absorption materials will be on-board tugs/barges at all times, spill kit emergency response trailer to be located at the on-shore facility; • Auto shut down on loss of pressure in the fuel system; • Trained and competent observers, appropriate record taking; • Loading Facility Operating Procedure; • Compliance with speed restrictions; • Ships from international ports are required to exchange ballast water outside of Australia's	

Aspect	Potential Hazard/Impact	Inherent Risk Score	Management Measures	Residual Risk Score
			territorial sea under the *Biosecurity Act 2015*; • Mandatory requirement that all ships comply with Australian regulatory requirements with respect to the management of ballast water (ie. any vessels originating from foreign ports, a hull inspection is required, or vessels that have been outside of Australian waters in the previous 12 months may also necessitate inspection); and • Appropriate disposal of all loading facility and ship waste onshore, in accordance with MMP and vessel operating procedures.	
Species Impacts	Impact on marine water and sediment quality	H	• Mandatory reporting and monitoring of stranded marine megafauna as per BBLF procedures listed in **Section 7**; • Dust-control measures in accordance with Air Quality Management Plan; • Transfer stations and the barge loading and refuelling area will be fully enclosed and sheeted, with floors of transfer stations fully sealed and bunded; • Routine visual inspections to loads to ensure these are fully contained and avoid material spillage during loading, at both the loading facility and the transhipment anchorages; • Fuel will be stored at the barge facility (2 x 45,000 L) – self bunded, 30 metres from the tug wharf; • Fuel pipeline/s will have an automatic cut off valve to prevent large spills; • No refuelling will be undertaken during inclement weather conditions to minimise chance of a spill; • Standard operating procedures including appropriate training, visual monitoring of hoses and the sea surface, initial shutdown, and spill response	M

Aspect	Potential Hazard/Impact	Inherent Risk Score	Management Measures	Residual Risk Score
			procedures will be implemented; • Twice daily servicing and inspection of vessels and machinery to identify and address any leaks or other problems; • An emergency response plan has been developed and equipment supplied to deal with any spill that occurs including fuel handling and storage procedures; • Oil spill kits of sufficient capacity including booms and absorption materials will be on-board tugs/barges at all times, with a spill kit emergency response trailer to be located at the on-shore facility; • Automatic shut down on loss of pressure in the fuel system; • Loading Facility Operating Procedure; • ROV scan of the mooring area – baseline survey; • Ships from international ports are required to exchange ballast water outside of Australia's territorial sea under the *Biosecurity Act 2015*; • Mandatory requirement that all ships comply with Australian regulatory requirements with respect to the management of ballast water (ie. any vessels originating from foreign ports, a hull inspection is required, or vessels that have been outside of Australian waters in the previous 12 months may also necessitate inspection); and • Appropriate disposal of all loading facility and ship waste onshore in accordance with MMP and vessel operating procedures.	

10. MITIGATION, MANAGEMENT AND MONITORING MEASURES

An extensive suite of management and mitigation measures (controls) is provided above in **9-1**. Some of these key controls, in terms of their likely effectiveness on managing the high inherent risks, medium residual risks and/or addressing multiple risk line items, include:

- Marine fauna observations;
- BBLF operating procedures (includes measures to manage water quality, light pollution and reporting of marine megafauna); and
- Vessel operating procedures (including speed restrictions and compliance with pre-determined transit routes).

Section's 10.1 to 10.2 provide further details on proposed key management measures, performance targets and monitoring programs to confirm such management measures are effective. In addition, corrective actions are identified in the event that monitoring programs indicate exceedance of a performance target.

10.1 Vessel Strike on Marine Megafauna

Management Measures	Performance Target	Monitoring Program	Corrective Action
Mandatory speed restriction of four knots inside the channel and swing basin	No vessel strikes on marine megafauna	Any vessel strikes or near misses are to be recorded by the Marine Superintendent in an Incident Report. All incidents are to be entered by the Marine Superintendent into an Incident Register.	Any observed injuries or mortality of marine fauna as a result of a vessel strike will be reported to the relevant regulatory agencies (both NT and Commonwealth) within one day of the incident. Data collected will inform the need for further controls of vessel movements.
Mandatory go-slow zone of six knots outside channel and swing basin			
Pre-determined barge transit routes			
Barge crew/s to observe area for marine megafauna prior to barge leaving the BBLF and during its voyage to and from the bulk vessel. If marine megafauna are sighted, barge will slow down to 4 knots (if empty) within 50 m of the animal. If the animal is moving within 50 m of the vessel, the vessel will slow down to 4 knots until animal has moved beyond 50 m.			
Small vessels to be fitted with propeller guards where possible			
10% under keel clearance			
Loading Facility Operating Procedure			

10.2 Light Pollution

Management Measures	Performance Target	Monitoring Program	Corrective Action
Mooring buoys relocated over the horizon from any turtle nesting sites.	No lighting to be visible from any sea turtle nesting sites	In the unlikely event that any marine megafauna (including sea turtles) are observed on land during the course of operational activities, or the presence of tracks are observed in the vicinity of the loading area, this will be recorded in the Marine Fauna Sightings	Review of appropriate management plan(s).
Consideration of fitting buoys with radar and light reflectors.			
Light intensity reduced from a nominal range of three nautical miles to one nautical mile			
Light colour changed from white to flashing yellow.			

Changed the light colour, intensity and flash frequency		Logbook, and will trigger corrective actions.	

10.3 Introduction of Rubbish/Waste

Management Measures	Performance Target	Monitoring Program	Corrective Action
Appropriate disposal of all loading facility and ship waste onshore in accordance with MMP and vessel operating procedures.	Compliance with Waste Management Plan	The Waste Management Plan will detail the checks and controls to be in place at the BBLF. It will also describe the triggers for corrective actions, should the Waste Management Plan not be adhered to.	Corrective actions to be taken in the event of non-compliance with the Waste Management Plan are detailed within the Waste Management Plan.
Collection and management of regulated waste in accordance with regulatory requirements (and by licensed waste contractor)			
Preparation and implementation of a Waste Management Plan.			

