

Water Management Plan

Mulga Downs Iron Ore Mine – Western Australia

Hancock Prospecting Pty Ltd

ABN 69 008 676 417

EPBC Assessment Number: 2022/09255

EPA Assessment Number: 2326

10 April 2025

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Revision Register

REV	DATE	DESCRIPTION OF CHANGES	PREPARED BY	REVIEWED BY	AUTHORISED BY
A1	11-Nov-2024	Draft management plan for Client review	JBS&G Australia	B Heemink C Jury L Dunn	
A2	22-Nov-2024	Draft management plan incorporating Client comments	JBS&G Australia	T Parker	
A3	25 Nov 2024	Draft management plan incorporating Client comments	JBS&G Australia	B Heemink B Willis-Jones L Dunn	
A4	12 Dec 2024	Draft management plan incorporating Client comments	JBS&G Australia	B Heemink B Willis-Jones L Dunn	
A5	19 Dec 2024	Final Management Plan	HanRoy	B Heemink B Willis-Jones L Dunn	
A6	10 April 2025	Updated for DCCEEW Comments	HanRoy	D Tucker	

Declaration of Accuracy:

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

Signed

Full name (please print)

Brett McGuire

Organisation (please print)

HanRoy

Date

10/04/2025

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Executive Summary

This Water Management Plan (WMP) outlines Hancock Prospecting Pty Ltd (HPPL) water monitoring and management strategy for the Mulga Downs Iron Ore Mine (MDIOM, the Proposal¹).

The Proposal is subject to assessment under the Western Australian *Environmental Protection Act 1986* (EP Act) (Assessment Number 2326) and will also be assessed separately under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (EPBC 2022/09255). The Proposal is not being assessed as an accredited assessment.

In accordance with consultation undertaken with the Environmental Protection Authority (EPA) and the Department of Climate Change, Energy, the Environment and Water (DCCEEW), this WMP has been developed in accordance with:

- ‘Instructions on how to prepare *Environmental Protection Act 1986 Part IV Environmental Management Plans*’ (EPA, 2020), as stated in the Environmental Referral Document (ERD), and addresses any specific additional work required for assessment of the Proposal under the EP Act
- Information required under the ‘*Environmental Management Plan Guidelines*’ (DCCEEW, 2024) and supports the Public Environmental Report (PER) for the Proposal.

The purpose of this WMP is to outline HPPL’s approach to monitoring and managing surface water, groundwater, and vegetation health at the MDIOM, in response to potential impacts associated with mine development of the Proposal. This document has been prepared to support the assessment of the MDIOM under the EP Act and the EPBC Act.

Additionally, this document will inform the future creation of the Groundwater Operating Strategy (GWOS) associated with groundwater licenses, as required under Section 5C of the *Rights in Water and Irrigation Act 1914* (RIWI Act).

Table ES 1 presents a summary of this WMP, including the key environmental factors and outcomes that must be achieved through the implementation of this WMP.

Table ES 1: Water Management Plan Executive Summary

Proposal name	Mulga Downs Iron Ore Mine
Proponent name	Hancock Prospecting Pty Ltd
Short Description / Key Elements	<p>The Proposal is for the development of the MDIOM, located 210 km south of Port Hedland and 180 km northwest of Newman in the Pilbara Region of Western Australia. The Proposal includes but is not limited to the following:</p> <ul style="list-style-type: none">• The development of a series of above and below water table mine pits• Ore processing facility (Dry)• Groundwater abstraction for water supply (for the mine and all associated infrastructure) and for the dewatering to facilitate the recovery of ore below water table in the mine pits• Surplus water management with discharge of excess water via managed aquifer recharge (MAR)• Mineral waste management (waste rock dumps (WRD))• Infrastructure to manage surface water (diversion of creeks and surface water flows)

¹ The term Proposal is used throughout this document and is the same as the Proposed Action under EPBC 2022/09255)

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	<ul style="list-style-type: none"> Linear infrastructure (haul roads, powerlines, pipelines and conveyor corridors) Mine infrastructure and support facilities (including, but not limited to accommodation camp, energy supply infrastructure, airstrip; wastewater treatment plant; landfill, offices, workshops, laydown areas, etc.), and Transport of ore via the Great Northern Highway to Port Hedland for export. The Great Northern Highway transport option will enable commencement of the Mulga Downs Iron Ore Mine. Future transport options (e.g. rail) will be subject to a separate referral.
Ministerial Statement	To be determined <i>Note: This document has been prepared to support the EPA's assessment of the Proposal.</i>
EPBC Act Approval	EPBC 2022/09255 <i>Note: This document has been prepared to support DCCEEW's assessment of the Proposal.</i>
Purpose of the EMP	To outline HPPL's approach to monitoring and managing surface and groundwater at the proposed MDIOM. To provide management and monitoring actions for surface water, groundwater [pit dewatering and MAR], and vegetation health to ensure the objectives are met.
Key Environmental factor/s and objectives relevant to this WMP	Inland Waters: To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values and beneficial use are protected. Flora and Vegetation: To protect flora and vegetation so that biological diversity and ecological integrity are maintained. Terrestrial Fauna: To protect terrestrial fauna so biological diversity and ecological integrity are maintained. Social Surroundings: To protect social surroundings from significant harm.
EPBC Act Controlling Provisions	Listed Threatened Species Listed Migratory Species
Main Potential Impacts and Management Strategies	Main potential impacts are changes to groundwater / surface water availability, altered conditions, and/or quality resulting in the loss / degradation of flora and vegetation habitat, fauna habitat and fauna mortality. The management strategies proposed to control these potential impacts are the monitoring programs implemented to identify exceedances in trigger or threshold criteria which in turn activate required management actions.
Condition clauses (if applicable)	Not Applicable. The Proposal has been referred to the EPA and DCCEEW for assessment, a Ministerial Statement and EPBC approval, and associated conditions are yet to be issued.
Key Components in this WMP	<ul style="list-style-type: none"> Minimise potential impacts associated with groundwater abstraction and MAR including water levels and groundwater quality. Minimise potential impacts to sheet flow dependent and surface water dependent riparian vegetation. No adverse impact that could result in contamination of groundwater environments associated with the WRD. Undertake appropriate monitoring and report sufficiently to demonstrate compliance with likely approval requirements and enable appropriate and informed water management decisions.
Proposed construction date	Construction of the Proposal is anticipated to commence at the beginning of FY2026 (subject to approvals) and is forecast to take approximately two years.
EMP required pre-construction?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>

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Abbreviations

Abbreviation	Definition
AEP	Annual Exceedance Probability
AER	Annual Environmental Report
AIC	Akaike Information Criterion (multivariate analysis)
AMD	Acid and Metalliferous Drainage
ANZECC	Australian and New Zealand Environment and Conservation Council
ANZG	Australia and New Zealand Guidelines
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
ASC NEPM	National Environment Protection (Assessment of Site Contamination) Measure 1999
BC Act	<i>Biodiversity Conservation Act 2016</i>
BIC	Bayesian Information Criteria (multivariate analysis)
BNTAC	Banjima Native Title Aboriginal Corporation
CEO	The Director General of the Western Australian Department of Water and Environmental Regulation, or his/her delegate
cm	Centimetres
CSFMP	Conservation Significant Fauna Management Plan
DBCA	Department of Biodiversity, Conservations and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DEM	Digital Elevation Model
DEMIRS	Department of Energy, Mines, Industry Regulation and Safety
DJTSI	Department of Jobs, Trade, Science and Innovation
DPLH	Department of Planning, Lands and Heritage
DGV	Default Guideline Value
DWER	Department of Water and Environmental Regulation
EMS	Environmental Management System
EP Act	<i>Environmental Protection Act 1986</i>
EPA	Environmental Protection Authority
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
ESA	Environmentally Sensitive Area
ERD	Environmental Referral Document
FY	Financial Year
GDV	Groundwater Dependent Vegetation
GWOS	Groundwater Operating Strategy
ha	Hectare
HPPL	Hancock Prospecting Pty Ltd
ITV	Investigation Trigger Value
km	Kilometre
km ²	Square kilometre
LAI	Leaf Area Index
LOM	Life of Mine
LRTV	Low Risk Trigger Value

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Abbreviation	Definition
L/s	Litre per second
m	Metre
mm	millimetres
MAR	Managed Aquifer Recharge via reinjection
magl	Metres below ground level
MDIOM	Mulga Downs Iron Ore Mine
m ² /ha	Square metre per hectare
mg/L	Milligrams per litre
ML/d	Megalitre per day
mm/yr	Millimetres per year
MNES	Matters of National Environmental Significance
mRL	metres Reduced Level
MRWA	Main Roads Western Australia
Mtpa	Million tonnes per annum
NAF	Non-Acid Forming
NATA	National Association of Testing Authorities
NDVI	Normalised Difference Vegetation Index
NDWI	Normalised Difference Wetness Index
NMD	Neutral Mine Drainage
OSA	Overburden Storage Area
PAF	Potentially Acid Forming
PAW	Plant Available Water
PEC	Priority Ecological Community
PER	Public Environmental Report
RIWI Act	Rights in Water and Irrigation Act 1914
SFMMP	Subterranean Fauna Monitoring and Management Plan
SRE	Short-range Endemism
SD	Saline Drainage
TDS	Total Dissolved Solids
TEC	Threatened Ecological Communities
TSS	Total Suspended Solids
WMP	Water Management Plan
WRD	Waste Rock Dump
µS/cm	Microsiemens per centimetre

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Mulga Downs Iron Ore Mine – Western Australia

1 Context, Scope and Rationale

Hancock Prospecting Pty Ltd (HPPL) is proposing to construct and operate the Mulga Downs Iron Ore Mine (MDIOM, the Proposal), located approximately 210 kilometres (km) south of Port Hedland and 180 km north of Newman in the Pilbara Region of Western Australia (**Figure 1-1**). The Proposal is subject to assessment under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) (EPBC 2022/090255) and the State Environmental Protection Act 1986 (EP Act) (Assessment Number 2326).

This Water Management Plan (WMP) is intended to support the Environmental Review Document (ERD) for the Proposal as well as the Commonwealth Public Environmental Report (PER) and as such, reference to ‘Development Envelope’ (**Figure 1-2**) and ‘Proposed Action Area’ (**Figure 1-3**) is applied herein, respectively.

This WMP outlines HPPL’s approach to monitoring and management of ground and surface water to mitigate potential impacts to receiving environment and receptors identified for the Proposal; namely, hydrogeologic and hydrologic regime; biological diversity and ecological integrity of terrestrial flora, vegetation, and fauna; and social surrounds. This WMP has been prepared in consideration of, and should be read in conjunction with, the Conservation Significant Fauna Management Plan (CSFMP) and the Subterranean Fauna Monitoring and Management Plan (SFMMMP).

This WMP is dynamic and is subject to adaptive management as improvements to monitoring and management of impacts are defined based on additional studies, refined mine plan design, and validation of modelled outcomes from monitoring

The content and structure of this WMP aligns with the EPA’s guidance document, Instructions on how to prepare *Environmental Protection Act 1986* (EP Act) Part IV Environmental Management Plans (EPA, 2020) and DCCEEW guidance document Environmental Management Plan Guidelines (DCCEEW, 2024).

1.1 Proposal

HPPL is the proponent for the Proposal, which encompasses the construction and operation of an iron ore mine, borefield and associated infrastructure. The Proposal involves the above and below water table mining of iron ore from open-cut pits, with a production rate of up to 12 million tonnes per annum (Mtpa) of ore over an expected life of 18 years. Ore will be transported via the Great Northern Highway to Port Hedland, or via road to a siding along Roy Hill railway infrastructure for export. Future transport options (e.g. rail) will be subject to a separate referral. Key characteristics of the Proposal are summarised in **Table 1-1**.

Table 1-1: Key Proposal Characteristics

Key Characteristics	Description
Clearing	Up to 4,339.16 hectare (ha) of native vegetation (Disturbance/Indicative Footprint) within the 16, 848.5 ha Development Envelope/Proposed Action Area.
Landforms	Waste rock dumps (WRD), ore stockpile, topsoil stockpiles and sub-soil stockpiles.
Support Facilities	Small scale power generation, telecommunications tower, power infrastructure, workshops, hydrocarbon storage, explosive missing and storage facilities, laydown areas and offices. Accommodation camps.
Infrastructure	Dry ore crushing, screening plant and truck loading

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Key Characteristics	Description
	<p>Linear infrastructure including heavy and light vehicle access roads, conveyors, pipelines and power and communications distribution.</p> <p>Diversion drains, levees and culverts for surface water management.</p> <p>Groundwater abstraction (including dewatering) and associated management infrastructure.</p> <p>Surplus water management with discharge of excess water via managed aquifer recharge (MAR), including groundwater injection and/or in-pit infiltration methods</p>
Mining	<p>Open cut pits in seven mining areas referred to as Murray's Hill, Anticline Hill, Fridge West, Fridge Central, Fridge Hill, Horseshoe West and Horseshoe Hill.</p> <p>The development of a series of above and below water table mine pits.</p> <p>Transport of ore via the Great Northern Highway to Port Hedland for export. The Great Northern Highway transport option will enable commencement of the Mulga Downs Iron Ore Mine. Future transport options (e.g. rail) will be subject to a separate referral.</p>

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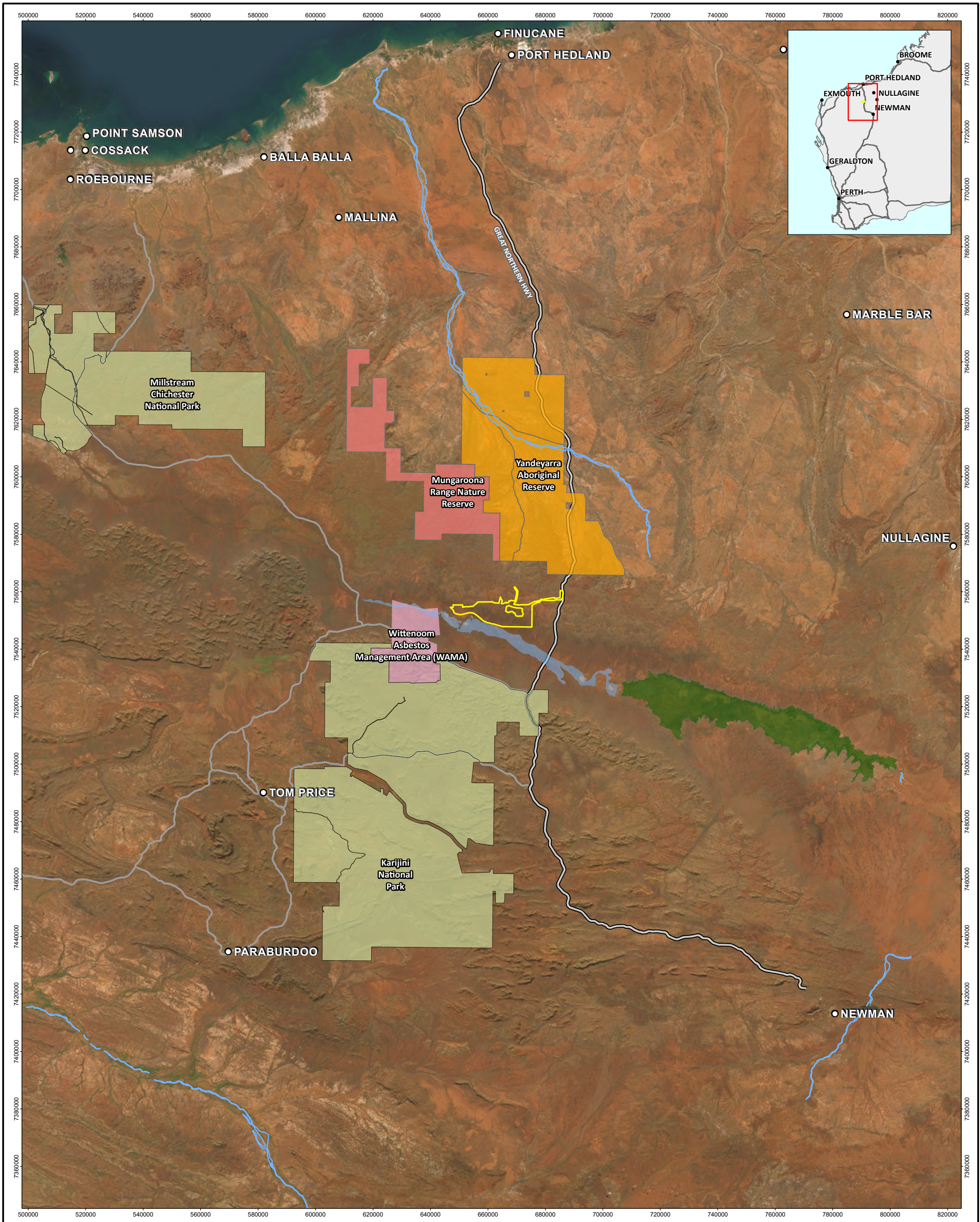
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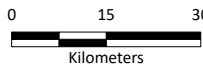
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Figure 1-1: Regional location of the Proposed Action Area (2022/09255) and Development Envelope (2326)

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<p>Legend</p> <ul style="list-style-type: none"> Development Envelope Wittenoom Asbestos Management Area (WAMA) (DWER-059) Legislated Lands and Waters (DBCA-011) <ul style="list-style-type: none"> National Park Nature Reserve 	<ul style="list-style-type: none"> Yandeyarra Aboriginal Reserve (LGATE-227) Directory of important wetlands (DBCA-045) <ul style="list-style-type: none"> Lower Fortescue River Upper Fortescue River including the Fortescue Marsh Watercourses (LGATE-053) 	<p>Roads (LGATE-195)</p> <ul style="list-style-type: none"> Highway Major road 	 <p>Job Number: 67751</p> <p>Client: Hancock Prospecting Pty Ltd</p> <p>Drawn By: droberts Checked By: VC</p>	 <p>Scale 1:1,200,000 at A3</p> <p>Coord. Sys. GDA2020 MGA Zone 50</p> <p>Version: Rev A Date: 31-Oct-2024</p>	<p>Mulga Downs Iron Ore Mine Central Pilbara, Western Australia</p> <p>REGIONAL LOCATION OF THE PROPOSAL</p> <p>FIGURE: 1.1</p>
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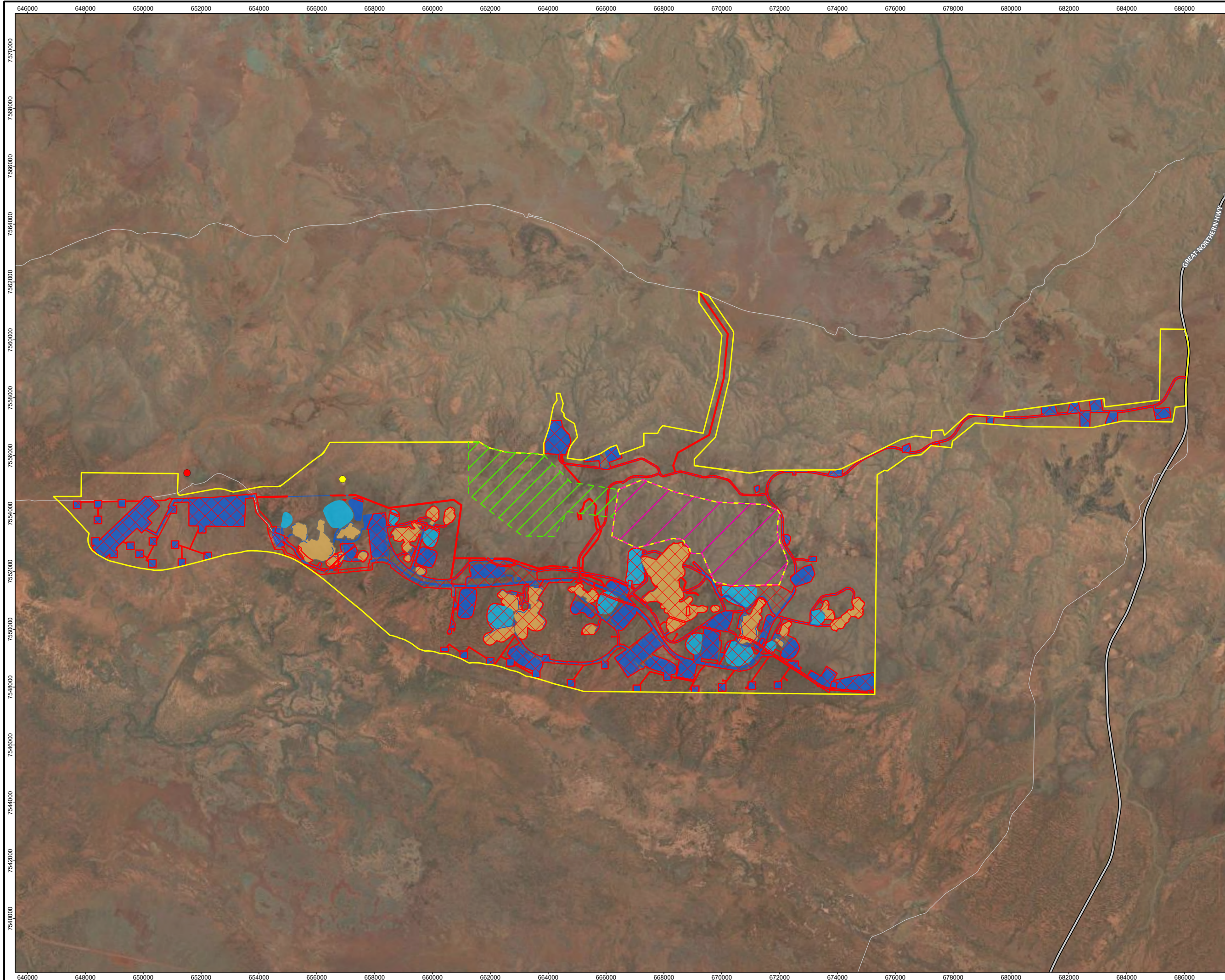
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Figure 1-2: State Proposal (Assessment No. 2326)– showing Development Envelope and Indicative Footprint

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- Legend**
- Development Envelope
 - Indicative Footprint
 - Fauna Habitat Exclusion Zone (FHEZ)
 - FHEZ Corridor
 - Mine Layout**
 - Supporting infrastructure
 - Pit
 - Waste Dump
 - Mulga Downs Exploration Camp (LGATE-013)
 - Mulga Downs Homestead (LGATE-013)
 - Roads (LGATE-195)**
 - Highway
 - Minor Road



Job No: 67751
 Client: Hancock Prospecting Pty Ltd
 Version: A Date: 26-Mar-2025
 Drawn By: dmills Checked By: VC

Scale 1:120,000 at A3

Coord. Sys. GDA2020 MGA Zone 50

**Mulga Downs Iron Ore Mine
 Central Pilbara, Western Australia**

**PROPOSAL LOCATION,
 DEVELOPMENT ENVELOPE AND
 INDICATIVE FOOTPRINT**

FIGURE 1.2

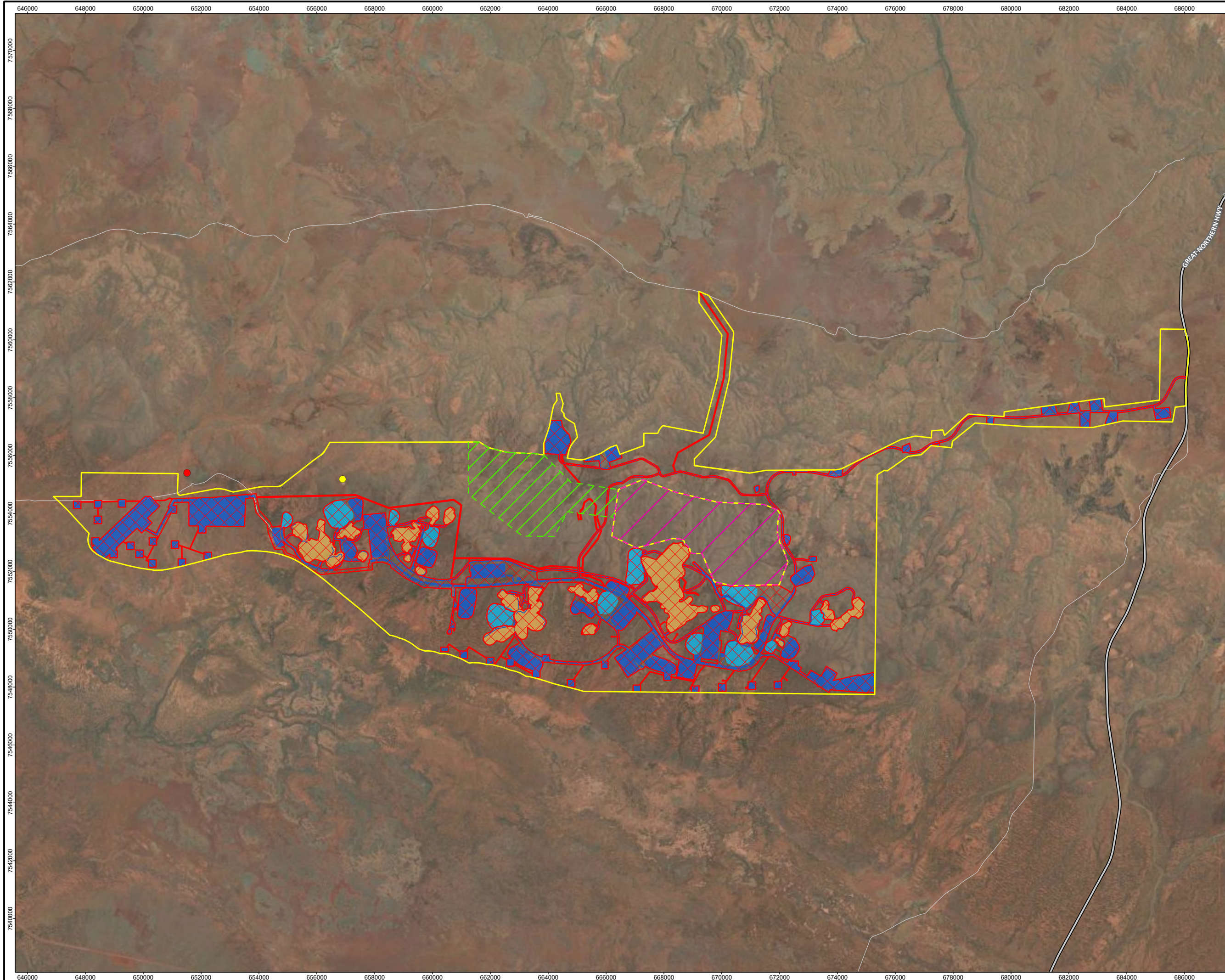
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Figure 1-3: Commonwealth Proposed Action (2022/09255) – showing Proposed Action Area and Disturbance Footprint

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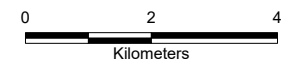


- Legend**
- Proposed Action Area
 - Disturbance Footprint
 - Fauna Habitat Exclusion Zone (FHEZ)
 - FHEZ Corridor
 - Mine Layout**
 - Supporting infrastructure
 - Pit
 - Waste Dump
 - Mulga Downs Exploration Camp (LGATE-013)
 - Mulga Downs Homestead (LGATE-013)
 - Roads (LGATE-195)**
 - Highway
 - Minor Road



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 Drawn By: droberts Checked By: VC

Scale 1:120,000 at A3



Coord. Sys. GDA2020 MGA Zone 50

**Mulga Downs Iron Ore Mine
 Central Pilbara, Western Australia**

**PROPOSED ACTION AREA
 DISTURBANCE FOOTPRINT**

FIGURE 1.3

File Name: C:\Users\droberts\JBS&G Australia\JBS&G - DCS - Internal - Documents\Projects\Hancock Prospecting\01_Mine\EPBC\02_Map\Projects\67751_MDIOM_EPBC_s156a_PER_R01.aprx
 Image Reference: World Imagery: Earthstar Geographics

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Mulga Downs Iron Ore Mine – Western Australia

1.2 Key Environmental Factors and Matters of National Environmental Significance

The EPA’s key environmental factors and Commonwealth Matters of National Environmental Significance (MNES) subject to this WMP are:

- Inland Waters
- Flora and Vegetation
- Terrestrial Fauna
- Social Surroundings
- MNES Listed Threatened Species
- MNES Listed Migratory Species

The key environmental factors and MNES objectives are outlined in Table 1-2. Table 1-3 outlines the Proposal activities and potential impacts to site specific environmental values.

Table 1-2: Key Environmental Factors

Key Environmental Factor / MNES	Objective
EPA Environmental Factors	
Inland Waters	To maintain the hydrological regimes and quality of groundwater and surface water so environmental values are protected
Flora and Vegetation	To protect flora and vegetation so biological diversity and ecological integrity are maintained
Terrestrial Fauna	To protect terrestrial fauna so that biological diversity and ecological integrity are maintained
Social Surroundings	To protect social surroundings from significant harm
Commonwealth MNES	
Listed Threatened Species	Conservation and recovery: to protect and recover threatened species and their habitats to ensure their long-term survival.
Listed Migratory Species	Sustainable management: to promote the sustainable management of habitats critical to the survival of these species. Mitigation of threats: to identify and mitigate threats to these species, including habitat destruction, invasive species, and climate change. Research and monitoring: to support research and monitoring efforts that enhance understanding of these species and inform conservation efforts. Collaboration: to encourage collaboration between government agencies, community groups, and stakeholders in conservation efforts.

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Table 1-3: Proposal Activities and Impacts to Environmental Factors and MNES

Key Environmental Factor / MNES	Site Specific Value / Receptors	Proposal Activities	Alteration to Environment	Potential Impacts
Inland Waters	<ul style="list-style-type: none"> Freshwater Claypans of the Fortescue Marsh, including Gnalka Gnoona Claypan and Koodjeepindarranna Claypan Lower Fortescue River and tributaries Groundwater users (community and pastoral) (refer to Figure 1-4) 	<ul style="list-style-type: none"> Dewatering MAR Landform development (e.g., WRDs) 	<p>Modification of Existing Hydrogeologic Regimes</p> <ul style="list-style-type: none"> Groundwater drawdown will occur as a result of dewatering to allow dry mining conditions. Groundwater level mounding will occur as a result of the MAR Change in groundwater levels and flow due to dewatering and MAR <p>Modification of Groundwater Water (Physical and Chemical) Quality</p> <ul style="list-style-type: none"> Change in groundwater salinity due to dewatering & MAR. Pollution from leachate infiltration from the WRD 	<p>Modification of Existing Hydrogeologic Regimes</p> <ul style="list-style-type: none"> Reduction in groundwater levels from abstraction and mine pit dewatering resulting in reduced groundwater availability at existing bores. Mounding of groundwater resulting in water logging of claypans and surface expression of saline groundwater <p>Modification of Groundwater Water (Physical and Chemical) Quality</p> <ul style="list-style-type: none"> Increased salinity and/or contamination impacting existing groundwater users Contamination subject to remedial response
		<ul style="list-style-type: none"> Ground disturbance Landform development Surface water diversions - linear infrastructure & site drainage infrastructure (e.g. sedimentation basins) Pit development 	<p>Modification of Existing Hydrologic Regimes</p> <ul style="list-style-type: none"> Altered drainage lines Altered catchment basins Change in surface flow direction and quantity of surface water Increased sedimentation and erosion Increased inundation Ponding/water shadowing <p>Modification of Surface Water (Physical and Chemical) Quality</p> <ul style="list-style-type: none"> Pollution from leachate infiltration from the WRD 	<p>Modification of Existing Hydrogeologic Regimes</p> <ul style="list-style-type: none"> Reduced catchment area and flow to claypans Increased sediment loads from mine runoff and erosion to the downstream environment and to the Fortescue Valley (including claypans and pools). <p>Modification of Surface Water (Physical and Chemical) Quality</p> <ul style="list-style-type: none"> Contamination subject to remedial response

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Key Environmental Factor / MNES	Site Specific Value / Receptors	Proposal Activities	Alteration to Environment	Potential Impacts
Flora and Vegetation	<ul style="list-style-type: none"> Priority 1, 3, 4 flora species Sheet-flow and surface water (riparian) dependent vegetation) Priority 1 Freshwater Claypans of the Fortescue Valley Four plant assemblages of the Wona Land System (Priority 1 to 3) 	<ul style="list-style-type: none"> Dewatering MAR Ground disturbance Landform development Surface water diversions - linear infrastructure & site drainage infrastructure (e.g. sedimentation basins) 	<ul style="list-style-type: none"> Modification of hydrogeologic and hydrologic regimes Modification of groundwater quality and levels Modification of surface water quality and quantity 	<ul style="list-style-type: none"> Mortality and/or habitat condition reduction from: <ul style="list-style-type: none"> waterlogging or root exposure to saline groundwater saline dust suppression water increased sediment loads decreased surface water quantity due to altered flow direction water shadowing Reduced catchments and altered surface water flow regime that could decrease flood levels. Soil water depletion and drought stress during prolonged interfloods can potentially impact E. victrix communities with denser patches with higher percentage cover. Vegetation types dominated by mulga (Acacia aneura complex) are susceptible to increased waterlogging, which could cause a decline in tree health
Terrestrial Fauna	<ul style="list-style-type: none"> Fauna habitat <i>Biodiversity and Conservation Act</i> (BC Act) listed fauna BC Act listed Migratory birds i.e., users of Fortescue Valley, Lower Fortescue River and tributaries 		<ul style="list-style-type: none"> Modification of groundwater quality and levels Modification of surface water quality and quantity 	<ul style="list-style-type: none"> Mortality, reduction, and/or loss of fauna habitat adversely impacting fauna foraging, nesting and migration patterns

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Key Environmental Factor / MNES	Site Specific Value / Receptors	Proposal Activities	Alteration to Environment	Potential Impacts
Social Surrounds	<ul style="list-style-type: none"> Mungurrdu lodged DPLH site (ACH-00040484) Koojeeepindarranna and Gnalka Gnoona pools 	<ul style="list-style-type: none"> Dewatering MAR Surface water diversions 	<ul style="list-style-type: none"> Modification of hydrogeologic and hydrologic regimes Modification of groundwater quality and levels Modification of surface water quality and quantity 	<ul style="list-style-type: none"> Disturbance to sites of cultural significance and surrounding sensitive receptors
MNES Listed Threatened Species	<ul style="list-style-type: none"> Gray Falcon 	<ul style="list-style-type: none"> Dewatering MAR Ground disturbance Landform development Surface water diversions - linear infrastructure & site drainage infrastructure (e.g. sedimentation basins) 	<ul style="list-style-type: none"> Modification of hydrogeologic and hydrologic regimes Modification of groundwater quality and levels Modification of surface water quality and quantity 	<ul style="list-style-type: none"> Mortality and/or habitat condition reduction from: <ul style="list-style-type: none"> waterlogging or root exposure to saline groundwater, saline dust suppression water increased sediment loads decreased surface water quantity due to altered flow direction water shadowing Mortality, reduction, and/or loss of fauna habitat adversely impacting fauna foraging, nesting and migration patterns
MNES Listed Migratory Species	<ul style="list-style-type: none"> Common Greenshank Wood Sandpiper Red-necked Stint Glossy Ibis Fork tailed Swift 	<ul style="list-style-type: none"> Dewatering MAR Ground disturbance Landform development Surface water diversions - linear infrastructure & site drainage infrastructure (e.g. sedimentation basins) 	<ul style="list-style-type: none"> Modification of hydrogeologic and hydrologic regimes Modification of groundwater quality and levels Modification of surface water quality and quantity 	<ul style="list-style-type: none"> Mortality and/or habitat condition reduction from: <ul style="list-style-type: none"> waterlogging or root exposure to saline groundwater, saline dust suppression water increased sediment loads decreased surface water quantity due to altered flow direction water shadowing Mortality, reduction, and/or loss of fauna habitat adversely impacting fauna foraging, nesting and migration patterns

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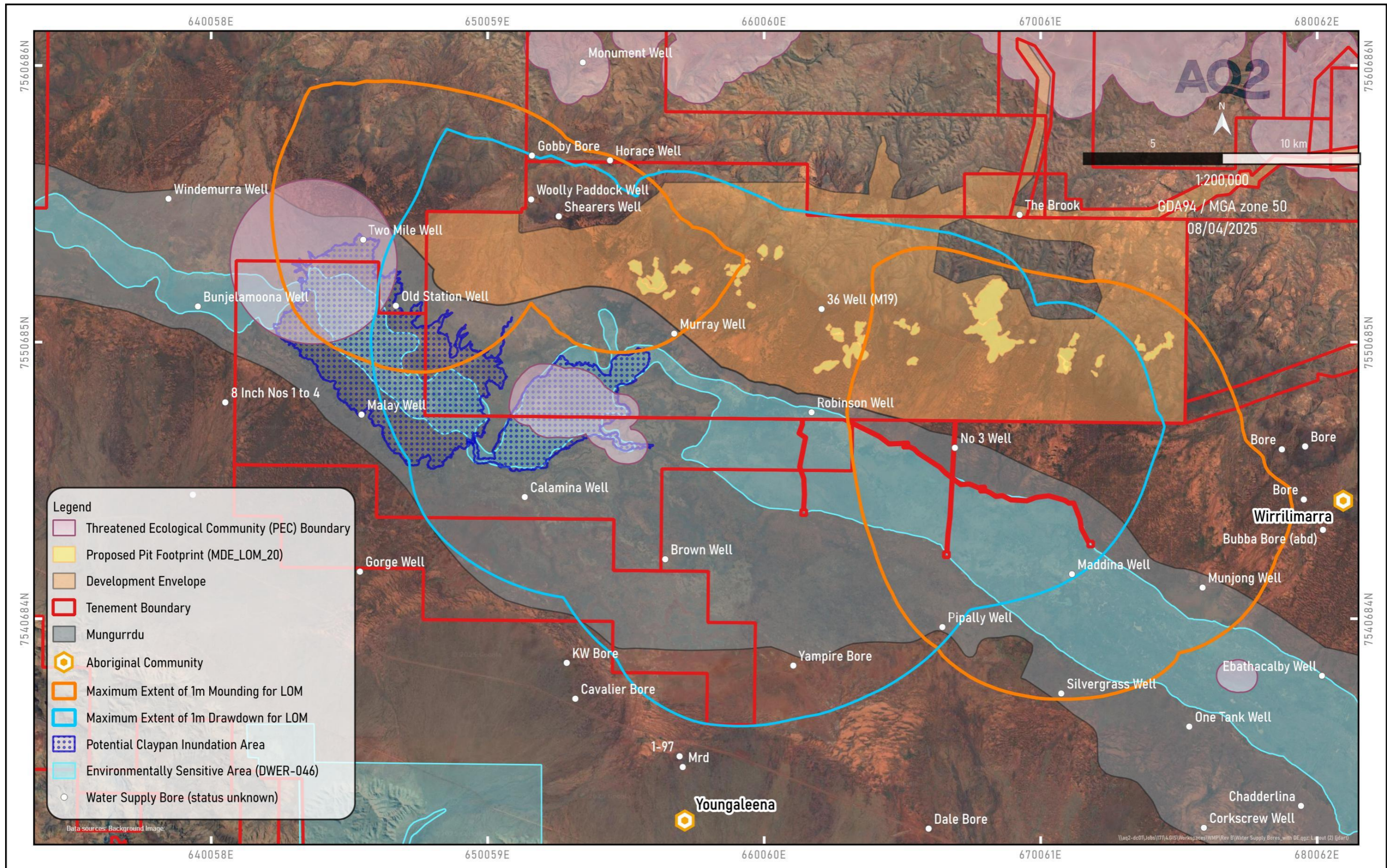


Figure 1-4: Water Supply Bores

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1.3 Condition Requirements

The Proposal was referred to the EPA under Part IV of the EP Act (Assessment No: 2326) and is currently under assessment. The Commonwealth is currently assessing the Proposal via a Public Environmental Report (PER) under Assessment Number: EPBC 2022/09255. The Proposal is not being assessed as an accredited assessment. It is noted the Murray's Hill Project (Murray's Hill) is included as part of the EPBC Act referral, but it is not part of the EP Act referral, hence the different Disturbance Footprint and Indicative Footprint. Murray's Hill is included for the purpose of this WMP.

This WMP will be updated pending State and/or Commonwealth conditions placed on the Proposal, and these conditions will be linked to the Environmental Management Provisions outlined in **Section 3**.

1.4 Rationale and Approach

This WMP has been developed to address potential impacts to EPA's key environmental factors (Inland Waters, Flora and Vegetation, Terrestrial Fauna, Social Surrounds) and MNES resulting from alterations to naturally occurring surface water and groundwater environments associated with the development of the Proposal. Survey and study findings, risk assessments, and monitoring completed to date and detailed in the ERD and PER, as well as an assessment of assumptions and uncertainties, have been used to define management provisions that will be applied to maintain the environmental objectives associated with EPA's key environmental factors and the Commonwealth MNES subject to this WMP.

HPPL intends to continue monitoring prior to construction and during initial mine development to further enhance existing datasets and support validation and verification of current numeric modelling. As such, it is expected that this WMP will be revised and updated to reflect increased knowledge prior to construction phase of the Proposal, and again following initiation of dewatering and MAR activities. Based on this approach, the trigger levels, threshold criteria, and management provisions as currently detailed in **Sections 2** and **3** are considered interim.

1.5 Survey and Study Findings

The studies and surveys outlined in Table 1-4 have been performed to inform the surface water, groundwater, ecohydrology, flora and vegetation, and terrestrial fauna summary. Full details of the outcomes from all baseline studies are provided in the State ERD and the Commonwealth PER. A summary of the key environmental aspects relevant to this WMP are provided below.

Table 1-4: Summary and Surveys and Studies

Report Year	Author	Survey / Study Name	Reference
Surface Water, Groundwater and Ecohydrology			
2009	MWH	Murray's Hill Groundwater Investigation – Stage 2	MWH, 2009
2012	MWH	Hydrogeological Assessment of the Fenceline Road Borefield Area	MWH, 2012
2014	MWH	Conceptual Hydrogeology of the Mulga East Deposit	MWH, 2014
2020	AQ2	Mulga Downs Ecohydrology Study	AQ2, 2020a*
2020	AQ2	Mulga East Baseline Water Studies	AQ2, 2020b*

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Report Year	Author	Survey / Study Name	Reference
2021	AQ2	Mulga East Preliminary Groundwater Management Assessment	AQ2, 2021a*
2021	AQ2	Mulga East PFS Desktop Study	AQ2, 2021b*
2022	PSM	Mulga Downs PFS Geotechnical Assessment and Pit Slope Design	PSM, 2022
2022	AQ2	Mulga Downs Interim Surface Water Impact Assessment	AQ2, 2022a*
2022	AQ2	Mulga Downs Site Water Management (Hydrology and Hydrogeology) Pre-feasibility Study	AQ2, 2022b*
2023	GWC	Mulga Downs Groundwater Modelling	GWC, 2023*
2024	AQ2	Mulga Downs Water Studies, Groundwater Surface Water Impact Assessment	AQ2, 2024a*
2024	AQ2	Mulga Downs Baseline Ecohydrological Assessment	AQ2, 2024b*
2024	AQ2	Mulga Downs Iron Ore Project: Assessment of Surface Water Change on Vegetation of the Fortescue Valley	AQ2, 2024c*
2024	GWC	Mulga Downs Groundwater Modelling	GWC, 2024
2024	AQ2	Mulga Downs Groundwater, Surface Water & Ecohydrological Studies Baseline Assessment	AQ2, 2024d
2024	AQ2	Mulga Downs Groundwater, Surface Water and Ecohydrological Impact Assessment	AQ2, 2024e
Terrestrial Fauna			
2020	ecologia	Baseline Terrestrial Invertebrate Fauna (SRE) Level 2 Assessment	ecologia, 2020
2021	ecologia	Mulga East Baseline Terrestrial Vertebrate Fauna Assessment	ecologia, 2021a
2021	ecologia	Letter: Targeted Pilbara Leaf-nosed Bat Gap Analysis	ecologia, 2021b
2022	Biologic	Mulga Downs Iron Ore Project: Transport Corridor to Great Northern Hwy Terrestrial Fauna Survey	Biologic, 2022a
2022	Biologic	Mulga East Iron Ore Project: Mulga West Borefield and Mulga East Corridors Terrestrial Fauna Survey.	Biologic 2022b
2023	Biologic	Mulga Downs Iron Ore Mine: Freshwater Claypans Desktop Assessment.	Biologic 2023
2023	Attexo	Consolidated Terrestrial Fauna Report	Attexo, 2023
2023	Spectrum	Mulga Downs Iron Ore Project (MDIOP) Solar Farm, Haul Road and Pipeline (ASA)	Spectrum, 2023a
2023	Spectrum	Memo: Mulga Downs Iron Ore Mine, Targeted Grey Falcon Survey	Spectrum, 2023b
2024	Spectrum	Targeted Bilby & Night Parrot Survey	Spectrum, 2024a
2024	Spectrum	Supplementary Targeted Fauna Survey	Spectrum, 2024b
Flora and Vegetation			
2021	Maia	Mulga East Iron Ore Project, Mine Study Area Detailed Flora and Vegetation Assessment 2019-2020	Maia, 2021a
2021	Maia	Mulga Downs West Flora and Vegetation Desktop Study	Maia, 2021b
2022	Maia	Mulga Downs Iron Ore Project, Mine and Borefield Study Area Detailed Flora and Vegetation Assessment 2019-2022	Maia, 2022

* Report has been superseded by AQ2, 2024d & AQ2, 2024e.