10.4 Acoustic Pollution and Disturbance

Management Measures	Performance Target	Monitoring Program	Corrective Action
Pre-determined barge transit routes	Compliance with barge transit routes and speed restrictions	GPS tracking of barge transit routes. Marine megafauna sighted during barge movements will be recorded in the species observation register. Information to be recorded will include: • Species • Date and time • approximate location • distance to barge • any corrective actions taken by barge to maintain a 20 m clearance zone (speed limit reduction) • general description of animal's behaviour. Failure of barge crew to adjust speed limits or maintain transit routes will trigger corrective actions.	In the event that performance targets fail to be met, all staff will be re-educated on their responsibilities under the MMMP. Ongoing failure by certain persons to meet performance targets may trigger disciplinary actions based on NRR policies.
Barge crew(s) to observe area for marine megafauna prior to barge leaving the BBLF and during its voyage to and from the bulk vessel. If marine megafauna are sighted, barge will slow down to 4 knots (if empty) within 50 m of the animal. If the animal is moving within 50 m of the vessel, the vessel will slow down to 4 knots until animal has moved beyond 50 m.			
Maintenance of onsite equipment			
Compliance with speed restrictions			
Loading Facility Operating Procedure			

10.5 Water and Sediment Quality

Management Measures	Performance Target	Monitoring Program	Corrective Action
Dust control measures in accordance with Air Quality Management Plan	Compliance with relevant procedures and management plans	To focus on sources of potential pollution during operations including: • Visual inspection of berth decks for cracks or seal damage will be undertaken routinely • Routine visual inspections to permit loads to be fully contained and avoid material	Implemented in the event that inspections identify a failure to meet performance targets. An incident investigation will be undertaken and
Barge loading and refuelling area (including bulk fuel tanks) will be fully enclosed and bunded			
Fuel pipeline/s will have automatic cut off valves to prevent large spills;			
Compliance with refuelling and loading procedures (including			

procedural directives to cease operations during periods of high precipitation		spillage during loading, at both the loading facility and the transhipment anchorages • Twice daily inspection of vessels and machinery to identify and address any leaks or other problems; • Routine water quality monitoring program in accordance with NRR's Water management and Monitoring Plan. Implementation of NRR Water Management and Monitoring Plan Annual audits to assess compliance with MMMP.	appropriate corrective actions documented. Corrective actions will be appropriate to the size, nature and scale of the incident identified.
Auto shut down on loss of pressure in the fuel system			
Barge loading conveyors will be designed and constructed to relevant Australian Standards			
Standard operating procedures including appropriate training, visual monitoring of hoses and the sea surface, initial shutdown, and spill response procedures will be implemented			
Twice daily servicing of vessels and machinery to identify and address any leaks or other problems;			
An emergency response plan will be developed and equipment supplied to deal with any spill that occurs including fuel handling and storage procedures;			
Oil spill kits of sufficient capacity including booms and absorption materials will be on-board tugs/barges at all times, with a spill kit emergency response trailer also located at the on-shore facility			

10.6 Introduction of Invasive Marine Species

Management Measures	Performance Target	Monitoring Program	Corrective Action
Ships from international ports are required to exchange ballast water outside of Australia's territorial sea under the *Biosecurity Act 2015*	Compliance with ballast water management regulatory requirements	Routine inspections/auditing of shipping ballast water management procedures	In the event of a ballast water management system failure, the operator must notify the Maritime National Coordination Centre as soon as they are aware of the failure, to seek the department's advice on contingency measures.
Mandatory requirement that all ships comply with Australian regulatory requirements for the management of ballast water (i.e., for any vessels originating from foreign ports, a hull inspection is required, or vessels that have been outside of Australian waters in the previous 12 months may also necessitate inspection)			
Appropriate disposal of all loading facility and ship waste onshore in accordance with MMP and vessel operating procedures.			

10.7 Exclusion from Access to Important Habitat during Critical Life History Stages

Management Measures	Performance Target	Monitoring Program	Corrective Action
Mandatory speed restriction of four knots inside the channel and swing basin; Mandatory offshore go-slow zone of six knots Pre-determined barge transit routes Dust control measures in accordance with Air Quality Management Plan An emergency response plan will be developed and equipment supplied to deal with any spill that occurs including fuel handling and storage procedures Oil spill kits of sufficient capacity including booms and absorption materials will be on-board tugs/barges at all times, spill kit emergency response trailer located at onshore facility Auto shut down on loss of pressure in the fuel system Trained and competent observers, appropriate record keeping Loading Facility Operating Procedure	Compliance with barge transit routes and speed restrictions Compliance with relevant management plans and procedures	GPS tracking of barge transit routes. Failure of barge crew to adjust speed limits or maintain transit routes will trigger corrective actions Routine monitoring of MMMP and procedure effectiveness via visual inspections.	In the event that performance targets fail to be met, all staff will be re-educated on their responsibilities under the MMMP. Ongoing failure by certain persons to meet performance targets may trigger disciplinary actions based on NRR policies.

10.8 Disease and Loss of Fitness

Management Measures	Performance Target	Monitoring Program	Corrective Action
Mandatory reporting and monitoring of stranded marine megafauna Dust control measures in accordance with Air Quality Management Plan Transfer stations and the barge loading and refuelling area will be fully enclosed and sheeted, with floors of transfer stations fully sealed and bunded The fuel pipeline will have an automatic cut off valve to prevent large spills No refuelling will be undertaken during inclement weather conditions An emergency response plan will be developed and equipment supplied to deal with any spill that occurs including fuel handling and storage procedures Oil spill kits of sufficient capacity including booms and absorption materials will be on-board tugs/barges at all times, spill kit	No reported megafauna' fatalities. Compliance with barge transit routes and speed restrictions Compliance with relevant management plans and procedures	GPS tracking of barge transit routes. Marine megafauna sighted during barge movements will be recorded in the species observation register. Information to be recorded will include: • species • date and time • approximate location • distance to barge • any corrective actions taken by barge to maintain a 20 m clearance zone (speed limit reduction) • general description of animal's behaviour. Failure of barge crew to adjust speed limits or maintain transit routes will trigger corrective actions. To focus on sources of	In the event that performance targets fail to be met, all staff will be re-educated on their responsibilities under the relevant procedures and management plans. Ongoing failure by certain persons to meet performance targets may trigger disciplinary actions based on NRR policies.

emergency response trailer to be located at the on-shore facility		potential pollution during operations including: • Visual inspection of berth decks for cracks or seal damage will be undertaken routinely • Routine visual inspections to permit loads to be fully contained and avoid material spillage during loading, at both the loading facility and the transhipment anchorages • Twice daily inspection of vessels and machinery to identify and address any leaks or other problems; • Routine water quality monitoring program.	
Auto shut down on loss of pressure in the fuel system			
Trained and competent observers, appropriate record keeping			
Loading Facility Operating Procedure			
Compliance with speed restrictions			
Ships from international ports are required to exchange ballast water outside of Australia's territorial sea under the *Biosecurity Act 2015*			
Mandatory requirement that all ships comply with Australian regulatory requirements with respect to the management of ballast water (ie. any vessels originating from foreign ports, a hull inspection is required, or vessels that have been outside of Australian waters in the previous 12 months may also necessitate inspection)			
Appropriate disposal of all loading facility and ship waste onshore, in accordance with MMP and vessel operating procedures.			

11. AUDIT AND REVIEW

11.1 Environmental Auditing

The implementation and effectiveness of this MMMP will be internally audited on an annual basis or in accordance with specific regulatory approval conditions. The Marine Superintendent will be responsible for coordinating this audit.

11.2 Management Plan Review

This MMMP, in its current state, is to remain in place throughout the Stage 2 MMP's duration, unless:

- The conservation status of marine megafauna under the EPBC Act or the TPWC Act changes; and/or
- Annual audits reveal a failure to meet one or more of the performance targets.

If a review is required, it will take into account environmental monitoring records, corrective actions and results of audits. The Marine Superintendent will be responsible for coordinating reviews, which should be undertaken in consultation with the NT DPIR and the Commonwealth DoEE. The NRR Managing Director is responsible for authorising the final version of the MMMP.

In the event that the MMMP is altered, the revised plan will be submitted to the DoEE and DPIR.

12. REFERENCES

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APPENDIX C – NRP EMERGENCY RESPONSE PLAN

Objective	Provide appropriate management of the most likely type and scale of emergency situation at the Nathan River Project including: - Injury or medical emergency - Flood levee collapse leading to flooding of pit - Hydrocarbon Storage Spill/Failures - Fire - Explosion - Cyclone damaging or destroying infrastructure including Wades Crossing, Flood - Levee, sections of the Haul Road and Bridges and Stormwater Basins.
Actions	**Injury or Medical Emergency** Contact the Mine and Environment Manager or Site Supervisor using the Emergency Communication Procedure "Emergency, Emergency, Emergency" over UHF channel 17, describing the nature of the emergency, number of people involved and nature of any injuries. Request emergency response as required e.g. ambulance, police, Royal Flying Doctors Service (RFDS). **Bushfire** Monitor the fire Danger Rating for Carpentaria East (http://www.bom.gov.au/nt/forecasts/fire.shtml). In the event of a bushfire the following measures should be taken: - If you see smoke or fire in the immediate area, alert all onsite personnel and provide regular updates. - Contact the Mine and Environment Manager or Site Supervisor who will monitor the radio for any changes and determine best course of action, whether to work or not work. - If the bushfire is threatening, ensure your own safety and Contractors by evacuating to Mining Services area. - If injuries have occurred attend to and assist injured personnel. - Contact the Site Caretaker using the Emergency Communication Procedure as follows: - Call "Emergency, Emergency, Emergency" "over UHF channel 17. - Response is given directly to the reportee acknowledging the call. - Describe the nature of the emergency including number of people involved, details of accident and nature of the injuries. - Continue to stay close to your source of communication. - Mine and Environment Manager or Site Supervisor to attend with onsite firefighting equipment. **Building Structure Fire** In the event of a building fire, the following measures should be taken: - If you hear a smoke alarm or see smoke, raise the alarm and evacuate the building. - Assist other personnel in evacuating the building to the muster point.

	- Contact the Site Caretaker using the Emergency Communication Procedure as follows: - Call "Emergency, Emergency, Emergency" "over UHF channel 17 - Response is given directly to the reportee acknowledging the call. - Describe the nature of the emergency including number of people involved, details of accident and nature of the injuries. - Under direction of the Site Caretaker attempt to extinguish the fire with fire hoses and fire extinguishers, if safe to do so. - Mine and Environment Manager or Site Supervisor to attend with onsite firefighting equipment. **Machinery / Plant Fire** In the event of plant fire, the following measures should be taken: - If you see smoke or fire and it's safe to do so, turn off plant. - Ensure your own safety by evacuating plant and moving yourself to a safe distance. - Alert people working in the area of the fire. - Attempt to extinguish the fire with fire suppression system and fire extinguishers, if safe to do so. - Contact the Site Caretaker using the Emergency Communication Procedure as follows: - Call "Emergency, Emergency, Emergency" "over UHF channel 17 - Response is given directly to the reportee acknowledging the call. - Describe the nature of the emergency including number of people involved, details of accident and nature of the injuries. - Under direction of the Mine and Environment Manager or Site Supervisor attempt to extinguish the fire with fire hoses and fire extinguishers, if safe to do so. - Mine and Environment Manager or Site Supervisor to attend with onsite firefighting equipment. **Flood Levee Collapse or Damage** In the event of a flood levee collapse or damage identified during/prior to the Wet Season the following measures should be taken: - Any equipment works should be stopped and people removed from the area. - Notify the Mine and Environment Manager or Site Supervisor over UHF channel 17 and report the situation. - Appropriately qualified personnel to go to the area and visually inspect the incident if safe to do so. - Request assistance as required; emergency response, medic, mine engineering, if needed. - Due to potential environmental impact the incident must be reported to the Department of Mines and Energy through a Section 29 Notification of

	Environmental Incident: Mineral.Info@nt.gov.au and the NT EPA Pollution Hotline (1800 064 567) through a Section 14 Incident Report Form within 24 hours of the incident occurring. - Field inspection by a mining engineer or geotechnical engineer as soon as practicable after the event, including an assessment of potential further impacts, risk assessment, remedial action and any additional failure (trigger events and movement rates). **Hazardous Substances Spill** The emergency procedure that the operator has in place to manage such a risk is as follows: - Alert co-workers and report the incident/or accident to the immediate supervisor. - Trap any spill if possible by bunding the area to prevent it from reaching any waterways and soak up as much of the spill as possible with absorbent material or sand. - Without placing the safety of the individual at risk, identify the source of the leak if possible and determine if it can safely be stopped. - Notify the Emergency Services if the situation is unable to be controlled by the above measures. - Any contaminated soil and material such as rags and blankets must be removed from the site and disposed of at a facility that is authorised to receive the material. - Reporting of the incident/ accident to DPIR as soon as practicable after the occurrence in accordance with section 29 of the *Mining Management Act* and the DPIR Reporting Guidelines***** **Cyclone Damage Destroying Infrastructure** In the event of cyclone or extreme weather causing flooding the following measures should be taken: - Assess the situation and advise personnel of evacuation to a safe area (if required). - Increase monitoring of site structures to twice a day to assess potential impacts and/or undertake emergency remediation measures. Mitigation measures should be consulted with a mining engineer or geotechnical engineer prior to implementation. - All abnormal flooding should be considered serious, and in the event of heavy rain or flooding, the Mine and Environment Manager or Site Supervisor should be notified so an inspection of the affected areas can be made and assistance requested if required. - If a Stormwater Pond overflows or the Flood Levee collapses the incident must be reported to the Department of Mines and Energy through a Section 29 Notification of Environmental Incident: Mineral.Info@nt.gov.au and the NT EPA Pollution Hotline (1800 064 567)

	through a Section 14 Incident Report Form within 24 hours of the incident occurring.
Monitoring and Reporting	The Mine and Environment Manager will monitor all potential and actual emergency situations on site daily. Annual Emergency Response performance review will occur annually by the Mine and Environment Manager.
Responsibility	Geology/ Environment Manager.
TARP	N/A