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1.5.1 Inland Waters

1.5.1.1 Hydrogeologic Regime

Physical Setting Overview

Five main hydrogeologic units have been identified as part of the hydrogeologic investigations:

- Tertiary/ Quaternary Cover: Basal 'Crete', CID/Pisolite, Undifferentiated Tertiary and Upper Calcrete
- Bedrock Units: Fresh Jeerinah and Marra Mamba Formations, Fresh West Angela Members (Wittenoom Formation), Altered Marra Mamba Formation and West Angela Member, Dolomite of the Wittenoom Formation)

A summary overview of these units is as follows:

- The Tertiary overburden forms a highly transmissive and continuous aquifer within the valley. Maximum thicknesses up to approximately 60 metres (m) occur in the middle of the valley, thinning on the valley slopes.
- The low permeability Jeerinah Formation and unmineralized Marra Mamba Iron Formation form a basement aquitard with a minor local fractured aquifers. A highly transmissive and continuous aquifer is hosted in the mineralised, fractured and weathered Marra Mamba Iron Formation. The overlying West Angela Member of the Wittenoom Formation forms a moderately permeable aquifer unit with localised (discontinuous) zones. These two formations are in hydraulic connection.
- The water table elevation ranges between approximately 385 metres Reduced Level (mRL) and 420 mRL, with groundwater flowing from the topographically higher areas into the valley and then in a north-westerly direction along the valley.
- In the Mulga East / Malay Well area the depth to groundwater is shallow in the lower lying, valley areas at approximately 3 and 5 metres below ground level (mbgl) and increases with elevation, to depths of up to 45 mbgl in the more elevated areas (north of the inferred resource areas)
- The derived depth to water for the claypans and channel pools indicate these features are not groundwater related.

Groundwater Data

Baseline groundwater monitoring has been ongoing since 2009. Summary findings are as follows:

- Groundwater flows from the topographically higher areas into the valley and then in a northwesterly direction along the valley.
- The depth to groundwater is shallow in the lower lying, valley areas at approximately 3 to 5 metres below ground level (mbgl) and increases with elevation, to depths of up to 45 mbgl.
- Groundwater ranges from fresh [180 milligrams per litre (mg/L) Total Dissolved Solids (TDS)] in the upper reaches of the groundwater system, to saline (17,000 mg/L TDS) across the valley area, with salinity profiling data confirming saline groundwater originates from the claypans and extends along the valley as well as beneath the southernmost orebodies.
- Laboratory analysis for metals, alkalinity, major and minor anions (chloride, sulfate, boron and fluoride), major and minor cations (potassium, sodium, calcium, magnesium, and strontium) has been completed to establish a baseline dataset. The baseline dataset has been evaluated and through statistical analysis, trigger levels established. The levels and approach are detailed in the CBEC (2024) document provided as **Appendix 1**.

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Groundwater in the region is predominantly used for stock water. Drinking water guidelines for beef cattle indicate a tolerance limit of 5,000 mg/L TDS (ANZECC/ARMCANZ, 2000; ANZG, 2018, therefore livestock water supply bores target where shall groundwater is within this limit. Water supply bores are shown on **Figure 1-4**.

Dewatering and MAR

Open cut pits are proposed in seven mining areas referred to as Murray's Hill, Anticline Hill, Fridge West, Fridge Central, Fridge Hill, Horseshoe West and Horseshoe Hill. All but 13 of the pits extend (to varying depths) below the groundwater level and will therefore require dewatering. The lowest estimated pit elevation is 388 mRL (i.e., -12 to 16 m below the groundwater level).

Dewatering exceeds water demand and surplus excess water will be managed via MAR (via re-injection bores, repurposed dewatering bores and/or in pt infiltration) There are three proposed MAR areas: Murray's West borefield, Fridge/Horseshoe South borefield; and re-injection in the Murray's Hill and Anticline Hill areas (post mining of these areas).

Groundwater salinity will change as a result of dewatering and MAR activities. An evaluation of the changes in groundwater salinity was undertaken and summarised as follows:

- The TDS of the combined dewatering discharge for all dewatering bores over Life of Mine (LOM) is predicted to range between 1,700 and 4,200 mg/L, taking into account the uncertainty associated with aquifer porosity.
- Changes in groundwater quality resulting from the proposed dewatering and MAR activities is anticipated to be fairly localised (i.e., <2 km in extent).
- The key driver for groundwater salinity change is the proposed dewatering at Murray's Hill. This is predicted to result in increases to the dewatering discharge salinity as more saline water is drawn in from the valley areas. The subsequent re-injection of this more saline dewatering discharge into the Murray's West and Fridge / Horseshoe South MAR Borefields results in localised areas of increased groundwater salinity as well as subsequent increases to the combined dewatering discharge, as the re-injected water in the east is recirculated towards the Fridge West and Fridge Hill mining area.
- Predicted groundwater salinity beneath the claypan areas shows only minor fluctuations (<500 mg/L TDS).

The effects of dewatering and MAR to the hydrogeologic regime are summarised in Table 1-5.

Table 1-5: Dewatering and MAR – Hydrogeologic Regime Alteration

Activity	Regime Alteration
Dewatering	<ul style="list-style-type: none">• Maximum drawdowns are predicted in the active mining areas, with maximum drawdown depths of up to 25 m• Drawdown is predicted to extend across the valley, away from the mining areas, however the extent of the drawdown along the strike of the valley is curtailed by MAR in both the east and the west of the Mulga East tenement for various periods through the LOM.• The maximum extent of predicted 2 m drawdown contours are as follows:<ul style="list-style-type: none">- Across the valley: ~8 km south-southwest of Fridge West, across the valley.- In the vicinity of the claypans: ~ 7.5 km south-southwest of the Murray's Hill mining area, across the Gnalka Gnoona Claypan area.- Western extent: ~6 km along strike to the west of the Murry's Hill mining area.- Eastern extent: ~-3.5 km to the east of the main Horseshoe West pit
MAR	<ul style="list-style-type: none">• Groundwater level rise (mounding) will occur as a result of MAR, with the maximum extent of predicted 1 m mounded contours as follows:

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Activity	Regime Alteration
	<ul style="list-style-type: none"> - Fridge/Horseshoe South Borefields: ~10 km to the south (across the valley) and ~5 km beyond the Mulga East tenement boundary, in a southeasterly direction. - Murrays West MAR Borefield: ~7km to the northwest (along strike) and ~5 to 5.5 km to the south and southwest (across the valley), in the vicinity of the Koodjeepindarranna Claypan • The threshold groundwater depth above which interaction with vegetation may occur is estimated to be about 2.0 mbgl

1.5.1.2 Hydrologic Regime

Physical Setting Overview

The Fortescue Valley is split by the Goodiadarrie Hills (a ~5 m barrier that forms a surface water divide) into the (eastern) Fortescue Marsh and the (western) Goodiadarrie Swamp. A second surface water divide exists to the west of the Goodiadarrie Swamp (immediately to the west of Koodjeepindarranna Claypan), separating the Goodiadarrie Swamp from the Lower Fortescue River. The Project is located on the northern flanks of the Fortescue Valley and is fully contained within the Goodiadarrie Swamp sub-catchment, with the swamp located on the northern side of the base of the valley and immediately to the south of the Project. The Goodiadarrie Swamp catchment is bounded by the Chichester Range to the north and the Hamersley Range to the south. Runoff from smaller rainfall events is likely to be contained within the Goodiadarrie Swamp area, with discharge into the Lower Fortescue River likely to require large rainfall events. Key features relevant to this WMP are claypans and channel pools, with noted information summarised in Table 1-6.

Table 1-6: Claypans and Channel Pools

Feature	Overview
Claypans	<ul style="list-style-type: none"> • Noted claypans within the Goodiadarrie Swamp catchment are the Koodjeepindarranna Claypan and the Gnalka Gnoona Claypans, immediately south of the Development Envelope. • The Gnalka Gnoona Claypan can form into an extensive waterbody that may persist for extended periods. • Very little transfer of water along the valley floor within the Goodiadarrie Swamp area is thought to occur, with no defined preferred drainage paths along the valley floor and a valley floor slope of -0.01% • Evaporation plays the primary role in removing collected water from the claypans, with only minor seepage to the groundwater system. Residual salts from this evaporative loss are leached into the groundwater system under the claypans by the small component of seepage.
Channel Pools	<ul style="list-style-type: none"> • Four surface water fed channel pools were identified in and near the Development Envelope, three of which are associated with claypan features. The pools occur within the Goodiadarrie Swamp and around deeper areas of flooding, storing following runoff events. These pools include: <ul style="list-style-type: none"> - Channel pool within the Koodjeepindarranna Claypan complex. - Channel pool at UTM Zone 50 653300E and 7550400N (vicinity of Gnalka Gnoona Claypan complex) - Channel pool at UTM Zone 50 661600E and 7547770N. - Gidyea pool south east (and upstream) of the Development Envelope (Ebathcalby Claypan complex)

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Surface Water Data

Baseline surface water monitoring has been undertaken within creek lines, claypans and channel pools at 11 locations (SWML01A, SWML01-09, SWML13). Surface water samples collected for laboratory analysis were collected from SWML01A, SWML01-05, SWML09, and SWML13 with a summary overview of surface water quality results provided in Table 1-7.

Table 1-7: Surface Water Quality Results Summary

Feature	Overview
Surface Water Sample Analytical Parameters	Surface water samples have generally been tested for: <ul style="list-style-type: none">• General water quality and general metals suite• Nutrients• TDS/ Total Suspended Solids (TSS).
Comparison to ANZECC Freshwater Aquatic Ecosystem Guideline Values	<ul style="list-style-type: none">• Samples collected from the creeks and channel pools are classified as being from an 'Upland River' sub-system for comparison to physical stressor trigger values.• Samples collected from the claypans would be classified as being from a 'Fresh Water Lakes' sub- system for comparison to physical stressor trigger values.• The site would be classified as slightly to moderately disturbed due to the historic and continuing cattle farming practices that occur through the catchment. However, the site is considered to have a high conservation value. <p><i>Based on the above, sampled results have been compared against ANZECC Tropical Fresh Water trigger levels for physical stressors for Upland River and Freshwater Lakes ecosystems, as well as toxicant trigger values for both ecosystem types associated with 95% species protection.</i></p>
Water Quality Data Analysis	Key data results analysis: <ul style="list-style-type: none">• Aluminium, Zinc, Phosphorus, Sulfate concentrations measured are consistently above the trigger levels.• The measured TDS concentrations of the samples taken from the claypans (SWML03 and SWML04) are variable (as expected) depending on the timing of the sample collection relative to the date of the inundation event. It is noted that:<ul style="list-style-type: none">- When runoff first reports to the claypans, the salinity of the ponded water is typically low (<100 mg/L)- As the water in the claypans evaporates and the salts are left behind, the salinity of the claypans increases- Maximum TDS values from observed data are less than 900 mg/L.• In general, claypan samples have a higher conductivity, TDS and alkalinity.

Flood Modelling

Seventeen baseline surface water catchments (Catchments 1 to 17) relative to the proposed mine development area have been delineated to the Fortescue Valley Environmental Sensitive Area (ESA).

2D flood modelling was undertaken to predict baseline inundation extents resulting from a range of design events. Inflow hydrographs at the model boundary were developed for catchments that extended outside the Digital Elevation Model (DEM) extents within the Chichester and Hamersley Ranges. The intent of the modelling was to provide baseline flood depths and flow velocities in the vicinity of the proposed mine disturbance areas so that impacts of the Proposal on the surface water regime could be quantified. Key outcomes are summarised in Table 1-8.

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Table 1-8: Flood Modelling Summary Overview

Overview	
	<ul style="list-style-type: none"> The proposed mine development represents a loss of surface water catchment of 21 km² The reduction in catchments due to the containment of runoff within the mine development areas that will cause a reduction in flood levels within some areas of the Fortescue Valley to the south of the Project. In particular, the areas of ponding within the Goodiadarrie Swamp immediately to the south of Anticline South, Fridge West, Fridge Central and Horseshoe South pits are predicted to have a reduction in flood levels of up to 0.2 m following a 50% Annual Exceedance Probability (AEP) rainfall event. Where flow is diverted around the mine development areas, some areas of the Fortescue Valley to the south of the Project are predicted to have increased flood levels. The modelling indicates that the mining development will have a greater effect on infrequent, large flow events than smaller, more frequent flow events. Key observations from the 1% AEP flood predictions: <ul style="list-style-type: none"> Across the alluvial fans, mine infrastructure would be exposed to extensive shallow sheet flow across the floodplain and braided channels branching over the fans A number of upstream catchments drain towards the Fortescue valley from the north through the mine as defined water courses. Flood depths in these channels can exceed 1.5 m. The proposed Fridge Central/Horseshoe West mining infrastructure areas appear more susceptible to these flows. Extensive flooding across the claypans is predicted with areas of widespread ponding occurring. The predicted changes in flood levels following a 63% AEP rainfall event have identified: <ul style="list-style-type: none"> A total area of approximately 25 ha subject to increased flood levels (>5 centimetres (cm) increase in maximum flood height). A total area of approximately 310 ha subject to decreased flood levels (>5 cm decrease in maximum flood height).

Claypan Water Balance

Baseline water balance modelling of the Gnalka Gnoona and Koodjeepindarranna Claypans was undertaken to provide baseline predictions of the claypans which can be compared to catchment conditions following mine development. Key outcomes are summarised in **Table 1-9**.

Table 1-9: Claypan Water Balance Summary

Feature	Overview
TDS Concentration Predictions	<ul style="list-style-type: none"> Observed salinity in the claypans is typically below 500 mg/L, with the exception of “first flush” spikes in salinity prior to large inflows of runoff into the claypan. The low salinity of the ponded water within the claypans and the recorded depth to groundwater below the claypans indicates the water is sourced from surface water runoff.
Long Term Water Balance Predictions – Pre Mining	<ul style="list-style-type: none"> The largest predicted water level in the claypans: 320 millimetres (mm) of rainfall was recorded over 24 hours. The highest claypan water level predicted: 405.4 mRL. The longest period of continuous claypan inundation predicted in the order of 300 days (i.e. the claypan hydroperiod); however, there are occasions where the hydroperiod of the claypans was predicted to exceed 200 days above 403.2 mRL. Flooding within the claypans can be driven by both a single rare (very large) rainfall event, or by multiple consecutive large rainfall events. The claypans are predicted to typically dry-out during the dry season in most years.
Mine Development	<ul style="list-style-type: none"> A 10% reduction to the Gnalka Gnoona catchment and 2% reduction to the combined claypan catchment areas. The catchment reduction estimated for Koodjeepindarranna is insignificant compared to the Baseline catchment (<0.5%). The impact of the loss of catchment area on claypan water levels is typically less than 0.02 m within the Gnalka Gnoona claypan. During large runoff events, if additional catchment areas report to the claypan areas (either from the Hamersley Range or from upstream areas of the Fortescue River) then the percentage catchment reduction due to the proposed mine development would reduce (lower impact).

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Feature	Overview
	<ul style="list-style-type: none"> The key characteristics of the claypans which may be impacted by the proposed development are changes to the inundation depths, ponding duration (hydroperiod) and water quality (TDS) of ponded water. The impacts are considered negligible and are summarised as follows: <ul style="list-style-type: none"> Reductions in claypan water level were predicted to range between nil to 0.022 m. Note that the water levels in the Koodjeepindarranna Claypan were only impacted if the water level in the Gnalka Gnoona Claypan exceeded the height of the divide between the two claypans (402.9 mRL). Inundation duration was predicted to decrease in the order of days for large and medium events with negligible change in inundation duration predicted for the small events. Only a marginal change in TDS between the model scenarios

1.5.2 Flora and Vegetation

Flora and vegetation assessments indicated several relevant species and types that may be subject to impact from altered hydrologic and hydrogeologic regimes result from mine development. These are summarised in Table 1-10.

No Threatened flora species listed under the Biodiversity Conservation Act 2016 (BC Act) have been recorded within the Development Envelope

There are no recorded Threatened Ecological Communities (TECs) listed under the BC Act within the Development Envelope or within 20 km of the Development Envelope. There is no groundwater dependent vegetation (GDVs) recorded in the Development Envelope, and ecohydrological studies concluded that GDVs are not expected to occur. Key rationale is as follows:

- Groundwater underlying the Fortescue Valley environs is generally brackish/saline and therefore does not constitute a favourable water source for the vegetation.
- In most areas, plant roots cannot readily access groundwater as there is calcrete or dense impermeable clay beneath the soil, and above the groundwater table, which plants roots cannot easily penetrate.
- Surface water inputs are sufficient to support the density of trees occurring in the Fortescue Valley *E. victrix* woodland communities. The denser woodland stands are associated with better structured soils with relatively higher plant-available water storage capacity.

Table 1-10: Relevant Flora and Vegetation Overview

Feature	Description
Flora	
Priority	<p>Eleven confirmed 'Priority' flora species have been identified in the Development Envelope</p> <ul style="list-style-type: none"> Priority 1: <i>Dipteracanthus chichesterensis</i>, <i>Hibiscus sp. Mulga Downs (S. Hitchcock SH 638, Triodia veniciae</i> Priority 3: <i>Aristida jerichoensis var. subspinulifera</i>, <i>Dolichocarpa sp. Hamersley Station (A.A. Mitchell PRP 1479)</i>, <i>Euphorbia australis var. glabra</i>, <i>Rostellularia adscendens var. latifolia</i>, <i>Themeda sp. Hamersley Station (M.E. Trudgen 11431)</i> Priority 4: <i>Rhynchosia bungarensis</i> and <i>Bulbostylis burbidgeae</i>.
Vegetation	
Priority Ecological Communities (PECs)	<p>Freshwater Claypans of the Fortescue Valley (Priority 1)</p> <ul style="list-style-type: none"> The Freshwater claypans of the Fortescue Valley PEC (Priority 1) comprise a series of claypans in the Fortescue Valley, including the Gnalka Gnoona Claypan and the Koodjeepindarranna Claypans. The Development Envelope does not intersect the Department of Biodiversity, Conservations and Attractions (DBCAs) designated buffer of the 'Freshwater Claypans of the Fortescue Valley' Priority 1 PEC.

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Feature	Description
	<p>Four plant assemblages of the Wona Land System (Priority 1-Priority 3)</p> <ul style="list-style-type: none"> Vegetation type MTGW has been mapped in the Development Envelope and described as Mixed Tussock Grasslands of <i>Eragrostis xerophila</i>, <i>Aristida latifolia</i> and <i>Astrebla pectinate</i>, with patches of <i>Triodia</i> spp. and sparse mixed shrublands. Vegetation type ASL(2) shares similar species to MTGW and may also be associated with the PEC so has been conservatively considered. Vegetation types MTGW & ASL (2) are mapped as the 'Four plant assemblages of the Wona Land System'
Surface Water Dependent Riparian Vegetation	<p>Surface water dependent riparian vegetation have been identified as:</p> <ul style="list-style-type: none"> <i>Eucalyptus victrix</i> <i>Melaleuca glomerata</i> <i>Ficus braccypoda</i> <i>Atalaya hemiglauca</i> <i>Hakea lorea</i>. <p>One mapped riparian vegetation of local significance (restricted to the Fortescue River and associated habitats) within the Development Envelope is AdEvWL. AdEvWL supports species that only occur in seasonally inundated habitats.</p>
Sheetflow Dependant Vegetation	<p>Vegetation potentially dependent on sheet flow (overland/surface water flow) is present within the Development Envelope. This have been recorded as:</p> <ul style="list-style-type: none"> AaAxSL - tall sparse shrubland of <i>Acacia aneura</i> (alliance) ASL (1) - <i>Acacia</i> tall shrubland ASL (2) - <i>Acacia</i> tall shrubland AWL (1) - <i>Acacia</i> low woodland or tall shrubland AWL (2) - <i>Acacia</i> low woodland or tall shrubland AWL (3) - <i>Acacia</i> low woodland or tall shrubland AxAsSL - <i>Acacia</i> tall sparse shrubland

1.5.3 Terrestrial Fauna

A total of 11 conservation significant fauna (as categorised by the BC Act and under DBCA classification) have been recorded within the Development Envelope. This includes four migratory birds, which were recorded within the Gnalka Gnoona and Koodjeepindarranna claypans. Suitable habitat to which conservation significant fauna habitat was recorded was further identified. The recorded fauna and suitable habitat are as follows:

- Recorded Fauna:** Northern Quoll, Pilbara Leaf-nosed Bat, Ghost Bat, Western Pebble-mound Mouse, Peregrine Falcon, Grey Falcon, Pilbara Olive Python, Gane's Blind Snake, Red-necked Stint, Wood Sandpiper, Common Greenshank
- Suitable Habitat – No Recorded Species:** Brush-tailed Mulgara, Northern Short-tailed Mouse, Glossy Ibis, Spotted Ctenotus

Key to this WMP is impact to habitat that supports foraging, breeding, nesting and access to surface water. To this purpose, the focus of this section is identification of fauna habit relevant to conservation species has the potential to be impact by changes in groundwater quality and levels, and surface water quality, flows and quantity.