APPENDIX D – MRM MARINE SEDIMENT AND DGT MONITORING DATA

Marine Sediment Data

Monitoring Location	Date	Fraction Wet Sieving <63µm	Al	Mn	Fe	Co	Ni	Cu	Zn	As	Ag	Cd	Sb	Pb	Hg
		%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
MS1B	20/11/2020	12.1%	2,600	230	8,400	4.8	2.7	5.8	8.2	1.8	<0.02	0.05	<0.2	9.8	<0.01
MS1B	1/03/2022	7%	2,100	260	7,300	4.3	2.4	5.3	7.7	3.4	<0.02	0.05	<0.2	11	<0.01
MS1B	28/11/2022	7%	1,800	280	7,500	4.1	2.3	5.9	8.2	3.8	0.02	0.05	0.2	11	0.01
MS1B	30/11/2023	6%	2,300	300	9,100	4.8	2.6	7.6	8.9	4.7	0.02	0.05	<0.2	12	0.01
MS2	20/11/2020	40.2%	2,600	330	11,000	5.1	2.8	8.5	24	2.6	0.03	0.07	<0.2	18	<0.01
MS2	1/03/2022	38%	2,500	400	11,000	5.2	2.7	8.7	23	5.4	0.03	0.06	<0.2	19	<0.01
MS2	28/11/2022	21%	2,500	340	11,000	5.1	2.7	10	40	4	0.04	0.1	0.2	30	0.01
MS2	30/11/2023	74%	2,800	490	13,000	5.8	3.1	11	27	5.7	0.04	0.06	<0.2	21	<0.01
MS3	20/11/2020	39.8%	3,200	310	13,000	5.3	3.2	13	52	2.9	0.04	0.17	<0.2	34	<0.01
MS3	1/03/2022	6%	2,100	250	8,100	4.1	2.3	7.8	19	3.9	0.02	0.08	<0.2	20	<0.01
MS3	28/11/2022	12%	2,100	230	6,700	4	2.2	8.3	23	2.2	0.03	0.08	0.2	17	0.01
MS3	30/11/2023	68%	2,900	340	14,000	5.2	3.1	14	44	4.5	0.04	0.15	<0.2	32	<0.01
MS4	20/11/2020	47.9%	3,200	300	13,000	5.2	3.1	28	250	4.1	0.05	0.71	<0.2	190	<0.01
MS4	1/03/2022	40%	2,500	280	9,200	4	2.2	18	120	2	0.04	0.32	<0.2	75	<0.01
MS4	28/11/2022	29%	2,500	300	10,000	4.9	2.8	21	140	4.6	0.05	0.43	0.2	96	0.01
MS4	30/11/2023	55%	2,700	330	8,700	5.2	2.9	17	88	4.5	0.05	0.25	<0.2	55	<0.01
MS5A	20/11/2020	33.6%	3,300	300	11,000	4.6	2.9	41	430	4.8	0.06	1.2	<0.2	350	<0.01
MS5A	1/03/2022	73%	2,700	330	8,800	4	2.4	30	240	4.3	0.06	0.74	<0.2	200	<0.01
MS5A	28/11/2022	20%	2,300	320	12,000	4.3	3.4	35	330	6	0.06	0.98	0.2	210	0.01
MS5A	30/11/2023	73%	2,600	350	11,000	4.3	2.7	37	320	5.7	0.08	0.97	<0.2	270	<0.01
MS5B	20/11/2020	42.0%	3,200	300	10,000	4.4	2.8	32	350	4.2	0.05	0.97	<0.2	270	<0.01
MS5B	1/03/2022	62%	2,600	330	16,000	3.2	2.4	32	250	3.1	0.05	0.79	<0.2	190	<0.01
MS5B	28/11/2022	30%	2,600	340	9,000	4.4	2.7	30	190	5.5	0.06	0.65	0.2	140	0.01
MS5B	30/11/2023	51%	2,700	360	13,000	4.1	2.6	35	270	5.2	0.07	0.89	<0.2	200	<0.01
MS6A	20/11/2020	60.9%	3,000	320	8,800	5.5	3	28	320	4.9	0.06	0.69	<0.2	170	<0.01
MS6A	1/03/2022	56%	2,600	290	11,000	3.8	2.4	37	310	4.1	0.06	0.97	<0.2	270	<0.01
MS6A	28/11/2022	39%	2,500	320	13,000	4.7	2.8	36	330	5.4	0.06	0.99	0.2	230	0.01
MS6A	30/11/2023	49%	2,500	350	8,600	6.2	3.3	13	72	4.9	0.04	0.17	<0.2	50	<0.01
MS6B	20/11/2020	41.4%	2,500	340	7,400	6.1	2.5	16	95	2.6	0.03	0.23	<0.2	61	<0.01
MS6B	1/03/2022	16%	2,200	240	11,000	3.9	2.4	28	240	3.5	0.06	0.73	<0.2	210	<0.01
MS6B	28/11/2022	35%	2,200	420	9,700	4	2.5	37	270	5.5	0.06	0.81	0.2	180	0.01
MS6B	30/11/2023	75%	2,600	380	14,000	4.2	2.8	37	300	5.9	0.07	0.97	<0.2	220	<0.01
MS7A	20/11/2020	31.0%	2,600	330	7,800	5.9	2.7	22	200	3.2	0.04	0.52	<0.2	150	<0.01
MS7A	1/03/2022	74%	2,600	340	17,000	4	2.9	33	240	3.9	0.07	0.82	<0.2	220	<0.01
MS7A	28/11/2022	22%	2,500	290	17,000	4.1	2.8	47	470	6.4	0.06	1.4	0.2	320	0.01
MS7A	30/11/2023	23%	2,500	360	13,000	3.9	2.3	35	300	5.6	0.06	0.94	<0.2	230	<0.01
MS7B	20/11/2020	10.9%	2,400	270	15,000	3.7	2.6	26	200	3.8	0.04	0.69	<0.2	190	<0.01
MS7B	1/03/2022	4%	2,000	340	13,000	4.2	2.7	27	320	9	0.04	1	<0.2	400	<0.01
MS7B	28/11/2022	42%	2,100	300	7,200	5.2	2.3	21	120	3.2	0.04	0.28	0.2	95	0.01
MS7B	30/11/2023	22%	2,600	280	13,000	4	2.6	33	330	4.7	0.06	1	<0.2	240	<0.01

DGT Field Parameters

Monitoring Location	Date	Time	Comments	Temperature	Field pH	Field EC	Field TDS	DO	DO	ORP (mV)	Salinity
				°C	pH units	µS/cm	mg/L	mg/L	% Sat	mV	psu
DGT1	4/08/2022	10:52		24.6	7.78	61,065	39,692	7.00	106.3	212	41.0
DGT1	9/08/2022	11:23		24.9	7.82	55,659	36,178	6.59	98.1	240	36.9
DGT1	13/11/2022	10:50	Missing Data	30.5	7.59	57,498			93.4	224	38.1
DGT1	18/11/2022	10:29	Brown algae	30.7	7.76	58,123	37,780	5.46	90.3	192	38.6
DGT1	2/03/2023	11:27		29.9	7.05	37,306	24,249	6.08	91.4	276	23.5
DGT1	8/03/2023	13:26	Seaweed on bouys	28.5	7.64	51,447	33,441	6.71	104.3	223	33.7
DGT2	4/08/2022	10:59		24.2	7.90	60,792	39,515	6.92	104.1	206	40.8
DGT2	9/08/2022	11:37		24.8	7.85	55,789	36,263	6.59	98.1	114	37.0
DGT2	13/11/2022	10:59	Missing Data	30.5	7.87	57,705			94.6	202	38.3
DGT2	18/11/2022	10:24	Brown algae	30.7	7.62	58,163	37,806	5.61	92.8	247	38.6
DGT2	2/03/2023	12:15		30.2	7.54	37,537	24,399	6.16	93.1	191	23.7
DGT2	8/03/2023	12:37	Seaweed on bouys	28.6	7.44	51,917	33,746	6.57	102.4	128	34.1
DGT3	4/08/2022	10:27		26.3	7.62	62,230	40,449	5.82	91.3	229	41.9
DGT3	9/08/2022	12:27		24.5	7.88	57,413	37,318	6.25	93.3	190	38.3
DGT3	13/11/2022	10:25	Excessive weed, Missing data	30.6	7.57	58,443			80.7	258	38.9
DGT3	18/11/2022	11:16	Brown algae	32.0	8.18	59,968	38,979	5.8	98.6	207	40.0
DGT3	2/03/2023	11:02	Seaweed	29.2	6.50	28,620	18,603	5.38	77.4	246	17.6
DGT3	8/03/2023	13:49	Small amount of seaweed on bouys	29.5	7.69	52,045	33,829	6.25	98.8	184	34.1
DGT4	4/08/2022	10:40		26.6	7.70	62,444	40,589	6.32	99.7	215	42.0
DGT4	9/08/2022	12:20		24.4	7.89	57,448	37,341	6.58	97.9	224	38.3
DGT4	13/11/2022	10:40	Missing Data	32.5	7.91	60,358			98.3	213	40.2
DGT4	18/11/2022	11:06	Brown algae + Biofouled	32.3	8.18	60,223	39,145	6.34	108.3	236	40.1
DGT4	2/03/2023	11:15	Seaweed	29.6	6.53	29,925	19,451	6.27	91.1	278	18.4
DGT4	8/03/2023	13:41		29.3	7.57	52,025	33,816	6.40	101.0	205	34.1
DGT5	4/08/2022	11:13		24.7	7.84	60,415	39,270	6.87	104.1	205	40.5
DGT5	9/08/2022	12:00		24.5	7.80	55,070	35,796	6.72	99.2	235	36.5
DGT5	13/11/2022	11:10	Missing Data	30.6	7.96	57,569			91.0	119	38.2
DGT5	18/11/2022	10:12	Brown algae	30.6	7.39	58,400	37,960	6.03	99.6	293	38.8
DGT5	2/03/2023	12:33		29.7	7.74	47,194	30,676	6.22	96.8	159	30.6
DGT5	8/03/2023	12:18		28.4	7.20	50,777	33,005	6.72	104.0	297	33.2
DGT6	4/08/2022	11:39		23.7	7.88	60,545	39,354	6.94	103.6	174	40.7
DGT6	9/08/2022	10:56		24.8	7.79	55,280	35,932	6.65	98.8	273	36.7
DGT6	13/11/2022	11:45	Missing Data	31.0	8.23	58,754			98.4	174	39.1
DGT6	18/11/2022	9:50	Brown algae	30.6	7.03	57,609	37,446	6.12	100.9	332	38.2
DGT6	2/03/2023	11:54		30.0	7.53	46,275	30,078	6.07	94.5	223	29.9
DGT6	8/03/2023	13:06	Seaweed on bouys	29.0	7.22	51,736	33,628	6.42	100.7	245	33.9