An overview of habitat type supporting conservation significant fauna is provided in Table 1-11.

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Table 1-11: Conservation Significant Fauna Habitat

Habitat Type	Conservation Significant Fauna Overview
Mulga Woodland	Although considered low value for conservation significant fauna and is widespread and common throughout the Pilbara region, this habitat is considered critical to the survival of the Bilby and foraging habitat for the Northern Quoll and supports Gane's Blind Snake. The Mulga Woodland also provides non-critical foraging habitat for the Pilbara Leaf-nosed Bat
Rocky Hills	This habitat is of high value as it provides shelter, denning and roosting habitat for conservation significant species and is widespread and common throughout the Pilbara region. The Rocky Hills habitat type are known to provide potential caves, denning and foraging habitat considered to be critical habitat for the survival of Northern Quoll, Pilbara Leaf-nosed Bat and Ghost Bat.
Stony Spinifex Plains and Hillslopes	Stony Spinifex Plains and Hillslopes are considered of moderate value as they generally offer minimal refugia to species of conservation significance however, where they are adjacent to high value breeding habitat they are a supporting habitat. This habitat is widespread and common throughout the Pilbara region. This is primarily habitat for the Western Pebble-mound Mouse, the Pilbara Leaf-nosed Bat, Northern Quoll and Gane's Blind-snake.
Chenopod/ Cracking Clay Floodplain	Chenopod/Cracking Clay Floodplains is habitat considered critical foraging for the survival of the Night Parrot and the Bilby and as supporting habitat for the migratory birds; however, due to the condition of this habitat type within the Development Envelope, it is considered low value to species of conservation significance.
Drainage Lines/ Floodplains	Drainage lines are of moderate conservation value as they provide foraging and dispersal habitat for fauna. They are considered high value when they are within the home range for the Northern Quoll breeding habitat. This habitat type is known to provide foraging and dispersal habitat for Pilbara Leaf-nosed Bat, Ghost Bat and the Northern Quoll. It also has the potential to support foraging and potential breeding habitat for the Grey Falcon.
Gibber Cracking Clay	This habitat type is known to be important breeding, foraging and dispersal habitat for the Short-tailed Mouse (P4, DBCA) and Western Pebble-mound Mouse and supports non-critical foraging habitat for the Ghost Bat and Peregrine Falcon. While sporadic in nature, this habitat is considered widespread in the Pilbara. Given the high percentage of retention in the Development Envelope and local mapped survey extent this is not considered a significant impact .
Cracking Clay	This habitat type exhibits little to no leaf litter and woody debris providing few niches for trappable fauna such as marsupials and reptiles. Due to the condition of this habitat type it is considered low value to species of conservation significance. However, it may be marginally suitable as foraging habitat for the Night Parrot. Given the high percentage of retention in the Development Envelope and local mapped survey extent this is not considered a significant impact .
Snakewood	This habitat is of low value and is widespread and common throughout the Pilbara region. Provides potential foraging for fauna which occur on Cracking Clay habitat. Given the high percentage of retention in the Development Envelope and local mapped survey extent this is not considered a significant impact.
Rocky Plains and Footslopes	This habitat provides potential foraging habitat in the drainage lines and grasslands and has the potential to support and number of conservation significant species.

1.5.4 MNES

1.5.4.1 MNES Threatened Species

The Grey Falcon (*Falco hypoleucos*) is listed as Vulnerable under the EPBC Act. Suitable nesting habitat within the Proposed Action Area is the Drainage Lines/Floodplains. The banks of some Drainage Line/Floodplains support *Eucalypts victrix* (*E. vicitrix*) trees that have the potential to be used for nesting if they possess previously built nest. The Mixed Eucalypt/Mulga Floodplain habitat type is associated with the Fortescue Marsh

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Environmentally Sensitive Area supports trees (*Eucalyptus victrix*) of a suitable size for nesting if they possess previously built nests. This habitat type occurs outside of the Disturbance Footprint.

1.5.4.2 MNES Migratory Species

The migratory bird species which are considered of particular relevance to the Proposed Action are the Common Greenshank (*Tringia nebularia*), Wood Sandpiper (*T. glareola*), Red-necked Stint (*Calidris ruficollis*), Glossy Ibis (*Plegadis falcinellus*) and the Fork Tailed Swift (*Apus pacificus*). All are listed as Migratory under EPBC Act.

An assessment of habitat for these migratory species indicates:

- Common Greenshank, Wood Sandpiper, Red-necked Stint, and Glossy Ibis are likely to be infrequent visitor to the Claypans and/or Drainage Lines within the Proposed Action Area when inundated after rainfall.
- The Fork-tailed Swift is almost exclusively aerial and likely to only overfly the Proposed Action Area

1.5.5 Social Surroundings

The Proposal is located entirely within Banjima Country. HPPL has undertaken consultation with Traditional Owners, including engagement to undertake ethnobiological surveys, to understand areas of importance and key concerns associated with the Proposal. Surveys and consultation have identified two sites within the vicinity of the Proposal that may be impacted by altered hydrological and hydrogeological regimes, including changes in water quality. These sites include:

- Mungurrdu lodged DPLH site (ACH-00040484)
- Koojjeepindarranna and Gnalka Gnoona claypans.

1.6 Key Assumptions and Uncertainties

Key assumptions and uncertainties adopted for the development of this WMP are detailed in Table 1-12.

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Table 1-12: Key Assumptions and Uncertainties

Key Assumptions	<ul style="list-style-type: none"> • This WMP has been developed based on information the outcome of studies and completed for the Proposal. As requirements change and knowledge increases over time, this WMP may be subject to updates. Consideration and investigation of new technologies and management practices will inform updates to monitoring parameters, monitoring sites, and management measures. • Regular review and update of the monitoring program will be based on changes to mine planning, diversion designs, timings of construction and operations of these diversion structures, operations, hydrological and surface water flood models, and monitoring data. • Groundwater in the region is used for potable supplies at the Wirrilimurra and Youngaleena Communities. Consultation between HPPL and these communities is ongoing to support agreed outcomes on alternative provisions of potable water. • The receptors subject to this WMP are: <ul style="list-style-type: none"> - Pastoral stock - Freshwater Claypans of the Fortescue Valley (Priority 1) - Gnalka Gnoona Claypan and the Koojjeepindarranna Claypans - Surface water dependent riparian vegetation and Fortescue Valley <i>E. Victrix</i> woodlands - Sheet flow dependent vegetation inside the Development Envelope • The existing and proposed use, and viability of, pastoral (stock) bores within and externally adjacent to predicated drawdown contours are pending further field evaluation and consultation with pastoral tenement holders. Included in these stakeholder consultations will be agreements on supply of alternate water sources and duration. Based on this assumption, interim management measures for the continued provision of pastoral stock water will be addressed through agreements made between HPPL and pastoral tenement holders. • In some cases, triggers proposed in this WMP are based on change from baseline conditions or the prediction of groundwater change, for example triggers related to the predicted 1m drawdown extent. The baseline or predicted change does not necessarily represent a threat to receptors however it is a divergence from the current conditions or the forecast and mean that future water levels/quality if continuing to diverge from the baseline or forecast may become a threat to receptors. Responses to trigger exceedances are focused on understanding why there is a divergence from the baseline or forecast for water levels and quality, revising the forecast for water levels or quality, evaluating specific receptor risk to the revised forecast, establishing specific receptor related threshold values and developing specific receptor response plans. • Releases of chemical constituents of concern associated with storage, handling and transport of explosives, hydrocarbons and chemicals, and hazardous materials will be assessed in line with guidelines endorsed by Department of Water and Environmental Regulation (DWER) under the <i>Contaminated Sites Act 2003</i> including the <i>National Environment Protection (Assessment of Site Contamination) Measure 1999</i> (the ASC NEPM) guideline.
Key Uncertainties	<ul style="list-style-type: none"> • The proposed dewatering and MAR borefields, and associated monitoring infrastructure, have not yet been constructed due to the preliminary nature of the Proposal. As the Proposal develops and infrastructure is installed and operated (i.e., dewatering and MAR borefields), this WMP will be updated to incorporate new knowledge and understanding. • The WMP is pending approval under the EPBC Act and EP Act, and will be updated upon receipt of approval conditions, as required.

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2 Management Approach

2.1 Environmental Management System

HPPL’s Environmental Management System (EMS) Framework provides a basis for achieving the key environmental management objectives during the construction and operational phases of the Proposal. The framework is illustrated in Figure 2-1. Implementation of the EMS Framework ensures environmental performance is achieved through environmental management practices consistent with HPPL’s Environmental Policy and objectives.



Figure 2-1: Environmental Management System Framework

2.2 Risk Assessment

Appendix 2 Surface water and groundwater environmental risk assessments for the proposed mining activities were completed and provided as Appendix 2. These assessments included the identification of risk pathways, description of impact, inherent risks, and residual risks post risk treatments. The risk assessment process adopted a systematic approach, aligned with standard risk assessment and management methodologies outlined in:

- AS/NZS ISO 31000:2018: Risk management - Guidelines
- Statutory Guidelines for Mining Proposals (DEMIRS, 2023).

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Results of additional risk assessments will be used to scope further investigations, as required, and to inform amendments to monitoring programs, enabling validation or refinement of trigger levels and contingency measures for future mining operations

2.3 Rationale for Choice of Indicators and Management Actions

Survey and study findings, risk assessments, and assessment of assumptions and uncertainties have been used to support the identification of indicators and management measures.

2.3.1 Indicators

Nominated indicators and associated rationale is summarised in Table 2-1.

Table 2-1: Nominated Indicators and Associated Rationale

Indicator	Rationale
Groundwater Quality	<p>Release of potential contaminants from WRDs result in contamination of groundwater subject to remediation</p> <p>Groundwater salinity will change as a result of dewatering and MAR activities.</p> <ul style="list-style-type: none">• Changes in salinity may impact:<ul style="list-style-type: none">- Local users of groundwater (stock)- Vegetation health if roots are exposed to shallow saline groundwater for extended periods of time.
Groundwater Levels	<ul style="list-style-type: none">• Groundwater drawdown from dewatering is predicted to extend across the valley, away from mining areas.• Surplus water from dewatering is to be managed via MAR (re-injection bores, repurposed dewatering bores and /or in pit infiltration). MAR is predicted to result in mounding of groundwater.• Changes in groundwater levels above certain thresholds may impact:<ul style="list-style-type: none">- Vegetation health of species supported by surface water infiltration and not exposed to groundwater under pre-development conditions. Waterlogging of root systems or exposure to surface expression of saline groundwater for extended periods of time may impact ecosystem health.
Surface Water Quality	<ul style="list-style-type: none">• Mining activities can impact surface water quality through various mechanisms, including sediment and erosion, and altered hydrological regimes
Surface Water Quantity	<ul style="list-style-type: none">• Mine development will alter the hydrologic regime. Alterations will reduce catchment areas and may alter flow directions and runoff quantities.• Altered surface water regime may impact the existing water balance that supports the hydrological function of the freshwater claypans and the health of riparian vegetation and sheet flow dependent vegetation.
Vegetation Health	<p>Maintaining vegetation health is critical to support MNES and terrestrial flora and vegetation and fauna habitats. Key habitats subject to potential impact are sheet flow dependent vegetation (sensitive to surface water flow and soil erosion) and surface water dependent riparian vegetation which support biodiversity and ecosystem health. Noted terrestrial fauna and MNES reliant on vegetation health are, Gray Falcon, and migratory birds.</p>

2.3.2 Management Measures

Management measures comprised both outcome-based and objective-based management provisions as detailed in **Table 2-2**.

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Table 2-2: Outcome -Based and Objective-Based Management Measures

Management Measure	Rationale	Applied Indicator	Management Objective
Outcome-Based Management Provisions	<ul style="list-style-type: none"> Outcome-based provisions are performance-based and may be used where the part of the environment is capable of objective measurement and reporting. Outcome-based provisions have been developed where the level of impact is known and quantifiable, with the establishment of trigger and threshold criteria and appropriate exceedance responses 	<ul style="list-style-type: none"> Groundwater Quality Groundwater Levels Vegetation Health 	<ul style="list-style-type: none"> Minimise change to current beneficial use of groundwater Minimise the impact on other groundwater users including minimising the extent of groundwater level change Manage groundwater levels such that there is no surface expression of groundwater or water logging of vegetation that could impact vegetation health
Objective Based Provisions	<ul style="list-style-type: none"> Objective-based management actions are applied when the level of impact is unknown or unable to be quantified. Objective-based management is used where specific trigger or threshold criteria may not be appropriate for the circumstances. This includes where insufficient information is known about the environmental system or where all or part of the environment is not capable of being measured against trigger or threshold criteria. 	<ul style="list-style-type: none"> Surface Water Quality Surface Water Quantity Vegetation Health 	<ul style="list-style-type: none"> Maintain the existing hydrological regime as much as is practicable Mitigate impacts on surface water regime within the Goodiadarrie Swamp and its catchment, in terms of both quality and quantity of water, to maintain vegetation health Mitigate impacts on surface water quality from erosion, sedimentation and pollution associated with construction and operations by containing clean water and impacted water, and treating impacted water on-site prior to release to the downstream environment Reduce the risk of surface water having a significant impact on mining operations

2.4 Groundwater Level and Quality Trigger Levels

Trigger levels have been defined for water quality and groundwater levels. Provisional water quality trigger levels, provided in Table 2-3, have been developed based on statistical analysis of baseline data and in line with Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC & ARMCANZ, 2000; ANZG, 2018). The methodology applied and rationale, as well as response actions, are detailed in the CBEC (2024) assessment document, provided as **Appendix 1**. Additionally, predicted water quality change, specifically salinity (as total dissolved solids), due to dewatering and MAR has been considered in setting water quality triggers. The prediction of salinity change has been undertaken in conjunction with the simulation of dewatering and MAR and prediction of water level change. It should be noted however that the triggers for elemental concentrations (Table 2-3) are not based on predictions of change or amended to reflect change in line with predicted salinity

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change. Future assessment of change to elemental concentrations will require consideration of predicted salinity change.

Table 2-3: Provisional Groundwater Water Quality Trigger Values

Parameter (mg/L)	ANZG Default Guideline Value (DGV) 95% of Species Limit of Protection	Low Risk Trigger Value (LRTV) 80th percentile	Investigation Trigger Value (ITV) 90th percentile
pH	6.5 – 8.5	7.1-8.0	7.0-8.0
EC (µS/cm)	-	8,000	15,000
Alkalinity as CaCO ₃	-	400	440
Ag	0.00005	(0.002)	(0.0025)*
Al	0.055	0.050	0.050
As	0.013	0.0025	0.0070
B	0.37	2.4	3.1
Ba	-	0.055	0.13
Be	0.00013 [§]	(0.001)*	(0.0025)*
Bi	0.0007 [§]	(0.0025)*	(0.0025)*
Ca	-	240	300
Cd	0.0002	(0.0001)	(0.00025)*
Cl	-	2,000	4,000
Co	0.0028	0.0010	0.0025
Cr	0.001	0.0080	0.0092
Cu	0.0014	(0.002)	(0.0025)*
F	-	2.0	3.3
Fe	0.3 [§]	0.013	0.030
HCO ₃	-	440	480
Hg	0.0006	0.0005	0.0005
K	-	270	320
Mg	-	350	480
Mn	1.9	0.15	0.92
Mo	0.034 [§]	0.0030	0.0060
N (as NO ₃)	-	21	26
Na	-	1,200	2,500
Ni	0.011	0.0014	0.0060
P	-	0.11	0.14
Pb	0.0034	0.0010	0.0025
SO ₄	-	2,200	2,600
Sb	0.009 [§]	0.0025	0.0025
Se	0.011	0.0094	0.011
Si	-	80	90

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Parameter (mg/L)	ANZG Default Guideline Value (DGV) 95% of Species Limit of Protection	Low Risk Trigger Value (LRTV) 80th percentile	Investigation Trigger Value (ITV) 90th percentile
Sn	0.003 [§]	0.0010	0.0025
Sr	-	2.8	3.8
Ti	-	0.0010	0.0025
Tl	0.00003 [§]	(0.0010)*	(0.0025)*
U	0.0005 [§]	0.0050	0.0068
V	0.006 [§]	0.018	0.029
Zn	0.008	0.020	0.033
TDS	-	10,000	12,000
[§] ANZG Low Reliability Trigger Value *Metals that require lower detection limits for establishment of trigger value			

Provisional trigger levels for groundwater levels and groundwater salinity have been developed bespoke to mine development progression and modelled hydrogeologic regime responses to dewatering and MAR. Bore-specific triggers and monitoring bore locations are presented in **Appendix 3**.

2.5 Surface Water Quality Trigger Levels

Provisional surface water quality trigger levels have also been developed by CBEC (2024), along with rationale (**Appendix 1**). The trigger levels are provided in Table 2-4 below.

Table 2-4: Provisional Surface Water Quality Trigger Levels

Parameter (mg/L)	ANZG DGV 95% of Species Limit of Protection	80th percentile
pH	6.5 – 8.5	7.1-8.0
EC (us/cm)	-	290
Alkalinity as CaCO ₃	-	88
Ag	0.00005	-
Al	0.055	1.68
As	0.013	-
B	0.37	-
Ba	-	-
Be	0.0001	-
Bi	0.0007	-
Ca	-	16
Cd	0.0002	-
Cl	-	558
Co	0.0028	-
Cr	0.001	-
Cu	0.0014	-

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Parameter (mg/L)	ANZG DGV 95% of Species Limit of Protection	80th percentile
Fe	-	1.6
HCO ₃	-	76
Hg	0.0006	-
K	-	24
Mg	-	5
Mn	1.9	0.34
Mo	0.034	-
N (as NO ₃)	-	2.3
Na	-	404
Ni	0.011	-
pH	-	0.67
Pb	0.0034	-
SO ₄	-	94
Sb	0.009	-
Se	0.011	0.0005
Si	-	23
Sn	0.003	-
Sr	-	-
Ti	-	-
Tl	0.00003	-
TL	0.0005	-
V	0.006	-
Zn	0.008	0.034
TDS	-	4,180

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3 Water Management Plan Provisions

3.1 Outcomes Based Environmental Management Provisions

Table 3-1: Outcomes – Based: Management of Groundwater Levels and Quality to Impacts on Groundwater Users

Management of Groundwater Levels and Quality to Impacts on Groundwater Users				
<p>EPA Factor: Inland Waters</p> <p>EPA Objective: To maintain the hydrological regimes and quality of groundwater and surface water so environmental values are protected.</p> <p>Key Environmental Values: Beneficial use, pastoral station livestock</p> <p>Rationale: Groundwater levels and flow direction, and salinity concentrations will change as a result of dewatering and MAR activities to the extent predicted in numeric modelling detailed in the ERD and PER.</p> <p>Key impacts and risks: Reduced groundwater availability and/or and impacted groundwater quality from salinity.</p> <p>Outcomes: Mitigate reduction in water availability and salinity increase at existing active pastoral bores within the predicted maximum vertical and lateral extents of modelled contours associated with dewatering and mounding.</p>				
Indicators:	Response Actions:	Monitoring	Timing / Frequency of Monitoring	Reporting
<ul style="list-style-type: none"> Trigger Levels: <ul style="list-style-type: none"> Groundwater Quality Groundwater Level Threshold Criteria: <ul style="list-style-type: none"> Groundwater Quality 	<ul style="list-style-type: none"> Trigger level actions Threshold contingency actions 			
<p>Interim Trigger Levels - Groundwater Salinity TDS is at 4,500 mg/L</p>	<p>Trigger Level Actions:</p> <ul style="list-style-type: none"> Investigate to establish causal factors such as equipment error, sampling error, climatic influences, individual bore characteristics i.e., infrastructure capacity. Undertake modelling to reforecast groundwater quality change Identify specific groundwater users at from re-forecasted water level change In conjunction with the stakeholder developed agreed threshold value and action plan to ensure continuity of water supply. 	<p>The proposed groundwater salinity monitoring bore network is shown in Appendix 3.</p>	<ul style="list-style-type: none"> Groundwater salinity profiling is to be undertaken at the salinity monitoring bores quarterly when MAR is being undertaken in the vicinity. Frequency may be reduced if the injected water is fresher than the MAR location. Monitoring to be conducted quarterly. 	<p>Annual Groundwater Monitoring Assessment</p>
<p>Interim Threshold Criteria - Groundwater Salinity Agreed on case-by-case basis with stakeholder</p>	<p>Threshold Contingency Actions:</p> <ul style="list-style-type: none"> Implement specific thresholds and action plans as agreed with stakeholder 			<p>Annual Groundwater Monitoring Assessment</p> <p>Report the threshold exceedance to the CEO of DWER and DCCEEW within seven (7) days of the exceedance being identified</p> <p>A report shall be provided to the CEO of DWER/DCCEEW within 21 days of the threshold criteria exceedance being reported</p>