DGT Labile Metal Concentrations

		Parameter	Mn	Fe	Co	Ni	Cu	Zn	Cd	Pb	
		Reporting limit	0.100	0.010	0.010	0.500	0.010	0.060	0.005	0.002	
Monitoring Location	Replicate	Date	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	Comments
DGT1	1	9/08/2022	3.92	3.27	0.029	1.55	0.11	<0.060	0.006	0.008	Clean, slight disscolouration, clean chelex
DGT1	2	9/08/2022	3.72	2.43	0.026	<0.50	0.10	<0.060	0.006	0.011	Clean, slight disscolouration, clean chelex
DGT1	3	9/08/2022	4.35	6.07	0.033	0.73	0.13	0.13	0.007	0.022	Clean, slight disscolouration, clean chelex
DGT2	1	9/08/2022	3.89	2.45	0.028	<0.50	0.10	0.20	<0.005	0.005	Clean, slight disscolouration, clean chelex
DGT2	2	9/08/2022	3.98	3.35	0.028	2.52	0.10	0.21	0.005	0.005	Clean, slight disscolouration, clean chelex
DGT2	3	9/08/2022	4.73	4.58	0.032	0.67	0.11	0.20	0.005	0.007	Clean, slight disscolouration, clean chelex
DGT3	1	9/08/2022	6.77	3.82	0.059	<0.50	0.42	3.10	0.018	0.203	Signs of growth, slight disscolouration, few small particles
DGT3	2	9/08/2022	6.80	3.06	0.063	<0.50	0.46	3.19	0.019	0.211	Signs of growth, slight disscolouration, clean chelex
DGT3	3	9/08/2022	6.34	1.42	0.059	<0.50	0.42	2.93	0.018	0.191	Signs of growth, slight disscolouration, clean chelex
DGT4	1	9/08/2022	5.00	7.02	0.053	0.66	0.16	0.99	0.011	0.091	Signs of growth, slight disscolouration, few particles on edge of chelex
DGT4	2	9/08/2022	5.31	6.91	0.053	<0.50	0.16	0.95	0.011	0.098	Signs of growth, slight disscolouration, few particles on edge of chelex
DGT4	3	9/08/2022	5.84	7.08	0.059	<0.50	0.17	1.17	0.012	0.095	Signs of growth, slight disscolouration, few particles on edge of chelex
DGT5	1	9/08/2022	2.48	3.69	0.019	<0.50	0.11	0.22	0.005	0.009	Signs of growth, slight disscolouration, clean chelex
DGT5	2	9/08/2022	2.67	2.34	0.022	<0.50	0.13	0.20	0.006	0.006	Signs of growth, slight disscolouration, clean chelex
DGT5	3	9/08/2022	2.83	5.80	0.024	<0.50	0.14	0.08	0.005	0.009	Signs of growth, slight disscolouration, clean chelex
DGT6	1	9/08/2022	2.07	5.02	0.023	<0.50	0.11	<0.060	0.005	0.011	Signs of growth, slight disscolouration, clean chelex
DGT6	2	9/08/2022	2.07	2.54	0.023	<0.50	0.11	0.07	0.005	0.008	Signs of growth, slight disscolouration, clean chelex
DGT6	3	9/08/2022	2.04	3.87	0.022	<0.50	0.11	0.22	0.005	0.008	Signs of growth, slight disscolouration, clean chelex
DGT1	1	18/11/2022	1.70	1.83	0.019	<0.20	0.062	<0.40	0.006	0.005	Slight discolouration, minimal growth, clean chelex
DGT1	2	18/11/2022	1.85	2.11	0.020	<0.20	0.066	<0.40	0.006	0.009	Slight discolouration, minimal growth, clean chelex
DGT1	3	18/11/2022	1.97	3.64	0.022	<0.20	0.068	<0.40	0.006	0.034	Slight discolouration, minimal growth, clean chelex
DGT2	1	18/11/2022	2.15	5.87	0.024	<0.20	0.069	<0.40	0.010	0.010	Slight discolouration, minimal growth, clean chelex
DGT2	2	18/11/2022	1.95	3.70	0.022	<0.20	0.073	<0.40	0.009	0.016	Slight discolouration, minimal growth, clean chelex
DGT2	3	18/11/2022	2.25	5.70	0.024	<0.20	0.072	<0.40	0.012	0.010	Slight discolouration, minimal growth, clean chelex
DGT3	1	18/11/2022	5.49	3.80	0.045	<0.20	0.16	1.46	0.017	0.133	Slight discolouration, minimal growth, clean chelex
DGT3	2	18/11/2022	5.64	1.65	0.045	<0.20	0.14	1.35	0.019	0.115	Slight discolouration, minimal growth, clean chelex
DGT3	3	18/11/2022	4.98	2.21	0.043	<0.20	0.14	1.40	0.019	0.117	Slight discolouration, minimal growth, clean chelex
DGT4	1	18/11/2022	4.57	0.85	0.040	<0.20	0.079	<0.40	0.008	0.060	Slight discolouration, some growth, clean chelex
DGT4	2	18/11/2022	4.22	1.62	0.042	<0.20	0.077	0.41	0.007	0.064	Slight discolouration, some growth, clean chelex
DGT4	3	18/11/2022	3.62	2.06	0.040	<0.20	0.067	0.47	0.007	0.062	Slight discolouration, some growth, clean chelex
DGT5	1	18/11/2022	1.13	4.31	0.015	<0.20	0.10	0.51	0.009	0.008	Slight discolouration, some growth, clean chelex
DGT5	2	18/11/2022	1.21	3.66	0.017	<0.20	0.12	<0.40	0.011	0.019	Slight discolouration, some growth, clean chelex
DGT5	3	18/11/2022	1.23	5.54	0.017	<0.20	0.11	0.52	0.013	0.010	Slight discolouration, some growth, clean chelex
DGT6	1	18/11/2022	1.59	3.09	0.018	<0.20	0.070	<0.40	0.009	0.003	Slight discolouration, more growth than 2,3, clean chelex
DGT6	2	18/11/2022	1.94	8.05	0.020	<0.20	0.069	<0.40	0.013	0.008	Slight discolouration, some growth, clean chelex
DGT6	3	18/11/2022	1.49	2.58	0.018	<0.20	0.11	<0.40	0.006	0.004	Slight discolouration, some growth, clean chelex
DGT1	1	8/03/2023	1.86	11.4	0.025	0.13	0.089	0.51	0.007	0.012	Growth on holder and filter, clean chelex
DGT1	2	8/03/2023	5.13	12.6	0.033	0.18	0.14	0.51	0.021	0.012	Growth on holder and filter, clean chelex
DGT1	3	8/03/2023	2.33	16.1	0.030	0.18	0.10	0.35	0.008	0.014	Growth on holder and filter, clean chelex
DGT2	1	8/03/2023	0.78	1.09	0.016	0.11	0.074	<0.20	0.007	<0.005	Growth on holder and filter, clean chelex
DGT2	2	8/03/2023	2.20	17.0	0.028	0.13	0.10	0.28	0.009	0.018	Growth on holder and filter, small particles on edge of chelex
DGT2	3	8/03/2023	1.50	8.26	0.030	0.16	0.10	0.37	0.009	0.008	Growth on holder and filter, clean chelex
DGT3	1	8/03/2023	7.19	2.42	0.048	0.13	0.10	1.69	0.014	0.059	Some growth on holder and filter, clean chelex
DGT3	2	8/03/2023	7.98	3.73	0.056	0.15	0.11	2.13	0.024	0.074	Some growth on holder and filter, clean chelex
DGT3	3	8/03/2023	7.21	1.56	0.052	0.15	0.11	3.33	0.014	0.057	Some growth on holder and filter, clean chelex
DGT4	1	8/03/2023	3.66	2.44	0.034	0.13	0.081	1.05	0.009	0.016	Growth on holder and filter, small particles on edge of chelex
DGT4	2	8/03/2023	4.10	6.72	0.038	0.14	0.087	0.67	0.008	0.024	Some growth on holder and filter, clean chelex
DGT4	3	8/03/2023	4.62	5.62	0.041	0.13	0.094	0.60	0.008	0.023	Some growth on holder and filter, clean chelex
DGT5	1	8/03/2023	1.76	16.3	0.025	0.14	0.10	<0.20	0.007	0.016	Growth on holder and filter, small particles on edge of chelex
DGT5	2	8/03/2023	1.97	19.6	0.025	0.13	0.10	<0.20	0.007	0.018	Growth on holder and filter, small particles on edge of chelex
DGT5	3	8/03/2023	1.48	13.2	0.020	0.12	0.094	<0.20	0.007	0.012	Growth on holder and filter, small particles on edge of chelex
DGT6	1	8/03/2023	2.39	14.2	0.027	0.12	0.080	<0.20	<0.005	0.011	Growth on holder and filter, clean chelex
DGT6	2	8/03/2023	2.27	14.1	0.024	0.12	0.078	0.29	0.006	0.010	Growth on holder and filter, clean chelex
DGT6	3	8/03/2023	2.09	8.38	0.022	0.13	0.076	0.27	0.006	0.008	Growth on holder and filter, clean chelex

APPENDIX E – BBLF MAINTENANCE DREDGING RISK ASSESSMENT

Table 1 **Categories used to assess the severity of potential impacts**

More Severe			Less Severe
Scale			
Widespread Impact occurs across the broader Gulf of Carpentaria and/or extends to the marine waters of Limmen Bight and associated coastal floodplains and Estuarine rivers.	**Regional** Impact occurs outside the boundaries of mineral lease/s and/or swing basin and channel.	**Localised** Impact is confined within the boundaries of mineral lease/s and/or swing basin and channel.	**Limited** Impact occurs only within the direct disturbance footprint.
Intensity			
High Impact alters the integrity of environmental values.	**Moderate** Impact compromises the integrity of environmental values.	**Low** Impact alters the quality, abundance or distribution of environmental values without compromising their ecological integrity.	**Very Low** Impact does not noticeably alter the quality, distribution or abundance of environmental values.
Timing, duration and frequency			
Permanent Impact that is permanent; values will never recover.	**Long-term** Impact that is measurable for many years post-dredging.	**Medium-term** Impact that is measurable during dredging and for some months following.	**Short-term** Impact that is measurable during dredging only.