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Indicators: <ul style="list-style-type: none"> Trigger Levels: <ul style="list-style-type: none"> Groundwater Quality Groundwater Level Threshold Criteria: <ul style="list-style-type: none"> Groundwater Quality 	Response Actions: <ul style="list-style-type: none"> Trigger level actions Threshold contingency actions 	Monitoring	Timing / Frequency of Monitoring	Reporting
Interim Trigger Level - Groundwater Level Nominated drawdown extent monitoring bores indicates that the extent of groundwater level drawdown resulting from dewatering exceeds numerical model predictions and has the potential to impact other groundwater users exceeding 1 m relative to baseline groundwater levels in regional monitoring bores.	Trigger Level Actions <ul style="list-style-type: none"> Investigate to establish causal factors such as equipment error, sampling error, climatic influences, individual bore characteristics i.e., infrastructure capacity. Undertake modelling to reforecast groundwater quality change Identify specific groundwater users at risk of water quality change greater than 5,000 mg/L In conjunction with the stakeholder developed agreed threshold value and action plan to ensure continuity of suitable quality water is available 	The proposed drawdown monitoring bore network is presented in Appendix 3 .	<ul style="list-style-type: none"> Continuous monitoring via logger when MAR not operational and quarterly assessment. Ongoing numerical modelling will be performed and reviewed utilising all available data. 	Annual Groundwater Monitoring Assessment
Interim Threshold Criteria - Groundwater Level Agreed on case-by-case basis with stakeholder	Threshold Contingency Actions <ul style="list-style-type: none"> Implement specific thresholds and action plans as agreed with stakeholder 			Annual Groundwater Monitoring Assessment Report the threshold exceedance to the CEO of DWER and DCCEEW within seven (7) days of the exceedance being identified A report shall be provided to the CEO of DWER/DCCEEW within 21 days of the threshold criteria exceedance being reported

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Table 3-2: Outcomes-Based: Management of Groundwater Level and Quality Impacts on Vegetation Health

Management of Groundwater Level and Quality Impacts on Vegetation Health	
<p>EPA Factor: Inland Waters, Flora and Vegetation, Terrestrial Fauna, Social Surrounds</p> <p>EPA Objective:</p> <ul style="list-style-type: none"> - To maintain the hydrological regimes and quality of groundwater and surface water so environmental values are protected - To protect flora and vegetation so biological diversity and ecological integrity are maintained. - To protect terrestrial fauna so biological diversity and ecological integrity are maintained. - To protect social surroundings from significant harm <p>Key Environmental Values: Freshwater Claypans of the Fortescue Valley (Priority 1) - Gnalka Gnoona Claypan and the Koojeeepindarranna Claypans, Fortescue Valley <i>E. Victrix</i> woodlands, Lower Fortescue River valley, Conservation Significant Fauna Habitat</p> <p>Rationale: Groundwater levels and flow direction, and salinity concentrations will change as a result of MAR activities to the extent predicted in numeric modelling detailed in the ERD and PER.</p> <p>Key impacts and risks: Waterlogging of root systems and exposure to surface expression of saline groundwater for extended periods of time may impact ecosystem health or sites of cultural significance.</p> <p>Outcomes:</p> <ul style="list-style-type: none"> - Maintain baseline water quality range of claypans - No significant impact to sites of cultural significance - No significant impact to vegetation health and terrestrial fauna habitat 	

Indicators:	Response Actions:	Monitoring	Timing / Frequency of Monitoring	Reporting
<ul style="list-style-type: none"> • Trigger Levels: <ul style="list-style-type: none"> - Groundwater Level • Threshold Criteria: <ul style="list-style-type: none"> - Groundwater Quality - Ground water Levels 	<ul style="list-style-type: none"> • Trigger level actions • Threshold contingency actions 			
<p>Interim Trigger Level - Groundwater Level for Mounding</p> <ul style="list-style-type: none"> • Provisional trigger levels for existing and proposed mounding monitoring bores are presented in Appendix 3. 	<p>Trigger Level Actions</p> <ul style="list-style-type: none"> • Investigate to establish causal factors such as modelling constraints, sampling or equipment error, climatic influences, and review against dewatering activities. • Per investigation outcomes: <ul style="list-style-type: none"> - Determine whether reducing, diverting or ceasing reinjection is most appropriate - If infrastructure capacity is identified as an issue the potential for additional bores to spread the injection load within approved limits will be assessed, determine - Identify multiple actions that can be staged if the if groundwater is safely reduced below trigger. - Update numeric modelling to determine viability and appropriateness of the trigger level • Undertake actions to reduce groundwater levels below trigger limits. These actions may include: <ul style="list-style-type: none"> - Adjust the distribution of MAR to mitigate drawdown - Reduce dewatering rates where safe to do so 	Proposed mounding monitoring bores shown in Appendix 3.	<ul style="list-style-type: none"> • Groundwater levels monitoring will be continuous via loggers and assessed weekly when MAR is operational in the vicinity. • Results will be assessed on a quarterly basis. • Ongoing numerical modelling will be performed and reviewed utilising all available data 	Annual Groundwater Monitoring Assessment
<p>Interim Threshold Criteria - Groundwater Level for Mounding</p> <ul style="list-style-type: none"> • Provisional threshold levels per for existing and proposed mounding monitoring bores are presented in Appendix 3. 	<p>Threshold Contingency Actions:</p> <ul style="list-style-type: none"> • Implement the Trigger Level Actions • Determine if any potential environmental harm or alteration of the environment occurred due to the threshold criteria being exceeded. • Where the investigation determines that the cause of the breach is due to factors unrelated to the operation (e.g. natural variability) submit to the CEO a report detailing the findings. • Continue implementation of threshold contingency actions until the CEO of DWER and DCCEEW has confirmed by notice in writing that it has been demonstrated that the threshold criteria are being met 			<p>Annual Groundwater Monitoring Assessment</p> <p>Report the threshold exceedance to the CEO of DWER and DCCEEW within seven (7) days of the exceedance being identified</p> <p>A report shall be provided to the CEO of DWER/DCCEEW within 21 days of the threshold criteria exceedance being reported.</p>
<p>Interim Trigger – Vegetation Health (Standard Deviation)</p> <p>Difference of 1.5 standard deviations between either:</p> <ul style="list-style-type: none"> • Impact and Control Sites OR • Impact and Baseline <p>For:</p> <ol style="list-style-type: none"> Tree water status Tree density 	<p>Trigger Level Actions</p> <ul style="list-style-type: none"> • Confirm the validity of the data, including compliance with sampling protocols, record keeping, and equipment calibration. • Investigate to establish causal factors, including reference against control sites: This includes conducting field monitoring and examining groundwater and surface water monitoring records. • Assess the ecological significance (as opposed to statistical significance) of any observed changes. • Review information that may indicate other causal factors, e.g. climate, grazing effects, pollution events. <p><u>If impact appears to have been caused by groundwater mounding:</u></p>	Vegetation health monitoring locations referenced in Section 4.3.	<p>Twice yearly during the first 3 years of operations:</p> <ul style="list-style-type: none"> • 6-8 weeks post wet season • During the dry season <p>Annually after the first 3 years of operations.</p>	<p>Annual Vegetation Health Monitoring Report</p> <p>Annual Compliance Assessment Report.</p> <p>A report shall be provided to the CEO (DWER/DCCEEW) within 21 days of the</p>

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Indicators: <ul style="list-style-type: none"> Trigger Levels: <ul style="list-style-type: none"> Groundwater Level Threshold Criteria: <ul style="list-style-type: none"> Groundwater Quality Ground water Levels 	Response Actions: <ul style="list-style-type: none"> Trigger level actions Threshold contingency actions 	Monitoring	Timing / Frequency of Monitoring	Reporting
c. Plant mortality d. Modified soil adjusted vegetation index (MSAVI2) AND Difference of 2 standard deviation between either: <ul style="list-style-type: none"> Impact and Control Sites OR Impact and Baseline For: a. Tree condition	<ul style="list-style-type: none"> Soil moisture and salinity testing and sampling over the vegetation root depth profile, with samples to be tested for saturated soil extract electrical conductivity Revise abstraction or MAR pumping rates in the relevant area, and/or redirect surplus water to alternate injection borefield. 		Remote sensing Multivariate modelling	threshold criteria exceedance being reported.
Interim Trigger - Vegetation Health (Multivariate Modelling) p<0.05 on either Akaike Information Criteria (AIC)/Bayesian Information Criterion (BIC) model selection or significance analysis.				
Interim Threshold Criteria – Vegetation Health Difference of 2 standard deviations between either: <ul style="list-style-type: none"> Impact and Control Sites OR Impact and Baseline For: a. Tree water status b. Tree density c. Plant mortality d. Modified soil adjusted vegetation index (MSAVI2) AND Difference of 2 between either: <ul style="list-style-type: none"> Impact and Control Sites OR Impact and Baseline For: b. Tree condition	Threshold Contingency Actions <ul style="list-style-type: none"> Determine if any potential environmental harm or alteration of the environment occurred due to the threshold criteria being exceeded, and the extent of this. Conduct additional field survey to establish the extent of the impact area and further investigate potential causal factors (e.g. climate, grazing effects, pollution events) as per responses to trigger exceedance as defined above. Investigations are to include potential for interactions between multiple factors that affect vegetation resilience, e.g. where minor mounding trims tree roots and the tree appears unaffected under ‘normal’ climatic conditions but suffers under drought conditions more than it would have if its root system had not been compromised by groundwater mounding. Inspect surface water infrastructure and upstream/upslope area to assess relevant surface water changes; review groundwater infrastructure for malfunctions, assess use of saline for dust suppression in the vicinity. Continue cessation of activities that have been identified to be contributing to the threshold exceedance until the CEO of DWER and DCCEEW has confirmed in writing that it has been demonstrated the threshold criteria are being met and implementation of the threshold contingency actions is no longer required. <u>If impact appears to have been caused by groundwater mounding:</u> <ul style="list-style-type: none"> Stop groundwater injection in nearby bore/s. Assess alignment between predicted and observed groundwater responses and stop groundwater injection in bores associated with any exceedances. <u>If impact appears to have been caused by groundwater mounding and includes significantly raised soil salinities that have caused “environmental harm” under the EP Act,</u> implement the following measures in consultation with the DWER/DCCEEW and with consideration of the logistical feasibility and net environmental impact of carrying out the mitigation measure: <ul style="list-style-type: none"> improving drainage to remove salts from the ground surface and their dilution by fresher surface flows and rainfall. This could be done by installing sub-surface drainage, interceptor drains and pumping bores plant salt-tolerant plants to improve land cover and lower ground-water levels apply fresh water to move salts below the root zone; and restore vegetation cover 			
Interim Threshold Criteria – Vegetation Health (Multivariate Modelling) p<0.01 on either AIC/BIC model selection or significance analysis				

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Table 3-3: Outcomes-Based: Management of Release of WRD Contaminants to Impacts on Groundwater Quality

Management of Release of WRD Contaminants to Impacts on Groundwater Quality
<p>EPA Factor: Inland Waters, Flora and Vegetation, Terrestrial Fauna, Social Surrounds</p> <p>EPA Objective:</p> <ul style="list-style-type: none"> - To maintain the hydrological regimes and quality of groundwater and surface water so environmental values are protected - To protect flora and vegetation so biological diversity and ecological integrity are maintained. - To protect terrestrial fauna so biological diversity and ecological integrity are maintained. - To protect social surroundings from significant harm <p>Key Environmental Values: Freshwater Claypans of the Fortescue Valley (Priority 1) - Gnalka Gnoona Claypan and the Koojeeepindarranna Claypans, Fortescue Valley <i>E. Victrix</i> woodlands, Lower Fortescue River valley, Conservation Significant Fauna Habitat</p> <p>Rationale: Groundwater levels and flow direction, and salinity concentrations will change as a result of MAR activities to the extent predicted in numeric modelling detailed in the ERD and PER.</p> <p>Key impacts and risks: Adverse impact to groundwater quality that may affect environmental values</p> <p>Outcomes:</p> <ul style="list-style-type: none"> - Maintain baseline water quality range of claypans - No significant impact to sites of cultural significance - No significant impact to vegetation health and terrestrial fauna habitat

Indicators:	Response Actions:	Monitoring	Timing / Frequency of Monitoring	Reporting
<ul style="list-style-type: none"> • Trigger Levels: <ul style="list-style-type: none"> - Groundwater Quality • Threshold Criteria: <ul style="list-style-type: none"> - Groundwater Quality 	<ul style="list-style-type: none"> • Trigger level actions • Threshold contingency actions 			
<p>Interim Trigger Level Refer to Table 2-3.</p> <p>Interim Threshold Criteria To be determined from Trigger Level Assessment</p>	<p>Trigger Level Actions</p> <ul style="list-style-type: none"> • Investigate to establish causal factors such as sampling or laboratory error, climatic influences, individual bore characteristics and potential sources of increased analyte(s). • One or more of the following may also be undertaken to improve the investigation findings and potential source identification: <ul style="list-style-type: none"> - Inspect upstream infrastructure and landforms. - Undertake a source-receptor-exposure pathway analysis to assess impacts to receptors and set threshold criteria. <p>Threshold Contingency Actions</p> <ul style="list-style-type: none"> • Implement Trigger Level Actions • Report the threshold exceedance to the CEO of DWER within seven (7) days of the exceedance being identified. • If the source of adverse impact is suspected to be due to MDIOM, determine if any potential environmental harm or alteration of the environment occurred due to the threshold criteria being exceeded. This may include review of results by a specialist to determine risk to the environment and define mitigation measures to prevent significant environmental impacts. 	<p>Groundwater sampling to be conducted manually in specified mine infrastructure and landform groundwater monitoring bores.</p>	<p>Groundwater quality sampling is to be conducted quarterly (laboratory analysis) and monthly (field parameter monitoring).</p>	<p>Annual Groundwater Monitoring Assessment delivered annually.</p> <p>The exceedance of the threshold criteria constitutes a non-compliance and will be reported in the Annual Compliance Assessment Report delivered to DWER.</p> <p>A report shall be provided to the CEO of DWER within 21 days of the threshold criteria exceedance being reported.</p>

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3.2 Objectives Based Environmental Management Provisions

Table 3-4: Objectives-Based: Management of Surface Water Diversions on Surface Water Quality

Management of Surface Water Diversions to Impacts on Surface Water Quality	
<p>EPA Factors: Inland Waters, Flora and Vegetation, Terrestrial Fauna, Social Surrounds</p> <p>EPA Objective:</p> <ul style="list-style-type: none"> - To maintain the hydrological regimes and quality of groundwater and surface water so environmental values are protected - To protect flora and vegetation so biological diversity and ecological integrity are maintained. - To protect terrestrial fauna so biological diversity and ecological integrity are maintained. - To protect social surroundings from significant harm <p>Key environmental values: Freshwater Claypans of the Fortescue Valley (Priority 1) - Gnalka Gnoona Claypan and the Koojeeepindarranna Claypans, Fortescue Valley <i>E. Victrix</i> woodlands, Lower Fortescue River valley, Conservation Significant Fauna Habitat and Mungurrdu lodged DPLH site (ACH-00040484).</p> <p>Rationale: Mine development will alter the hydrologic regime. Alterations will reduce catchment areas and may alter flow directions and runoff quantities. Altered surface water regime may impact the existing water balance that supports the hydrological function of the freshwater claypans and the health of riparian vegetation and sheet flow dependent vegetation.</p> <p>Key impacts and risks: Altered hydrological regimes, reduction in water quantity and quality reporting to the Fortescue Valley and claypans, impacts to local vegetation and fauna habitat quality immediately downstream of mine disturbance areas.</p>	

Management targets	Management actions	Monitoring / Assessments	Timing / frequency of actions	Reporting
1 No degradation of water quality reporting to downstream environments due to mining and associated activities	<ul style="list-style-type: none"> • Ongoing development of baseline water quality data set for surface water runoff and ponded water. During operations, monitoring network to include upstream control sites for comparison. • Divert undisturbed catchments around disturbance areas to avoid contamination of “clean” water. • Contain runoff from disturbance areas where sediment loads are likely to be high (waste dumps, stockpiles, pits and ROM pads) and divert runoff through sediment treatment facilities prior to release to the environment. Sediment control facilities (such as basins and containment bunding) to be designed to reduce sediment loads to the environment. • Local runoff management practices deployed within plant and mining areas as outlined in the EMS, including: <ul style="list-style-type: none"> - Storage, handling and disposal of hazardous substances in accordance with internal procedures. - Containment of runoff and waste water at washdowns, workshops etc and passed through an oily water separator with re-use of runoff water within the process prioritised - Clean up local oil spills and leaks immediately when they occur. - Procedures for applying dust suppression to roads will prevent over-watering of roads. - Design and operation of dewatering and MAR system to prevent pipeline bursts 	<ul style="list-style-type: none"> • Surface water quality monitoring as per the monitoring network discussed in Section 4-2. • Water quality monitoring includes sites upstream and downstream of disturbance areas • Surface water samples to be collected immediately following rainfall event >35 mm over 24-hr period (nominally). Surface water stations to be visited, and samples collected if water available. Samples from creek stations to be collected within 24-hrs of rainfall event where access is possible. • Surface water samples to be collected from claypans and other ponding areas following large runoff events. Samples to be collected at locations where the ponding is accessible, which may not be the same exact location each time. • Surface water monitoring stations are equipped with data loggers that record EC at sub-hourly time increments. • Surface water quality monitoring suite shown in Appendix 3. • Annual inspection of site aerial photography for evidence of sediment transport around WRDs and pit stormwater discharge points. • Event-based inspections of sediment basins and containment infrastructure to ensure hydraulic integrity and erosion control effectiveness. 	<ul style="list-style-type: none"> • On a continuous basis during construction and mine operation until the mine is decommissioned. • Event based inspection once access allows following 24-hr rainfall event exceeding 100 mm. 	Annual Surface Water Monitoring Assessment
2 No significant modification to the hydrological function of the claypans and other ponding areas in the Fortescue Valley due to mining activities. In particular, the hydroperiod of the claypans should not be significantly impacted.	<ul style="list-style-type: none"> • Culverts to allow flow of runoff past roads and other linear infrastructure. • Diversion of catchments around mine disturbance areas to minimise the reduction in surface water runoff to the downstream environment. • Re-do the 2D flood modelling and claypan water balance predictions once detailed design of drainage requirements for the Proposal are completed to update predicted changes to surface water availability. 	<ul style="list-style-type: none"> • Vegetation health monitoring (refer Section 4.3). • Remodel claypan water balances if changes to the mine plan result in increased catchment reductions due to the Proposal. • Re-run 2D flood model predictions on an annual basis with the upcoming 12-month mine plan to allow management and vegetation health monitoring to focus on areas at risk in the next 12-months. Significant runoff events over the period would be used to recalibrate the models. 	<ul style="list-style-type: none"> • Annual vegetation health monitoring • Annual flood modelling assessment. • Claypan water balance assessment if the mine plan changes. 	Annual Surface Water Monitoring Assessment

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Management targets	Management actions	Monitoring / Assessments	Timing / frequency of actions	Reporting
	<ul style="list-style-type: none"> Update the 2D flood modelling and claypan water balance predictions if a large (>5% AEP) rainfall event were to occur to revise the calibration of the models. Burial of pipeline at drainage lines/ creek crossings to prevent disruption to flows Raise pipelines at regular intervals to allow surface water to move past 	<ul style="list-style-type: none"> Annual LIDAR survey of the Proposal site to underpin the above surface water modelling and allow current site conditions to be modelled. 		
3 Minimal impact on vegetation and fauna habitat quality immediately downstream of mine disturbance areas due to interrupted runoff regime and altered sediment transport.	<ul style="list-style-type: none"> Culverts to allow flow of runoff past roads and other linear infrastructure. Diversion of catchments around mine disturbance areas to minimise the reduction in surface water runoff to the downstream environment. Re-do the 2D flood modelling once detailed design of drainage requirements for the Proposal are completed to update predicted changes to surface water availability. Ongoing development of baseline water quality data set for surface water runoff and ponded water. During operations, monitoring network to include upstream control sites for comparison. Divert undisturbed catchments around disturbance areas to avoid contamination of “clean” water. Contain runoff from disturbance areas where sediment loads are likely to be high (waste dumps, stockpiles, pits and ROM pads) and divert runoff through sediment treatment facilities prior to release to the environment. Sediment control facilities (such as basins and containment bunding) to be designed to reduce sediment loads to the environment. Design and operation of a controlled release strategy for water held in sediment dams 	<ul style="list-style-type: none"> Vegetation health / fauna habitat quality monitoring. Annual inspection of condition culverts and other surface water management infrastructure (including sediment basins and diversion drains/bunds). Maintenance of this infrastructure as required. Event-based inspection of surface water management infrastructure to ensure hydraulic integrity is maintained. Maintenance of this infrastructure as required. Surface water samples to be collected from claypans and other ponding areas following large runoff events. Samples to be collected at locations where the ponding is accessible, which may not be the same exact location each time. Annual inspection of site aerial photography for evidence of sediment transport around WRDs and pit stormwater discharge points. Inspection of aerial photography is to focus on identifying the presence of potential erosion gullies and sedimentation build up. 	<ul style="list-style-type: none"> As per Section 4-3. Annual inspection surface water infrastructure (nominally before August to provide sufficient time to complete maintenance works). Event based inspection once access allows following 24-hr rainfall event exceeding 100 mm. 	Annual Surface Water Monitoring Assessment

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4 Monitoring

The purpose of monitoring is to inform, through environmental criteria, if environmental objectives are being achieved. In addition, monitoring will inform when trigger level actions or threshold contingency actions are to be implemented or if the objectives are being achieved through the defined management tasks.

The preliminary groundwater and surface water monitoring program and network are described in further detail in **Section 4.1** and **Section 4.2**. Monitoring terminology has been clarified for dewatering and MAR activities, as follows:

- Mine – is relevant to the impacts of mining activities not associated with reinjection i.e., dewatering, dust suppression and mine landforms; and
- MAR – is relevant to aquifer reinjection i.e., source, monitoring infrastructure and potential reinjection impacts etc.