Table 2 **Likelihood categories adopted in risk assessment**

Probability/Likelihood			Likelihood Criteria
1	Rare	The impact is very unlikely to occur. The impact has not occurred on similar projects and/or in similar environments.	0-1%
2	Unlikely	The impact is not expected to occur. The impact occurs very infrequently on similar projects and/or in similar environments.	2-10%
3	Possible	The impact could occur in some circumstances. The impact has occurred infrequently on similar projects and/or in similar environments.	11-50%
4	Likely	The impact will probably occur in most circumstance but there is some uncertainty about the likelihood. The impact has occurred on more than one occasion in association with similar projects and/or in similar environments.	51-90%
5	Almost Certain	The event/impact will occur or is expected to occur. The impact occurs regularly in association with similar projects and/or in similar environments.	91-100%

Table 3 Consequence categories adopted in risk assessment

Score	Consequence	Description
1	Insignificant	No measurable impact on the environment No injuries. Low-nil financial loss.
2	Minor	A minor impact has two or more of the following characteristics: **Limited** = Impact occurs within the immediate disturbance footprint only (swing basin zone of impact) **Very Low Intensity** = Impact does not noticeably alter the quality, distribution or abundance of environmental values. **Short-term** = Impact that is felt during the mining operations phase only. No publicity likely and no stakeholder concerns. First aid treatment required. Medium-low financial loss.
3	Moderate	A moderate impact has two or more of the following characteristics: **Localised** = Impact to environmental values within boundaries of mineral lease/s or swing basin and channel. **Low Intensity** = Impact alters the quality, abundance or distribution of environmental values without compromising ecological integrity. **Medium term** = Impact that is felt during operations and for some months post-closure. Stakeholder enquires (this may include government, unions or public). Medical attention required. High-medium financial loss.
4	Major	A major impact has two or more of the following characteristics: **Regional** = Impact occurs over a larger area than the Mineral Lease/s and/or beyond channel. **Moderate to High Intensity** = Impact compromises the integrity of environmental values. **Long-term** = Impact that is felt for many years post-closure. Prosecution possible. Loss of company credibility and high stakeholder interest. Permanent injuries. High financial loss.
5	Severe	A severe impact has two or more of the following characteristics: **Widespread** = Impact occurs across the broader Roper Gulf Region and/or extends to the marine waters of Limmen Bight and associated coastal floodplains, and/or extends within the Gulf of Carpentaria **High Intensity** = Impact alters the integrity of environmental values. **Permanent** = Impact is permanent - values will never recover. Major stakeholder and media interest. Prosecution likely. Permanent injury or death. Extreme financial loss.

Table 4 **Risk matrix adopted in risk assessment**

			CONSEQUENCE				
			1	2	3	4	5
			Insignificant	Minor	Moderate	Major	Severe
LIKELIHOOD	5	Almost Certain	Medium	Medium	High	Very High	Very High
	4	Likely	Medium	Medium	High	Very High	Very High
	3	Possible	Low	Medium	Medium	High	Very High
	2	Unlikely	Low	Low	Medium	Medium	High
	1	Rare	Low	Low	Low	Medium	High

Table 5 **Risk level and target action matrix used in evaluate risks**

Risk level	Target action
Very High	Risk is unacceptable. Specific action plans required to reduce risk to an acceptable level. Director/CEO level management attention required.
High	Risk is generally unacceptable without action. Specific action plans required to reduce risk to 'as low as reasonably practicable' (ALARP). Senior management attention required.
Medium	Risk is generally acceptable. Proactive action is required to reduce risk to ALARP. Requires routine monitoring and adaptive management in accordance with EMPs. Line management attention is required.
Low	Risk is acceptable. Management by routine policies and procedures. Reduce risk to ALARP and monitor to ensure risk level remains low.

Table 6 BBLF Maintenance Dredging Risk Assessment

Item	Aspect	Incident / Event	Receptor	Potential Impact	C[1]	L[2]	IR[3]	Management and Mitigation Measures	C[1]	L[2]	RR[4]
Dredge Spoil Pond	Vegetation clearing	Removal of vegetation for the construction of the spoil pond.	Terrestrial biota	- Removal of environmental significant coastal vegetation resulting in impacts to local ecosystem functioning at the BBLF and surrounding environment.	3	4	**High**	- Vegetation within the proposed spoil pond area has been mapped, with vegetation type being common and widespread throughout the BBLF and surrounds. No vegetation of legislative significance is proposed to be removed. - The location for the dredge spoil pond has avoid environmental sensitive and significant vegetation communities (ie. Melaleuca swamp).	3	3	**Medium**
Dredge Spoil Pond	Receiving water quality	Dredge Spoil Pond Operation	Terrestrial biota Groundwater Surface water	- Seepage of highly saline and/or poor-quality water from the spoil pond to the surrounding environment.	3	4	**High**	- Engineered design pond foundations and bund walls. Engineering certification prior to pond commission. - In-situ compaction testing during pond construction to ensure maximum amount of compaction is achieved. - Decant and discharge of excess water from spoil pond to promote drying of spoil material and reduce evaporative loss which can increase material salinity. - Surrounding vegetation of the area is generally tolerant of high saline conditions. - Routine visual inspections of pond bund walls. - Continued water monitoring programs to identify changes in water chemistry (e.g. groundwater monitoring program).	3	2	**Medium**

Item	Aspect	Incident / Event	Receptor	Potential Impact	C[1]	L[2]	IR[3]	Management and Mitigation Measures	C[1]	L[2]	RR[4]
Dredge Spoil Pond	Receiving water quality	Potentially Acid Sulfate Soils (PASS)	Terrestrial biota Groundwater Surface water	- Excavation and exposure of PASS material causing material oxidation. - Seepage poor-quality water from the spoil pond to the surrounding environment.	3	4	**High**	- Engineered design pond foundations and bund walls. Engineering certification prior to pond commission. - In-situ compaction testing during pond construction to ensure maximum amount of compaction is achieved. - Previous assessments have concluding low risk of the potential presence of PASS at the proposed spoil pond location or within the BBLF marine sediment targeted by this dredge program. - Sampling of dredge spoil material during the first week of dredging program commencing to confirm presence of PASS.	3	1	**Low**
Dredge Spoil Pond	Vegetation	Terrestrial vegetation dieback	Terrestrial vegetation surrounding pond	- Seepage of highly saline / poor quality water from spoil pond impacting vegetation surrounding the pond, resulting in vegetation dieback.	2	4	**Medium**	- Surrounding vegetation of the area is generally tolerant of high saline conditions. - No vegetation diebacks have been recorded during the operation of NRR's existing spoil pond or the larger dredge facility operated by MRM at the BBLF. - Routine visual inspections of vegetation around the perimeter of the spoil pond.	2	2	**Low**
Dredge Spoil Pond	Marine surface water quality	Discharge of dredge spoil decant water to the BBLF swing basin	Marine surface water quality	- Contamination of marine surface waters within the BBLF associated with the release of contaminated water. - Contamination of surface waters with the BBLF	3	4	**High**	- Implementation of surface water monitoring plan including monitoring surface water quality at the decant pond, discharge point and within the mixing zone to assess for potential environmental impact from the release of decant water.	3	2	**Medium**