Vegetation health monitoring is detailed in **Section 4.3**. The proposed monitoring actions are intended to support compliance monitoring. These monitoring actions will be revised once the mine is operational.

A summary of monitoring actions is provided in Table 4-1.

Table 4-1: Monitoring Action Summary

Monitoring Event	Monitoring Action	Frequency	Responsibility
Groundwater	MAR groundwater quality chemistry <ul style="list-style-type: none">• ReInjection bores	Quarterly	Site Environmental Advisor
	MAR groundwater quality field readings <ul style="list-style-type: none">• ReInjection bores	Monthly	Site Environmental Advisor
	MAR groundwater levels	Continuous groundwater level monitoring and monthly manual measurements	Site Environmental Advisor
	Mine groundwater drawdown	Monthly	Site Environmental Advisor
	Mine groundwater quality chemistry – upstream and downstream of WRD's	Quarterly	Site Environmental Advisor
Surface Water	Surface water quality	Following significant rainfall event	Site Environmental Advisor
Vegetation	Field based surveys	Twice yearly <ul style="list-style-type: none">• 6-8 weeks post wet season• During the dry season	Site Environmental Advisor
	Remote sensing	In addition to field based surveys	Site Environmental Advisor
	Multivariate modelling	In addition to field based surveys	Site Environmental Advisor

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4.1 Groundwater Monitoring

The proposed groundwater monitoring timing and frequency is provided in Table 3-1, Table 3-2, Table 3-3 and Table 4-1. Groundwater sample analytical results will be compared against provisional groundwater quality results identified in Table 2-3. Proposed groundwater monitoring bores are shown in Figure 4-1. Monitoring bore details are provided in Figure 4-2.

Table 4-2: Proposed Ground Monitoring Bore Information

Bore / Site	Easting	Northing	Stressor	Monitoring Parameter	Receptor	Status	Tenement Status
MDE_MON_1	645718	7556531	MAR	Water Quality - Salinity	Shallow Fresher GW - Other GW Users	Proposed	Tenement Required
MDE_MON_2	654703	7551910	MAR	Water Quality - Salinity	Shallow Fresher GW - Other GW Users	Proposed	On Tenement
MDE_MON_4	665185	7546959	MAR	Water Level - Mounding	Mounding at break of slope	Proposed	Tenement Pending
MDE_MON_5	667964	7545368	MAR	Water Level - Mounding	Mounding at break of slope	Proposed	Tenement Granted
MDE_MON_6	669255	7543432	MAR	Water Level - Mounding	Mounding on valley floor	Proposed	Tenement Required
MDE_MON_7	671873	7543379	Dewatering	Water Level - Drawdown Extent	Other GW Users	Proposed	Tenement Granted
MDE_MON_8	666653	7542993	MAR	Water Level - Mounding	Mounding on valley floor	Proposed	Tenement Pending
MDE_MON_9	675125	7547815	MAR	Water Quality - Salinity	Other GW Users - Wirrilimarra	Proposed	On Tenement
MDE_MON_10	676395	7546188	MAR	Water Quality - Salinity	Other GW Users - Wirrilimarra	Proposed	Tenement Required
MDE_MON_11	669636	7547030	MAR	Water Quality - Salinity	Shallow Fresher GW - Other GW Users	Proposed	Tenement Required
MDE_MON_12	671595	7545400	MAR	Water Quality - Salinity	Shallow Fresher GW - Other GW Users	Proposed	Tenement Required
MDE_MON_13	658610	7537800	Dewatering	Water Level - Drawdown Extent	Other GW Users - Youngaleena	Proposed	On Tenement
MDPZ7449A,B,C	655657	7551787	MAR	Water Level - Mounding	Mounding at break of slope	Existing	On Tenement
MDPZ7450A, B, C	652219	7552541	MAR	Water Level - Mounding	Tracking mounding for break of slope	Existing	On Tenement
MDPZ7451A, B, C	651347	7550579	MAR	Water Level - Mounding	Mounding near Claypans	Existing	On Tenement
MDPZ7456A, B,C	665851	7547907	MAR	Water Level - Mounding	Tracking mounding for break of slope	Existing	On Tenement
MDPZ7460A, B, C	663202	7547987	MAR	Water Level - Mounding	Mounding at break of slope	Existing	On Tenement
MDPZ7461	656010	7542996	Dewatering	Water Level - Drawdown Extent	Other GW Users - Youngaleena	Existing	On Tenement
MDPZ7462A, B, C	644800	7548089	Dewatering	Water Level - Drawdown Extent	Other GW Users	Existing	On Tenement
MDPZ7463	642867	7553588	Dewatering	Water Level - Drawdown Extent	Other GW Users	Existing	On Tenement
MDPZ7464	649944	7552428	MAR	Water Quality - Salinity	Shallow Fresher GW - Other GW Users	Existing	On Tenement
MDPZ7465, MDPZ0757	670005	7547881	MAR	Water Quality - Salinity	Shallow Fresher GW - Other GW Users	Existing	On Tenement
MDPZ7468A, B, C	647191	7551524	MAR	Water Level - Mounding	Koodjeepindarranna Claypan	Existing	On Tenement
MDPZ7469A, B, C	657312	7550011	MAR	Water Level - Mounding	Mounding at break of slope	Existing	On Tenement
MDPZ7470A, B, C	661399	7546377	MAR	Water Level - Mounding	Mounding on valley floor	Existing	On Tenement
MDPZ7471A, B, C	646686	7549394	MAR	Water Level - Mounding	Koodjeepindarranna Claypan	Existing	On Tenement
MDPZ7472	670921	7555275	Dewatering	Water Level - Drawdown Extent	Other GW Users	Existing	On Tenement

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Bore / Site	Easting	Northing	Stressor	Monitoring Parameter	Receptor	Status	Tenement Status
MDWB0011	660244	7557808	Dewatering	Water Level - Drawdown Extent	Other GW Users	Existing	On Tenement
MDWB0013	665270	7556265	Dewatering	Water Level - Drawdown Extent	Other GW Users	Existing	On Tenement
MDWB0034	652853	7555585	MAR	Water Quality - Salinity	Shallow Fresher GW - Other GW Users	Existing	On Tenement

A revised groundwater monitoring program, including bore locations will be defined, pending finalised mine design and approvals for land access, to assess groundwater quality around specified mine areas, mine infrastructure and landforms.

All groundwater samples will be analysed at a National Association of Testing Authorities (NATA)-certified laboratories. As part of the revised groundwater monitoring program, preparation and sampling laboratory methods and appropriate levels of reporting (LOR), as well as additional hydrogeochemical analytical parameters, will be defined and included in this WMP. Groundwater field parameters are shown in Table 4-3.

Table 4-3: Proposed Groundwater Field Parameter Monitoring

Parameter	Unit of Measurement	Comment
Depth to Water	Metres below ground level (mbgl)	-
pH	-	To be collected where field water quality monitoring is specified
Electrical Conductivity (EC)	Microsiemens per centimetre ($\mu\text{S}/\text{cm}$)	
Temperature	Degrees Celsius ($^{\circ}\text{C}$)	
Dissolved Oxygen (DO)	Percentage (%)	To be collected where water chemistry sampling is specified
Redox Potential	Millivolts (mV)	

4.2 Surface Water Monitoring

The baseline monitoring network will serve as the foundation for the ongoing surface water monitoring network during mine development. This network comprises reference monitoring sites unaffected by mining operations and monitoring sites potentially impacted (disturbed) by mine development. Additional sampling locations are proposed during the mine operations period over and above the baseline monitoring network. The proposed surface water monitoring network is shown in Figure 4-2, Figure 4-3 and Figure 4-4.

Note that the additional nominal monitoring locations are based on the indicative surface water diversions. Some of these locations cannot be installed before the diversions are constructed. Final locations for these additional monitoring locations are subject to final design of the project surface water diversions.

Water quality sample collection from the claypans are proposed to be taken from along transects across the claypan, as the exact location for sample collection will be dependent on the level of inundation within the claypan. A single water sample is proposed to be taken from the transect during each monitoring event.

Water quality samples will be collected opportunistically after a substantial rainfall event. Other than the claypans and other ponding locations, the monitoring sites will contain a passive water quality sampling unit installed in the drainage line which will collect a water quality sample when water levels reach a set flow/inundation depth (to avoid collecting first flush samples).

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An updated surface water monitoring program will be defined, pending finalised mine design, to assess surface water quality around specified mine areas, mine infrastructure and landforms.

Where specified, surface samples will be analysed at a National Association of Testing Authorities (NATA)-certified laboratories. As part of the revised surface water monitoring program, preparation and sampling laboratory methods and appropriate LORs, as well as other relevant analytical parameters, will be defined and included in this WMP. Surface water field parameters are shown in Table 4-4.

Table 4-4: Proposed Surface Water Field Parameter Monitoring

Parameter	Unit of Measurement	Comment
Depth to Water	Metres below ground level (mbgl)	-
pH	-	To be collected where field water quality monitoring is specified
Electrical Conductivity (EC)	Microsiemens per centimetre ($\mu\text{S}/\text{cm}$)	
Temperature	Degrees Celsius ($^{\circ}\text{C}$)	
Dissolved Oxygen (DO)	Percentage (%)	To be collected where water quality sampling is specified
Redox Potential	Millivolts (mV)	

4.3 Vegetation Health Monitoring

The vegetation health monitoring program will employ a combination of field-based and remote sensing techniques to assess the impact of mining activities on vegetation. Field surveys will involve measurements of tree water status, density, mortality, and physiological health, as well as assessments of vegetation composition and soil conditions. Remote sensing will provide broader coverage and allow for monitoring of inaccessible areas.

A multivariate modelling approach will be used to analyse the impact of various factors, including climate and mining activities, on vegetation health. Multivariate modelling indicates a significant impact of any of the impact pathways based on either Akaike Information Criteria (AIC)/Bayesian Information Criterion (BIC) model selection or significance analysis.

The monitoring program will focus on claypans, groundwater mounding areas, surface water dependent riparian vegetation, channel pools, and Sheetflow dependent vegetation. The specific locations and methods may be adjusted based on ongoing monitoring, stakeholder input, and regulatory requirements.

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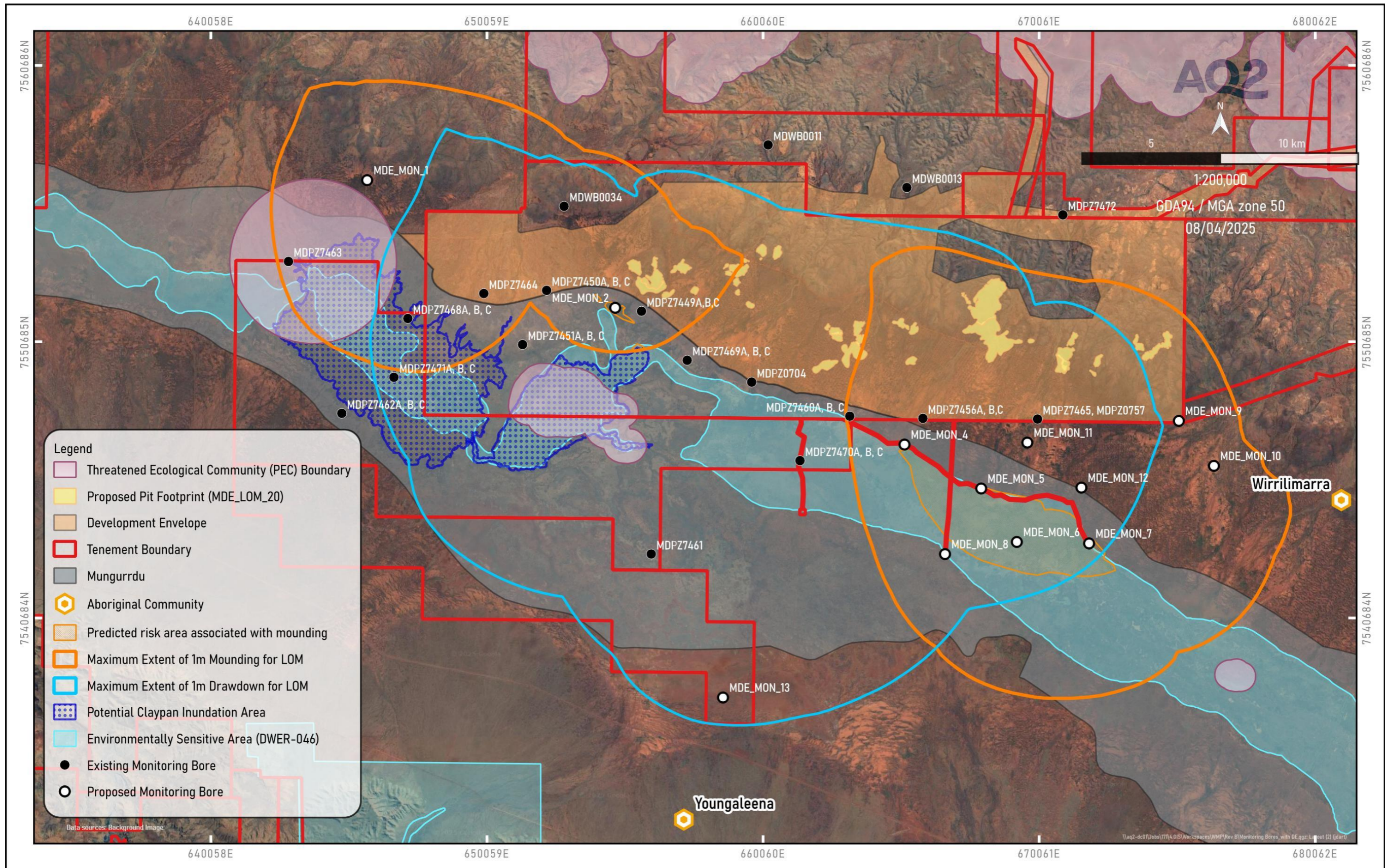


Figure 4-1: Proposed Groundwater Monitoring Network

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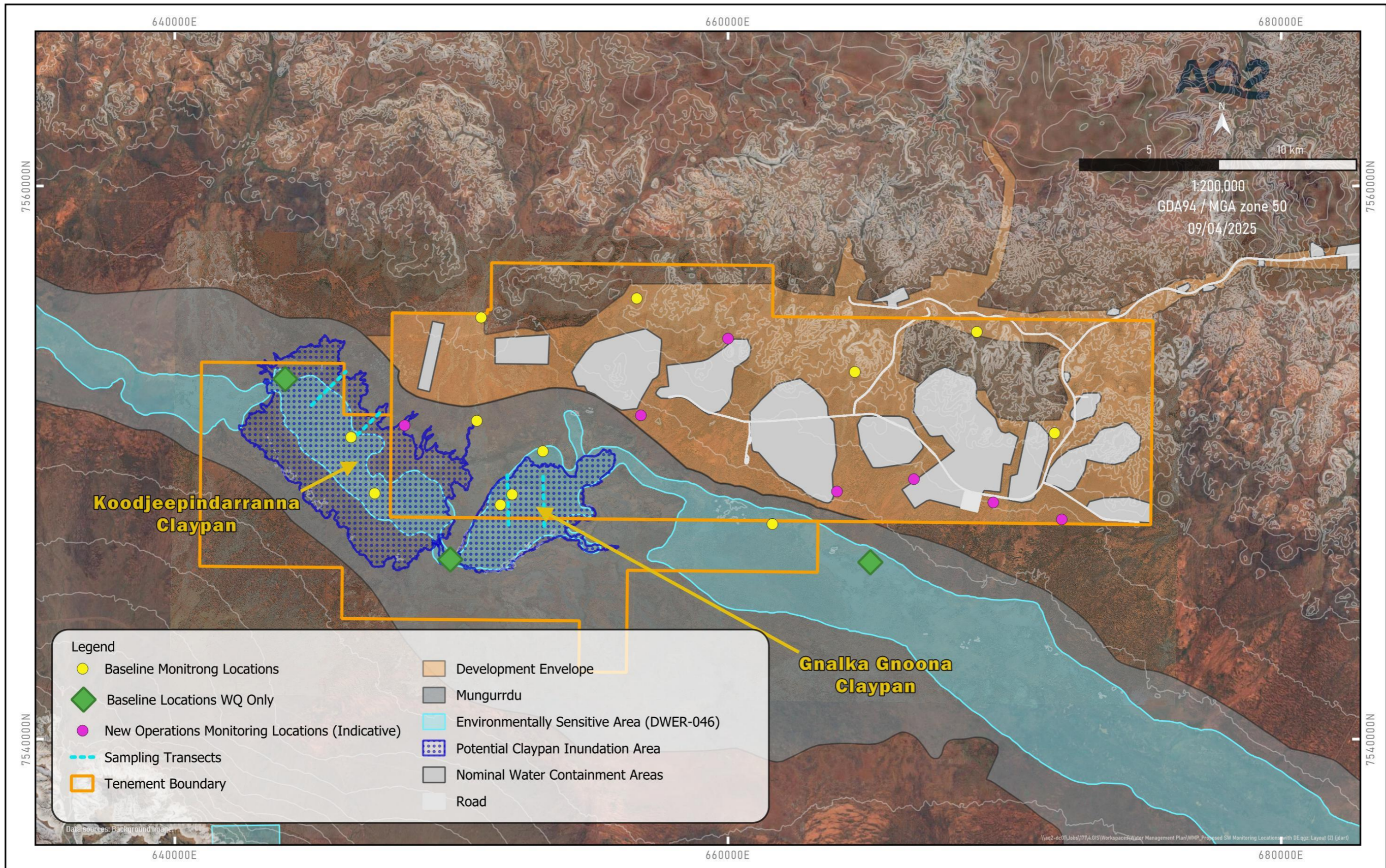


Figure 4-2: Proposed Surface Water Monitoring Network

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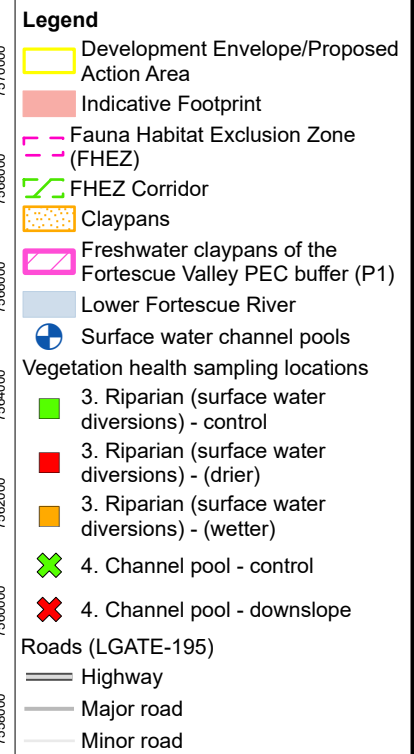
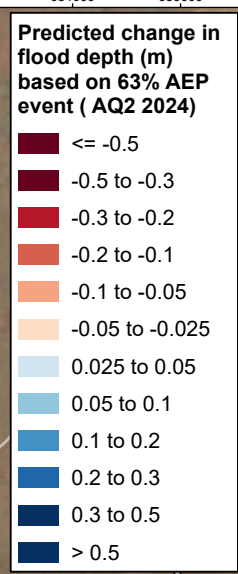
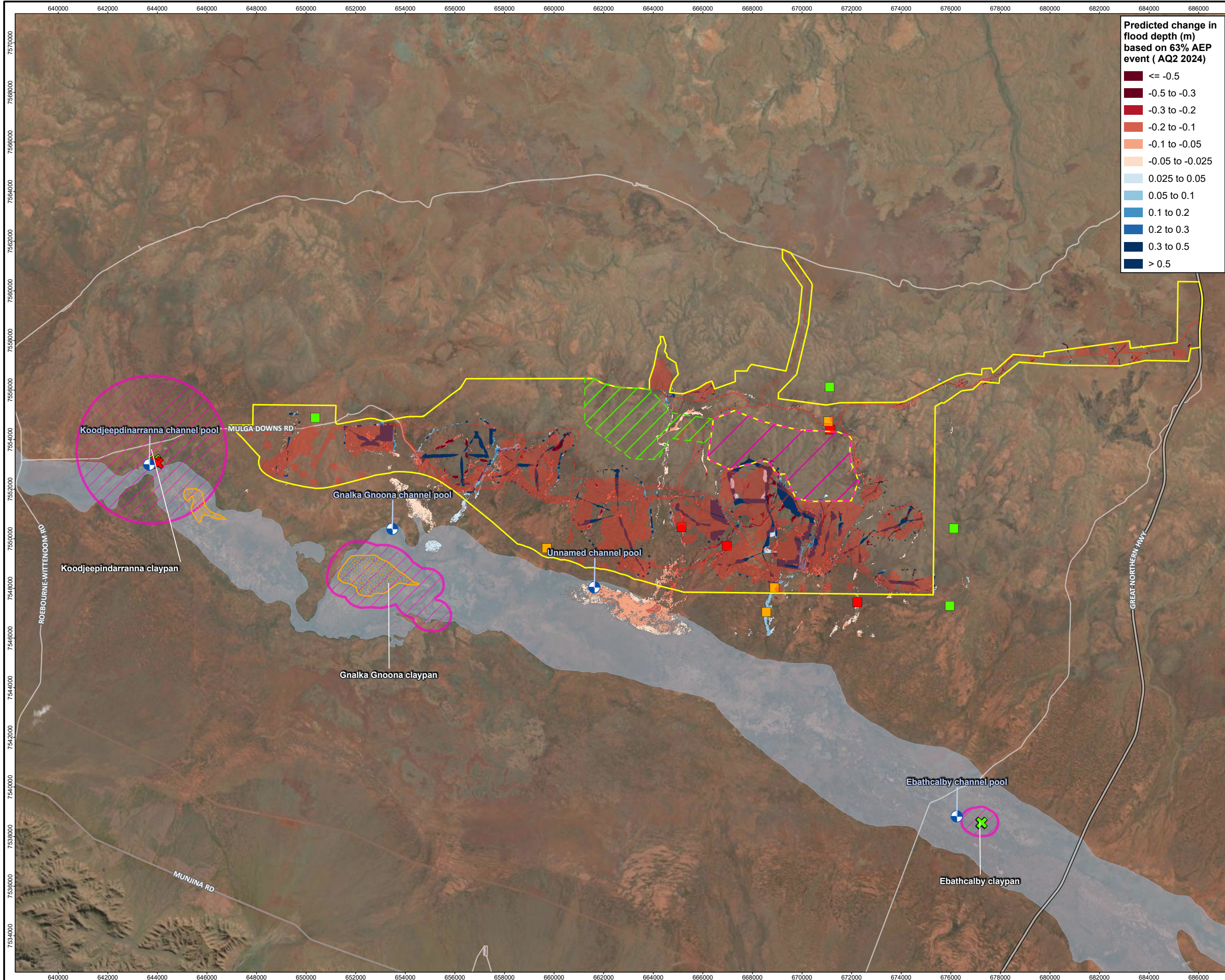
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Figure 4-3: Preliminary Monitoring locations for impacts of surface water diversions on riparian environments and channel pools – Proposed Action Area (EPBC 2022/09255) and Development Envelope (EP 2326)

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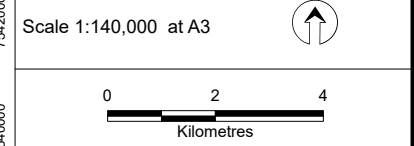


Job No: 64593

Client: Hancock Prospecting Pty Ltd

Version: A Date: 10-Apr-2025

Drawn By: droberts Checked By: KR



Coord. Sys. GDA2020 MGA Zone 50

**Mulga Downs Iron Ore Mine
Central Pilbara, Western Australia**

MONITORING LOCATIONS FOR IMPACTS OF SURFACE WATER DIVERSIONS ON RIPARIAN ENVIRONMENTS AND CHANNEL POOLS – PROPOSED ACTION AREA (EPBC 2022/09255) AND DEVELOPMENT ENVELOPE (EP 2326)

FIGURE 4-3

File Name: C:\Users\droberts\JBS&G Australia\JBS&G - DCS - Internal - Documents\Projects\Hancock Prospecting\01_Mine\EPBC\02_Map\Projects\64593_VHMMP_PER_R01_v4\64593_VHMMP_PER_R01_v4.aprx
Image Reference: World Imagery: Earthstar Geographics

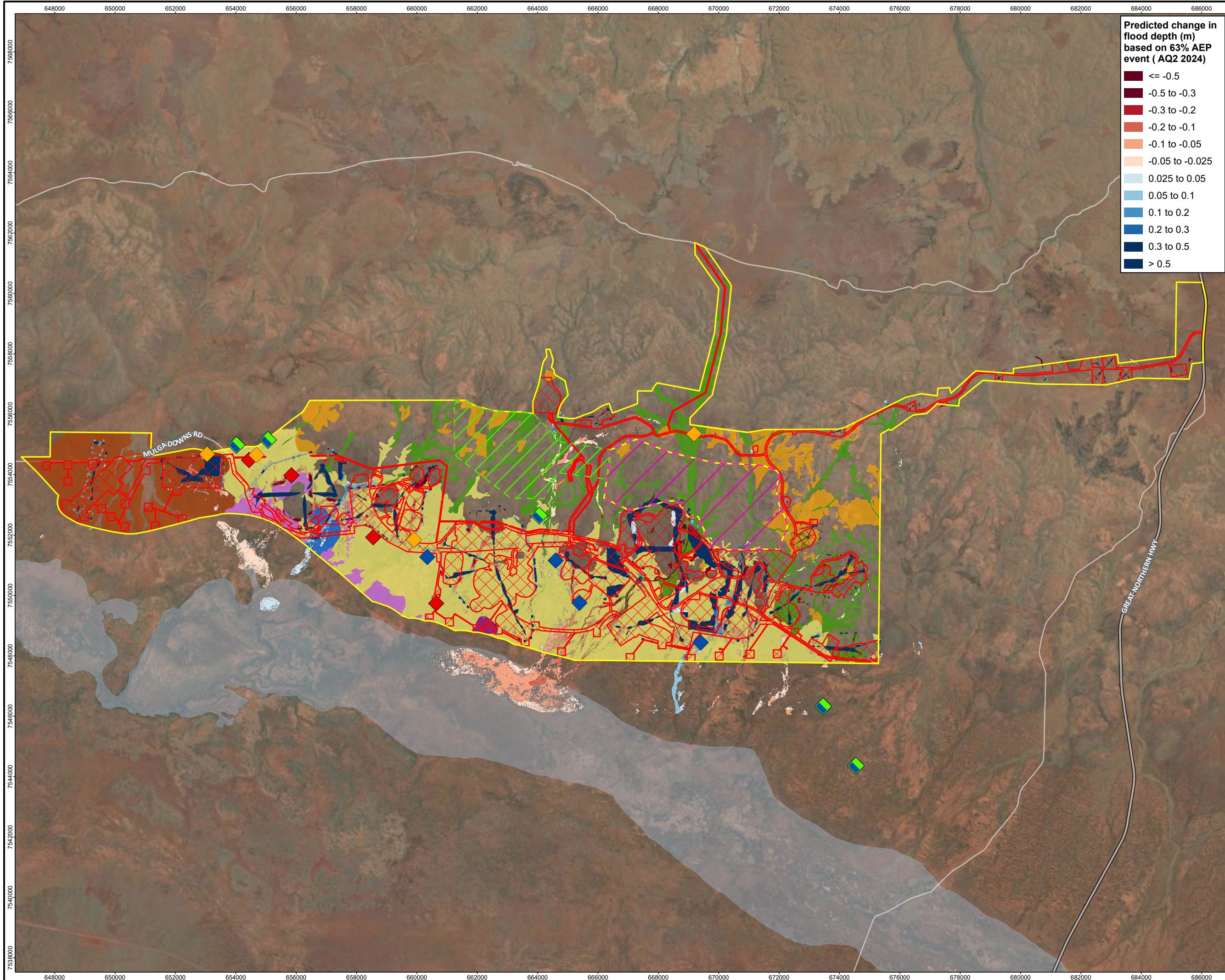
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Figure 4-4: Preliminary Monitoring locations for impacts of sheetflow disruptions and use of saline water for dust suppression – Proposed Action Area (EPBC 2022/09255) and Development Envelope (2326)

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Predicted change in flood depth (m) based on 63% AEP event (AQ2 2024)

- <= -0.5
- 0.5 to -0.3
- 0.3 to -0.2
- 0.2 to -0.1
- 0.1 to -0.05
- 0.05 to -0.025
- 0.025 to 0.05
- 0.05 to 0.1
- 0.1 to 0.2
- 0.2 to 0.3
- 0.3 to 0.5
- > 0.5

Legend

- Development Envelope/Proposed Action Area
- Indicative Footprint
- Fauna Habitat Exclusion Zone (FHEZ)
- FHEZ Corridor
- Lower Fortescue River

Sheet flow vegetation


- ASL (1) - Acacia tall shrubland
- ASL (2) - Acacia tall shrubland
- AWL (1) - Acacia low woodland or tall shrubland
- AWL (2) - Acacia low woodland or tall shrubland
- AWL (3) - Acacia low woodland or tall shrubland
- AaAxSL - Tall sparse shrubland of Acacia aneura (alliance)
- AxAsSL - Acacia tall sparse shrubland

Vegetation health sampling locations

- 5. Sheet flow vegetation - impact (drier)
- 5. Sheet flow vegetation - impact (wetter)
- 5/6. Sheetflow & dust - control
- 6. Dust and/or dust suppression - impact

Roads (LGATE-195)

- Highway
- Minor road




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Client: Hancock Prospecting Pty Ltd

Version: A	Date: 10-Apr-2025
Drawn By: droberts	Checked By: KR

Scale 1:115,000 at A3 ↑



Coord. Sys. GDA2020 MGA Zone 50

**Mulga Downs Iron Ore Mine
Central Pilbara, Western Australia**

MONITORING LOCATIONS FOR IMPACTS OF SHEETFLOW DISRUPTIONS AND USE OF SALINE WATER FOR DUST SUPPRESSION – PROPOSED ACTION AREA (EPBC 2022/09255) AND DEVELOPMENT ENVELOPE (EP 2326)

FIGURE 4-4

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5 Reporting

Table 5-1 outlines proposed internal and external reporting actions.

Table 5-1: WMP Reporting Actions

Notification Event / Reporting	Action	Responsibility	Timing
Trigger exceedance (and failure of management target)	Internal incident report and investigation	Environmental Advisor	At time of event or as soon as reasonably practicable.
Threshold exceedance	Internal incident report and investigation. External incident report to regulator	Environment Manager	Notify the CEO of DWER and DCCEEW within seven (7) days of the exceedance being identified Report on the outcomes of the exceedance investigation within 21 days of event.
Management action revision(s)	External notification to regulators (DWER and DCCEEW)	Environment Manager	Within 21 days of management action revision(s)
Groundwater and Surface Water Monitoring Assessment Report	Includes monitoring conducted, deviations to the WMP, apparent trends or patterns, trigger and threshold exceedances and other observations relevant to the data collated.	Environment Manager	Annually
Vegetation Health Monitoring Assessment Report	Includes monitoring conducted, deviations to the vegetation monitoring plan, trends or patterns detected (changes in vegetation health), trigger and threshold exceedances and other observations relevant to the data collated. The frequency of reporting will be at least annually.	Environment Manager	Annually
Annual Environmental Report	This report will be submitted to the regulator (DWER and DCCEEW) and include an assessment of compliance with any conditions that apply	Environment Manager	Annually – April each year for the reporting period 1 January to 31 December

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6 Roles and Responsibilities

All employees and contractors are required to comply with the requirements of this WMP. An outline of roles and responsibilities for all personnel is provided in Table 6-1.

Table 6-1: Roles and Responsibilities for Implementation of this Plan

Role	Responsibility
All personnel	Comply with all legal requirements and the requirements of this plan.
Environment Manager	<ul style="list-style-type: none">• Maintain the WMP, and review the WMP as required• Provide advice, including procedures and requirements, to all key parties to ensure compliance with legal requirements, achievement of environmental objectives and improving environmental performance• Provide support to all personnel as required to ensure the WMP is implemented.
Site Environmental Advisor	<ul style="list-style-type: none">• Report on the implementation of the plan.• Provide advice, including procedures and requirements, to all key parties to ensure compliance with legal requirements, achievement of environmental outcomes and objectives

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7 Adaptive Management and Review

HPPL will employ adaptive management through the LOM to incorporate knowledge from the implementation of mitigation measures, monitoring, and evaluation of data against trigger and threshold criteria to more effectively meet regulatory conditions and objectives outlined in this WMP. The following approach will be followed:

- Monitoring data will be systematically evaluated and compared to baseline data and predictions on an annual basis to verify whether groundwater responses to operational activities are the same or similar to predictions
- Re-evaluate the risk assessments annually after monitoring is completed
- Incorporate additional knowledge as it comes to hand to address assumptions and uncertainties to gain increased understanding of vegetation and aquifer response
- Periodically incorporate additional data, acquired through detailed design and monitoring, into groundwater and surface water models to increase certainty around predicted changes to groundwater regimes and water quality
- Review the mine planning program, GWOS, and input changes into risk assessments to refine or modify the monitoring program
- Undertake revision(s) when WMP provisions are not as effective as predicted, or trigger levels do not have the outcome anticipated or required
- Incorporate alternative techniques, technologies, and methodologies to enhance and improve the program
- Revise the WMP periodically to include additional and updated trigger and threshold levels based on developed baseline data
- Revise the WMP periodically to include additional Proposal areas (if required), monitoring locations, parameters and site-specific trigger and threshold levels
- Develop other monitoring programs as required to respond to additional operational activities
- Incorporate and modify the program to include any external changes during the life of the Proposal (e.g., changes to the sensitivity of the vegetation, climate change, implementation of other activities in the area, etc.).

All amendments to this WMP must be submitted to and approved by the CEO of DWER and DCCEEW. The Management Plans shall also be reviewed, and amendments submitted as and when directed by the CEO in addition to every five years from approval with outcomes of the five-yearly review submitted to the CEO.

The WMP will be reviewed on a biennial basis, or following:

- The grant of, or modification to, relevant approvals
- Major changes to the scope or operation of the mine
- Relevant findings or actions identified through monitoring, audits and incident reporting.

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8 Stakeholder Consultation

HPPL has consulted with key stakeholders in relation to its Proposal. These stakeholders include regulatory groups:

- Department of Water and Environmental Regulation (DWER) (EPA Services; Part V; Water)
- Department of Mining Industry Regulation and Safety (DEMIRS) - Environment and Mining Divisions
- Department of Biodiversity Conservation and Attractions (DBCA)
- Department of Planning, Lands and Heritage (DPLH)
- Commonwealth – Department of Climate Change, Energy, the Environment and Water (DCCEEW)
- Department of Jobs, Tourism, Science and Innovation (DJTSI)
- Main Roads Western Australia (MRWA)
- Pilbara Development Commission
- Shire of Ashburton.

Key Aboriginal Traditional Owners and communities identified and consulted are as follows:

- Banjima Native Title Aboriginal Corporation RNTBC (BNTAC) is the native title body corporate of the Banjima People Native Title Determination area
- Youngaleena Community
- Wirrilimurra Community.

The following industry stakeholder groups have been identified and consultation is ongoing:

- Western Australian Chamber of Minerals and Energy
- Chamber of Commerce and Industry
- Regional Chambers of Commerce and Industry – Karratha, Port Hedland and Newman
- Australian Miners and Mineral Associations
- Association of Mining and Exploration Companies
- Fortescue Metals Group.

The following key community stakeholders have been identified and consultation is ongoing:

- Mulga Downs Station
- Mt Florance Station
- Hooley Station
- Auski Munjina Roadhouse.

HPPL will continue to engage with stakeholders for the life of the Mine.

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9 References

Table 9-1: References

Author, year published	Title
ANZECC/ARMCANZ, 2000	National Water Quality Management Strategy Guidelines
ANZG, 2018	Australian and New Zealand Guidelines for Fresh and Marine Water Quality: Default Guideline Values
Attexo, 2023	Consolidated Terrestrial Fauna Report
AQ2, 2020a	Mulga Downs Ecohydrology Study
AQ2, 2020b	Mulga East Baseline Water Studies
AQ2, 2021a	Mulga East Preliminary Groundwater Management Assessment
AQ2, 2021b	Mulga East PFS Desktop Study
AQ2, 2022a	Mulga Downs Interim Surface Water Impact Assessment
AQ2, 2022b	Mulga Downs Site Water Management Pre-Feasibility Study
AQ2, 2024a	Mulga Downs Groundwater, Surface Water & Ecohydrological Studies - Impact Assessment (
AQ2, 2024b	Mulga Downs Baseline Ecohydrology Assessment
AQ2, 2024c	Mulga Downs Groundwater and Surface Water Risk Assessment Tables
AQ2, 2024d	Mulga Downs Groundwater, Surface Water & Ecohydrological Studies – Baseline Assessment
AQ2, 2024e	Mulga Downs Groundwater, Surface Water and Ecohydrological Impact Assessment
AS/NZS ISO 31000:2009	Risk management – Principles and Guidelines
Biologic, 2022a	Mulga Downs Iron Ore Project: Transport Corridor to Great Northern Hwy Terrestrial Fauna Survey
Biologic 2022b	Mulga Downs Iron Ore Mine: Mulga West Borefield and Mulga East Southern Corridor Terrestrial Fauna Survey. Report
Biologic 2023	Mulga Downs Iron Ore Mine: Freshwater Claypans Desktop Assessment.
CBEC, 2024	Mulga Downs Project-Provisional Water Quality Trigger Values
DCCEEW 2024	<i>Environmental Management Plan Guidelines.</i>
DEMIRS, 2023	Statutory Guidelines for Mining Proposals
ecologia, 2020	Baseline Terrestrial Invertebrate Fauna (SRE) Level 2 Assessment
ecologia, 2021a	Mulga East Baseline Terrestrial Vertebrate Fauna Assessment
ecologia, 2021b	Letter: Targeted Pilbara Leaf-nosed Bat Gap Analysis
EPA, 2020	EPA Guideline: Instructions on how to prepare <i>Environmental Protection Act 1986</i> Part IV Environmental Management Plans.
GWC, 2023	Mulga Downs Groundwater Modelling
GWC, 2024	Mulga Downs Groundwater Modelling
Maia 2021a	Mulga East Iron Ore Project, Mine Study Area Detailed Flora and Vegetation Assessment 2019-2020
Maia 2021b	Mulga Downs West Flora and Vegetation Desktop Study
Maia, 2022	Mulga Downs Mine and Borefield Study Area Detailed Flora and Vegetation Assessment
MWH, 2009	Murray's Hill Groundwater Investigation – Stage 2
MWH, 2012	Hydrogeological Assessment of the Fenceline Road Borefield Area
MWH, 2014	Conceptual Hydrogeology of the Mulga East Deposit
PSM, 2022	Mulga Downs PFS Geotechnical Assessment and Pit Slope Design
Spectrum, 2023a	Mulga Downs Iron Ore Project (MDIOP) Solar Farm, Haul Road and Pipeline (ASA)
Spectrum 2023b	Memo: Mulga Downs Iron Ore Mine, Targeted Grey Falcon Survey
Spectrum, 2024a	Targeted Bilby & Night Parrot Survey
Spectrum, 2024b	Supplementary Targeted Fauna Survey

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10 Appendices

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Appendix 1 Provisional Water Quality Trigger Report (CBEC, 2024)

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Appendix 2 – Groundwater and Surface Water Risk Assessment

Table A2-1: Likelihood Criteria

Rating	Likelihood Factor	Descriptor	Description	Frequency	Probability
5	30	Almost Certain	The event is expected to occur in most circumstances	May occur multiple times within 12 months	>91% chance of occurrence
4	20	Likely	The event will probably occur in many circumstances	May occur once per year	61-90% chance of occurrence
3	12	Possible	The event is expected to occur at some time	May occur once in 5 years	41-60% chance of occurrence
2	7.5	Unlikely	The event could credibly occur at some future time	May occur once in 10 years	10-40% chance of occurrence
1	5	Rare	The event may occur only in special circumstances	May occur once during life of mine	<10% chance of occurrence

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Table A2-2: Consequence Criteria

Environmental Factor	Slight	Minor	Moderate	Major	Severe
Biodiversity	Direct impact to fauna (does not include conservation significant, priority or threatened fauna species).	Localised impact (<24 hours recovery time) to land or water providing habitat for threatened flora or fauna species or a mangrove community OR Medium term impact (<3 months recovery time) to land or water providing habitat for flora and fauna that can be remediated within 3 months	Long term impact (>5 years recovery time) to land or water that provides habitat for flora and fauna OR Medium term impact (<3 months recovery time) to land or water providing habitat for threatened flora or fauna species or a mangrove community OR Direct impact to individual flora/fauna of threatened species	Permanent or irreversible widespread impact to land or water that provides habitat for flora and fauna OR Long term impact (>5 years recovery time) to land or water providing habitat for threatened flora or fauna species or a mangrove community OR Irreversible impact to scheduled, listed or declared rare and/or threatened species of flora or fauna (>5 individuals)	Permanent or irreversible widespread impact to land or water providing habitat for threatened flora or fauna species or a mangrove community
Water Resources	Local impact to water that can be remediated within 24 hours.	Localised impact (<24 hours recovery time) to land or water providing habitat for threatened flora or fauna species or a mangrove community OR Medium term impact (<3 months recovery time) to land or water providing habitat for flora and fauna that can be remediated within 3 months	Long term impact (>5 years recovery time) to land or water that provides habitat for flora and fauna OR Medium term impact (<3 months recovery time) to land or water providing habitat for threatened flora or fauna species or a mangrove community OR Direct impact to individual flora/fauna of threatened species	Permanent or irreversible widespread impact to land or water that provides habitat for flora and fauna OR Long term impact (>5 years recovery time) to land or water providing habitat for threatened flora or fauna species or a mangrove community OR Irreversible impact to scheduled, listed or declared rare and/or threatened species of flora or fauna (>5 individuals)	Permanent or irreversible widespread impact to land or water providing habitat for threatened flora or fauna species or a mangrove community
Land and Soils	Local impact to land or water that can be remediated within 24 hours.	Localised impact (<24 hours recovery time) to land or water providing habitat for threatened flora or fauna species or a mangrove community OR Medium term impact (<3 months recovery time) to land or water providing habitat for flora and fauna that can be remediated within 3 months	Long term impact (>5 years recovery time) to land or water that provides habitat for flora and fauna OR Medium term impact (<3 months recovery time) to land or water providing habitat for threatened flora or fauna species or a mangrove community OR Direct impact to individual flora/fauna of threatened species	Permanent or irreversible widespread impact to land or water that provides habitat for flora and fauna OR Long term impact (>5 years recovery time) to land or water providing habitat for threatened flora or fauna species or a mangrove community OR Irreversible impact to scheduled, listed or declared rare and/or threatened species of flora or fauna (>5 individuals)	Permanent or irreversible widespread impact to land or water providing habitat for threatened flora or fauna species or a mangrove community
Rehabilitation and Mine Closure	Site is safe, stable and non-polluting and post land use is not adversely affected	The site is safe, all major landforms are stable, and any stability or pollution issues are contained and require no residual management. Post-mining land use is not adversely affected.	The site is safe, and any stability or pollution issues require minor, ongoing maintenance by end land-user	The site cannot be considered safe, stable or non-polluting without long-term management or intervention. Agreed end land-use cannot proceed without ongoing management.	The site is unsafe, unstable and/ or causing pollution or contamination that will cause an ongoing residual affect. The post-mining land use cannot be achieved.