Item	Aspect	Incident / Event	Receptor	Potential Impact	C[1]	L[2]	IR[3]	Management and Mitigation Measures	C[1]	L[2]	RR[4]
				associated with the release of turbid decant water.				- Visual monitoring of mixing zone during discharge of decant water to ensure there is not an excess of silt within the mixing zone. - Decant water is held in the decant basin for as long as possible to allow for suspended particulate matter to settle before been discharged. - Discharge of decant water will be controlled by the conditions of a waste discharge license.			
Dredging Operations	Marine habitat	Removal of benthic marine habitat	Marine biota	- Dredging of marine sediments removing benthic habitat (i.e. seagrass).	2	3	**Medium**	- The BBLF transhipment zone is a previously dredged area whereby limited benthic habitat existing owing to the historic capital dredging programs. - Some benthic biota may colonise previously dredged areas between maintenance events. However, further impacts on these directly-affected biota are not considered to be a key consideration in the assessment of maintenance dredging proposals. This is due to those direct impacts being largely unavoidable and recolonising biota being well-adapted to surviving within dynamic benthic habitats.	2	2	**Low**
Dredging Operations	Marine Surface water quality	Deterioration of marine water quality	Marine biota Marine water quality	- Reduction in marine water quality impacting light attenuation within water column. - Mobilisation of metals into water column,	3	4	**High**	- Selection and use of a cutter-suction dredge as the dredge method. This dredge method is commonly used in sensitive environments owing to the less intensive interaction with sediments and vessel's ability to be stationary whilst operating.	3	2	**Medium**

Item	Aspect	Incident / Event	Receptor	Potential Impact	C[1]	L[2]	IR[3]	Management and Mitigation Measures	C[1]	L[2]	RR[4]
				impacting marine biota health.				- Implementation of turbidity plume monitoring, allowing the detection of plume extent and magnitude. - Aerial survey (via drone) of dredging area. - Dredge rates will be altered in response to environmental conditions and monitoring data collected, with dredging rates decreased as required to minimise the extent of the turbidity plume. - Waste Discharge Licence to condition mixing zone (transhipment zone) water quality triggers. Should trigger values be exceeded at the compliance monitoring location, dredging operations will cease until mitigative controls are implemented.			
Dredging Operations	Coastal hydrology	Change in coastal hydrology	Marine biota Marine water quality	- Changes to transhipment zone's coastal hydrology associated with the removal of marine sediment and discharge of decant water.	2	3	**Medium**	- The BBLF has previously undergone extensive capital dredging programs since its construction. Maintenance dredging is not expected to cause any additional changes to coastal hydrology within the BBLF or surrounds given its an already dredged zone. - The transhipment zone experiences good tidal flushing with hydrology unlikely to be impacted from the discharge of decant water into the BBLF.	2	2	**Low**
Dredging Operations	Marine ecosystem	Invasive Marine Species	Marine biota	Impacts on marine ecology within the BBLF and surrounds.	2	3	**Medium**	- Ships from international ports are required to exchange ballast water outside of Australia's territorial sea under the *Biosecurity Act 2015*. - Mandatory requirement that all ships comply with Australian regulatory	2	2	**Low**

Item	Aspect	Incident / Event	Receptor	Potential Impact	C[1]	L[2]	IR[3]	Management and Mitigation Measures	C[1]	L[2]	RR[4]
								requirements with respect to the management of ballast water (ie. any vessels originating from foreign ports, a hull inspection is required, or vessels that have been outside of Australian waters in the previous 12 months may also necessitate inspection.			
Dredging Operations	Marine megafauna	Vessel strike	Marine megafauna	- Impacts on marine biodiversity caused by vessels striking megafauna.	4	3	**High**	- Mandatory speed restriction of four knots inside the channel and swing basin. - 10% under keel clearance. - Speed-restricted vessels. - Offshore six knots (mandatory go-slow zone of six knots). - Drivers of all marine vessels are to remain alert to marine megafauna and document all sightings with the General Manager. - Noise from dredge vessel expected to deter megafauna from the immediate area.	3	2	**Medium**
Dredging Operations	Marine habitat quality	Noise and light pollution	Marine megafauna	- Disorientation of megafauna. - Impacts on turtle nesting sites.	2	3	**Medium**	- Light intensity reduced from a nominal range of three nautical miles to one nautical mile. Light colour changed from white to flashing yellow. - Short duration program only spanning over three to forth months. - The BBLF is an operational port whereby noise and light impacts are already presence. The proposed dredging program is not expected to increase the impact of noise or light at the BBLF.	2	1	**Low**

Item	Aspect	Incident / Event	Receptor	Potential Impact	C[1]	L[2]	IR[3]	Management and Mitigation Measures	C[1]	L[2]	RR[4]
								- No turtle nesting sites within 10km of the BBLF.			
Dredging Operations	Marine habitat quality	Waste pollution	Marine biota Marine water quality	Introduction of rubbish/waste into the marine environment causing impact to marine ecology and water pollution.	3	3	**Medium**	- Appropriate collection and disposal of all vessel waste onshore in accordance with regulatory requirements (and by licensed waste contractor) and vessel operating procedures. - All materials and equipment on board vessels and plant are to be appropriately covered and/or stored to prevent waste overboard. - Dredge contractor to receive induction and training in relation to waste management procedures. - NRR Waste Management Plan developed and implemented. The Procedure will include details of waste types, quantities and methods of containment/disposal.	3	2	**Medium**
Dredging Operations	Vessel Refuelling	Hydrocarbon Spill	Marine biota. Marine surface water quality.	- Contamination of marine water quality. - Deterrent of marine fauna from habitat in the vicinity of spill. - Impacts to mucous membranes of sensitive marine fauna. - Impacts on Turtle nesting beaches.	3	3	**Medium**	- Fuel storage area is away from the wharf's edge, secure and appropriately bunded. - Fuel delivery pipeline has an automatic cut-off valve to prevent large spills. - No refuelling will be undertaken during inclement weather conditions to minimise chance of a spill. - Standard operating procedures including appropriate training, visual monitoring of hoses and the sea surface, initial shutdown, and spill response procedures will be implemented.	3	2	**Medium**

Item	Aspect	Incident / Event	Receptor	Potential Impact	C[1]	L[2]	IR[3]	Management and Mitigation Measures	C[1]	L[2]	RR[4]
								- Twice daily servicing and inspection of vessels and machinery to identify and address any leaks or other problems. - Emergency response plan has been developed and implemented outlining the spill clean up procedure. - Hydrocarbon spill kits of sufficient capacity including booms and absorption materials will be onboard tugs/barges at all times, with a spill kit emergency response trailer also located at the BBLF wharf. - Automatic shut down on loss of pressure within marine vessel fuel systems in-place.			

Notes: [1] Consequence, [2] Likelihood, [3] Inherent Risk, [4] Residual Risk

Appendix B – Bing Bong Dredge Pond – Detailed Design Report (SLR 2024)

provided in Appendix A of the MMP Amendment Document