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Table A2-3: Risk Matrix

Risk Matrix (5 x 5)							
RHH Risk Evaluation Matrix			Likelihood Rating				
			Rare	Unlikely	Possible	Likely	Almost Certain
			1	2	3	4	5
			Residual Risk Rating (RRR)				
Consequence/Impact	Factors		5	7.5	15	20	30
Severity Level	Severe	10	High (50.00)	High (75.00)	Extreme (150.00)	Extreme (200.00)	Extreme (300.00)
	Major	5	Medium (25.00)	Medium (37.50)	High (60.00)	Extreme (100.00)	Extreme (150.00)
	Moderate	2	Low (10.00)	Medium (15.00)	Medium (30.00)	Medium (40.00)	High (60.00)
	Minor	1	Low (5.00)	Low (7.50)	Medium (15.00)	Medium (20.00)	Medium (30.00)
	Slight	0.5	Low (2.50)	Low (3.75)	Low (7.50)	Low (10.00)	Medium (15.00)

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Table A2-4: Risk Assessment - Groundwater

Risk Pathway/Unwanted Event	Description of Impact	Phase(s) Unwanted Event likely to occur	Inherent Risk				Risk Treatments	Phase(s) Treatments to be implemented	Residual Risk		
			Consequence	Likelihood	Risk Rating	Data Certainty			Consequence	Likelihood	Risk Rating
Water Resources											
Drawdown related to pit dewatering	Groundwater levels will be drawn down. This may impact stygofauna habitat and other groundwater users in the area (i.e., station bores for livestock and water supplies for nearby Aboriginal communities). No groundwater-dependent vegetation has been identified in the area.	Operations / Closure	Moderate	Likely	M-40	High	<ul style="list-style-type: none"> Excess water is to be injected into the groundwater system thereby limiting the extent of drawdown from the immediate mining area (accepting recirculation of groundwater). Comprehensive baseline and operational monitoring of groundwater levels in and around areas of dewatering and nearby groundwater users that may be impacted. Provision of water supply to “unduly affected” groundwater users. Backfilling of the pits at closure will allow groundwater levels to return to near pre-development conditions. Identification of stygofauna outside of the impact area. 	Operations / Closure	Moderate	Likely	M-40
Change in groundwater flow direction related to pit dewatering	As a result of dewatering, more saline groundwater from the valley area will be drawn towards the pit areas and the saline interface may rise in the broader cone of depression. This may impact stygofauna habitat and other groundwater users in the area (station bores for livestock).	Operations	Moderate	Unlikely	M-15	High	<ul style="list-style-type: none"> Groundwater modelling predictions suggest that changes to groundwater salinity resulting from dewatering are modest with respect to beneficial use and stygofauna habitat. MAR should reduce the potential hydrostatic changes in the broader cone of depression. 	Operations	Moderate	Unlikely	M-15
Groundwater mounding resulting from MAR	Groundwater will mound in areas of aquifer MAR. Mounding will reduce potential troglofauna habitats. If groundwater mounds into the root zone for extended periods of time, this will have a detrimental impact on the vegetation. Mounding may also result in the surface expression of groundwater which, in the claypan areas, or at the break of slopes down-gradient from MAR areas. This could result in salinisation of the freshwater surface features. Potential impact on aesthetic and cultural heritage values.	Operations	Moderate	Possible	M-30	Medium	<ul style="list-style-type: none"> Water from in-pit sump pumping will not be re-injected without appropriate treatment for removing sediment. Comprehensive baseline and operational monitoring of groundwater levels in MAR areas. Reduction of MAR if required. Multiple MAR areas to allow flexibility of MAR and periods of recovery (ie reduced MAR in one area and increased in another). Review dewatering and mine schedule, if required. 	Operations	Minor	Unlikely	L-7.5
Change to groundwater quality resulting from MAR	Due to the variable groundwater salinity across the project area, MAR will change the groundwater quality in the MAR areas. This may impact stygofauna habitats and other groundwater users (station bores for livestock and water supplies for nearby Aboriginal communities).	Operations	Moderate	Possible	M-30	Medium	<ul style="list-style-type: none"> Groundwater modelling predictions suggest that changes to groundwater salinity resulting from MAR are modest with respect to beneficial use and stygofauna habitat and of limited extent (<2 km). Comprehensive baseline and operational monitoring of groundwater quality in and around MAR areas and nearby groundwater users that may be impacted. Provision of water supply to “unduly affected” groundwater users. 	Operations	Moderate	Unlikely	M-15
Change in groundwater flow direction related to MAR	Groundwater mounding in MAR areas will result in local changes to groundwater flow directions. This may result in water quality changes beyond the immediate MAR areas which may impact stygofauna habitats and other groundwater users (station bores for livestock and water supplies for nearby Aboriginal communities).	Operations	Moderate	Possible	M-30	Medium	<ul style="list-style-type: none"> The location of MAR sites near to the mining area, limits the spatial extent of changes to the groundwater system. Groundwater modelling predictions suggest that changes to groundwater salinity resulting from MAR are modest with respect to beneficial use and stygofauna habitat. Comprehensive baseline and operational monitoring of groundwater quality in and around MAR areas and nearby groundwater users that may be impacted. Provision of water supply to “unduly affected” groundwater users. 	Operations	Moderate	Unlikely	M-15
Contamination of groundwater from waste rock dumps / spills etc	Potential for pollutants such as hydrocarbons or metals to reach the groundwater system. Potential toxicity to biodiversity and deterioration of shallow aquifer salinity.	Operations	Moderate	Unlikely	M-15	Moderate	<ul style="list-style-type: none"> Efficient water management during operations, dewatering abstraction is predominantly ex-pit, prior to inflow to the pit therefore reduced risk of contaminating water for MAR. Water from in-pit sump pumping will not be re-injected without appropriate treatment. Comprehensive baseline and operational monitoring of groundwater quality. 	Operations	Moderate	Rare	L-10

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Table A2-5: Risk Assessment – Surface Water

Risk Pathway/Unwanted Event	Description of Impact	Phase(s) Unwanted Even likely to occur	Inherent Risk				Risk Treatments	Phase(s) Treatments to be implemented	Residual Risk		
			Consequence	Likelihood	Risk Rating	Data Certainty			Consequence	Likelihood	Risk Rating
Water Resources											
Reduction of water to downstream environment	Runoff collected within, and ponding upstream of, the pit, waste dumps, stockpiles and borrow pits will reduce the runoff to the downstream environment, resulting in areas of water shadowing. This may impact the vegetation in the downstream environment.	Construction / Operations / Closure	Major	Likely	E-100	High	<ul style="list-style-type: none"> Diversions around mine disturbance and development areas. With proposed mitigation measures, there is an estimated reduction of 10% in the catchment area of the Gnalka Gnoona Claypan, if no water from the pits/waste dumps reports downstream. The Koodjeepindarranna Claypan catchment area is reduced by <0.5% and the combined claypan catchment area is reduced by 2%. Flood modelling comparisons of predicted baseline and LOM water distributions from small recurrence events (such as the 50% AEP) indicate that the reduction in water levels within the Fortescue Valley within these rain shadow areas is limited to approximately 0.1m. Refer to Appendix D. Water balance modelling of the claypan water levels indicate that the reductions in catchment areas result in only a negligible impact on the hydroperiod (how long they hold water) and water levels of the claypans. Runoff collected from pits, waste dumps and stockpiles will be contained and released to the environment following sediment treatment. 	Construction / Operations / Closure	Slight	Possible	L-7.5
Reduction of water to downstream environment	Water shadowing on the downstream side of road and rail embankments (and pipeline installations) caused by ponding and potential redirection and concentration of surface water flows through culverts along their alignments.	Construction / Operations	Moderate	Likely	H-60	High	<ul style="list-style-type: none"> Culverts positioned to allow flow of surface water across linear infrastructure areas. Flood modelling comparisons of the predicted baseline and LOM water distributions from the small recurrence events (such as the 50% AEP) indicate reductions in flood depths on the downstream side of linear infrastructure are less than 0.1m. Refer to Appendix D. Burial of pipeline at drainage lines/ creek crossings to prevent disruption to flows Raise pipelines at regular intervals to allow local surface water runoff to flow downstream 	Construction / Operations	Slight	Rare	L-2.5
Reduction of water to downstream environment	Diversion of drainage lines around development areas and into a different downstream drainage line	Construction / Operations / Closure	Minor	Possible	M-15	High	<ul style="list-style-type: none"> All diversions to be returned back to the same downstream catchment/drainage path where possible. Flood modelling comparisons of baseline and LOM water distribution from small recurrence events (such as the 50% AEP) indicate that the reduction in water levels within the Fortescue Valley within these rain shadow areas is limited to approximately 0.1m. Refer to Appendix D. 	Construction / Operations / Closure	Slight	Rare	L-2.5
Increased inundation of water on upstream side of development areas	Blockage of drainage lines may result in prolonged inundation in areas where it may not have occurred previously. This may lead to vegetation health impacts due to water logging and changes to the vegetation composition of communities. Likely to be limited in extent to local area upstream of disturbance footprints.	Construction/ Operations/ Closure	Moderate	Likely	H-60	High	<ul style="list-style-type: none"> Diversion of drainage lines around disturbance areas. 	Construction / Operations / Closure	Slight	Rare	L-2.5
Water quality impacts (sediment)	OSA face failure due to erosion along waste dump toe leading to sediment reporting to Fortescue Valley and claypans	Construction / Operations / Closure	Major	Unlikely	M-20	Medium	<ul style="list-style-type: none"> Diversions around mine disturbance areas to protect the toe of the waste rock dumps. Diversions required for closure to have flood damage resilience for up to 1:10,000 yr event. 	Construction / Operations / Closure	Slight	Rare	L-2.5
Water quality impacts (sediment)	Ongoing sediment release to downstream environment from frequent rainfall events leading to increased sediment load to Fortescue Valley and claypans	Construction / Operations	Moderate	Likely	H-60	High	<ul style="list-style-type: none"> Containment of sediment laden runoff from pits and waste rock dumps and stockpile areas and passing this runoff through sediment basins prior to release downstream. 	Construction / Operations	Minor	Rare	L-3.75
Water quality impacts (sediment)	Ongoing sediment release to downstream environment from frequent rainfall events leading to increased sediment load to Fortescue Valley and claypans	Closure	Moderate	Likely	H-60	High	<ul style="list-style-type: none"> Closure landform designs, revegetation of landform slopes and armouring as required. 	Closure	Minor	Rare	L-3.75

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Risk Pathway/Unwanted Event	Description of Impact	Phase(s) Unwanted Even likely to occur	Inherent Risk				Risk Treatments	Phase(s) Treatments to be implemented	Residual Risk		
			Consequence	Likelihood	Risk Rating	Data Certainty			Consequence	Likelihood	Risk Rating
Water quality impacts (chemical)	Dust suppression application impacting on local fauna/vegetation	Construction / Operations	Minor	Possible	M-15	Low	<ul style="list-style-type: none"> Dust suppression operations to be managed to prevent over-watering of roads. Road spoon drains to prevent dust suppression runoff to surrounding areas. Vegetation health monitoring adjacent to roads 	Construction / Operations	Moderate	Rare	L-10
Water quality impacts (chemical)	Runoff from within mine development areas containing pollutants such as hydrocarbons or metals etc. entering local waterways and downstream Fortescue Valley and claypans	Construction / Operations	Moderate	Likely	M-40	Medium	<ul style="list-style-type: none"> Local runoff management practices deployed within plant and mining areas as outlined in the Roy Hill Environmental Management System, including: <ul style="list-style-type: none"> Containment of runoff and wastewater at washdowns, workshops etc and passed through an oil/water separator with re-use of runoff water within the process prioritised. Deployment of spill kits to clean up local oil spills immediately when they occur. Ongoing monitoring of groundwater and surface water for potential contaminants which could occur from the mining process. 	Construction / Operations	Moderate	Rare	L-10
Water quality impacts (chemical)	Dewatering / MAR pipeline burst resulting in spill of water with elevated salinity.	Operations	Major	Possible	H-60	High	<ul style="list-style-type: none"> Appropriate (conservative) design of transfer piping and pumping systems, particularly where they cross the Fortescue Valley including: <ul style="list-style-type: none"> pressure rating of pipeline high pressure and low flow protection settings on the transfer system leak detection systems to shut off pumping in the event of pipeline burst and operator warnings in the event of pipeline leaks burial of pipeline sections at drainage lines/ creek crossings to prevent widespread surface discharge of leaks routine inspection and maintenance 	Operations	Minor	Unlikely	L-7.5

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Appendix 3 – Bore Specific Interim Trigger Levels and Threshold Criteria and Bore Locations

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Table A3-1: Drawdown Monitoring Bores Triggers and Thresholds

Bore / Site	Easti ng	Northi ng	Stressor	Monitori ng Paramet er	Receptor	Status	Teneme nt Status	Groundwa ter Level (mbgl)*	Modelle d Drawdo wn (m)	Groundwa ter Level Trigger**	Groundwa ter Level Threshold
MDE_MON_1	6457 18	75565 31	Dewateri ng	Water Level - Drawdo wn Extent	Other GW Users	Proposed	Teneme nt Require d	9.5	<1	1 m ddn	tbc
MDE_MON_7	6718 73	75433 79	Dewateri ng	Water Level - Drawdo wn Extent	Other GW Users	Proposed	Teneme nt Granted	3.5	~1	1 m ddn	tbc
MDE_MON_9	6751 25	75478 15	Dewateri ng	Water Level - Drawdo wn Extent	Other GW Users	Proposed	On Teneme nt	20	<1	1 m ddn	tbc
MDE_MON_13	6586 10	75378 00	Dewateri ng	Water Level - Drawdo wn Extent	Other GW Users - Youngale ena	Proposed	On Teneme nt	4.5	~1	1 m ddn	tbc
MDPZ7462A, B, C	6448 00	75480 89	Dewateri ng	Water Level - Drawdo wn Extent	Other GW Users	Existin g	On Teneme nt	4.67	<1	1 m ddn	tbc
MDPZ7461	6560 10	75429 96	Dewateri ng	Water Level - Drawdo wn Extent	Other GW Users - Youngale ena	Existin g	On Teneme nt	4.41	~2.5	2.5 m ddn	tbc
MDPZ7463	6428 67	75535 88	Dewateri ng	Water Level - Drawdo wn Extent	Other GW Users	Existin g	On Teneme nt	5.36	<1	1 m ddn	tbc
MDPZ7472	6709 21	75552 75	Dewateri ng	Water Level - Drawdo wn Extent	Other GW Users	Existin g	On Teneme nt	15.18	<1	1 m ddn	tbc
MDWB0011	6602 44	75578 08	Dewateri ng	Water Level - Drawdo wn Extent	Other GW Users	Existin g	On Teneme nt	22.6	<1	1 m ddn	tbc
MDWB0013	6652 70	75562 65	Dewateri ng	Water Level - Drawdo wn Extent	Other GW Users	Existin g	On Teneme nt	17.08	<1	1 m ddn	tbc

ddn = drawdown

tbc = to be confirmed based on trigger level assessment

* Groundwater levels for proposed bores are estimates

** Groundwater level depth (as opposed to drawdown) will be identified prior to operation, based on complete set of baseline data

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Table A3-2: Mounding Monitoring Bores Triggers and Thresholds

Bore / Site	Easti ng	North ing	Stres sor	Monito ring Parame ter	Receptor	Status	Tenem ent Status	Groundw ater Level (mbgl)*	Groundwate r Level Trigger	Groundwater Level Threshold
MDE_MON_4	6651 85	75469 59	MAR	Water Level - Moundi ng	Mounding at break of slope	Propo sed	Tenem ent Pendin g	4.5	3 mbgl	2.5 mbgl
MDE_MON_5	6679 64	75453 68	MAR	Water Level - Moundi ng	Mounding at break of slope	Propo sed	Tenem ent Grante d	4	3 mbgl	2.5 mbgl
MDE_MON_6	6692 55	75434 32	MAR	Water Level - Moundi ng	Mounding on valley floor	Propo sed	Tenem ent Requir ed	3.5	min baseline DTW	min baseline DTW less 0.5m
MDE_MON_7	6718 73	75433 79	MAR	Water Level - Moundi ng	Mounding at break of slope	Propo sed	Tenem ent Pendin g	3.5	min baseline DTW	min baseline DTW less 0.5m
MDE_MON_8	6666 53	75429 93	MAR	Water Level - Moundi ng	Mounding on valley floor	Propo sed	Tenem ent Pendin g	3.5	min baseline DTW	min baseline DTW less 0.5m
MDPZ0704	6596 49	75492 20	MAR	Water Level - Moundi ng	Mounding at break of slope	Existin g	On Tenem ent	4.43	3 mbgl	2.5 mbgl
MDPZ7449A,B,C	6556 57	75517 87	MAR	Water Level - Moundi ng	Mounding at break of slope	Existin g	On Tenem ent	4.71	3 mbgl	2.5 mbgl
MDPZ7450A, B, C	6522 19	75525 41	MAR	Water Level - Moundi ng	Tracking mounding for break of slope	Existin g	On Tenem ent	5.78	3 mbgl	2.5 mbgl
MDPZ7451A, B, C	6513 47	75505 79	MAR	Water Level - Moundi ng	Mounding near Claypans	Existin g	On Tenem ent	4.34	3 mbgl	2.5 mbgl
MDPZ7456A, B,C	6658 51	75479 07	MAR	Water Level - Moundi ng	Tracking mounding for break of slope	Existin g	On Tenem ent	7.91	3 mbgl	2.5 mbgl
MDPZ7460A, B, C	6632 02	75479 87	MAR	Water Level - Moundi ng	Mounding at break of slope	Existin g	On Tenem ent	4.68	3 mbgl	2.5 mbgl
MDPZ7464	6499 44	75524 28	MAR	Water Level - Moundi ng	Tracking mounding for break of slope	Existin g	On Tenem ent	6.47	3 mbgl	2.5 mbgl
MDPZ7465, MDPZ0757	6700 05	75478 81	MAR	Water Level - Moundi ng	Tracking mounding for break of slope	Existin g	On Tenem ent	15.48	3 mbgl	2.5 mbgl
MDPZ7468A, B, C	6471 91	75515 24	MAR	Water Level - Moundi ng	Koodjeepindar anna Claypan	Existin g	On Tenem ent	4.49	3 mbgl	2.5 mbgl
MDPZ7469A, B, C	6573 12	75500 11	MAR	Water Level - Moundi ng	Mounding at break of slope	Existin g	On Tenem ent	2.96	min baseline DTW	min baseline DTW less 0.5m

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Bore / Site	Easting	Northing	Stressor	Monitoring Parameter	Receptor	Status	Tenement Status	Groundwater Level (mbgl)*	Groundwater Level Trigger	Groundwater Level Threshold
MDPZ7470A, B, C	661399	7546377	MAR	Water Level - Mounding	Mounding on valley floor	Existing	On Tenement	3.61	min baseline DTW	min baseline DTW less 0.5m
MDPZ7471A, B, C	646686	7549394	MAR	Water Level - Mounding	Koodjeepindarra Claypan	Existing	On Tenement	3.86	3 mbgl	2.5 mbgl

Table A3-3: Salinity Monitoring Bores Triggers and Thresholds

Bore / Site	Easting	Northing	Stressor	Monitoring Parameter	Receptor	Status	Tenement Status	Baseline EC (uS/cm)*	Salinity Trigger (TDS as mg/L)
MDE_MON_1	645718	7556531	MAR	Water Quality - Salinity	Shallow Fresher GW - Other GW Users	Proposed	Tenement Required	1,000	4,500
MDE_MON_2	654703	7551910	MAR	Water Quality - Salinity	Shallow Fresher GW - Other GW Users	Proposed	On Tenement	3,500	4,500
MDE_MON_4	665185	7546959	MAR	Water Quality - Salinity	Shallow Fresher GW - Other GW Users	Proposed	Tenement Pending	4,500	4,500
MDE_MON_5	667964	7545368	MAR	Water Quality - Salinity	Shallow Fresher GW - Other GW Users	Proposed	Tenement Granted	4,500	4,500
MDE_MON_7	671873	7543379	MAR	Water Quality - Salinity	Shallow Fresher GW - Other GW Users	Proposed	Tenement Pending	4,300	4,500
MDE_MON_9	675125	7547815	MAR	Water Quality - Salinity	Other GW Users - Wirrilimarra	Proposed	On Tenement	1,000	4,500
MDE_MON_10	676395	7546188	MAR	Water Quality - Salinity	Other GW Users - Wirrilimarra	Proposed	Tenement Required	1,500	4,500
MDE_MON_11	669636	7547030	MAR	Water Quality - Salinity	Shallow Fresher GW - Other GW Users	Proposed	Tenement Required	3,500	4,500
MDE_MON_12	671595	7545400	MAR	Water Quality - Salinity	Shallow Fresher GW - Other GW Users	Proposed	Tenement Required	3,500	4,500
MDE_MON_6	669255	7543432	MAR	Water Quality - Salinity	Shallow Fresher GW - Other GW Users	Proposed	Tenement Required	5,000	4,500
MDPZ7449B	655657	7551787	MAR	Water Quality - Salinity	Shallow Fresher GW - Other GW Users	Existing	On Tenement	2,000	4,500
MDPZ7456C	665851	7547907	MAR	Water Quality - Salinity	Shallow Fresher GW -	Existing	On Tenement	4,400	4,500

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Bore / Site	Easting	Northing	Stressor	Monitoring Parameter	Receptor	Status	Tenement Status	Baseline EC (uS/cm)*	Salinity Trigger (TDS as mg/L)
					Other GW Users				
MDPZ7464	649944	7552428	MAR	Water Quality - Salinity	Shallow Fresher GW - Other GW Users	Existing	On Tenement	2,200	4,500
MDPZ7465, MDPZ0757	670005	7547881	MAR	Water Quality - Salinity	Shallow Fresher GW - Other GW Users	Existing	On Tenement	1,700	4,500
MDPZ7469C	657312	7550011	MAR	Water Quality - Salinity	Shallow Fresher GW - Other GW Users	Existing	On Tenement	3,200	4,500
MDWB0034	652853	7555585	MAR	Water Quality - Salinity	Shallow Fresher GW - Other GW Users	Existing	On Tenement	1,500	4,500

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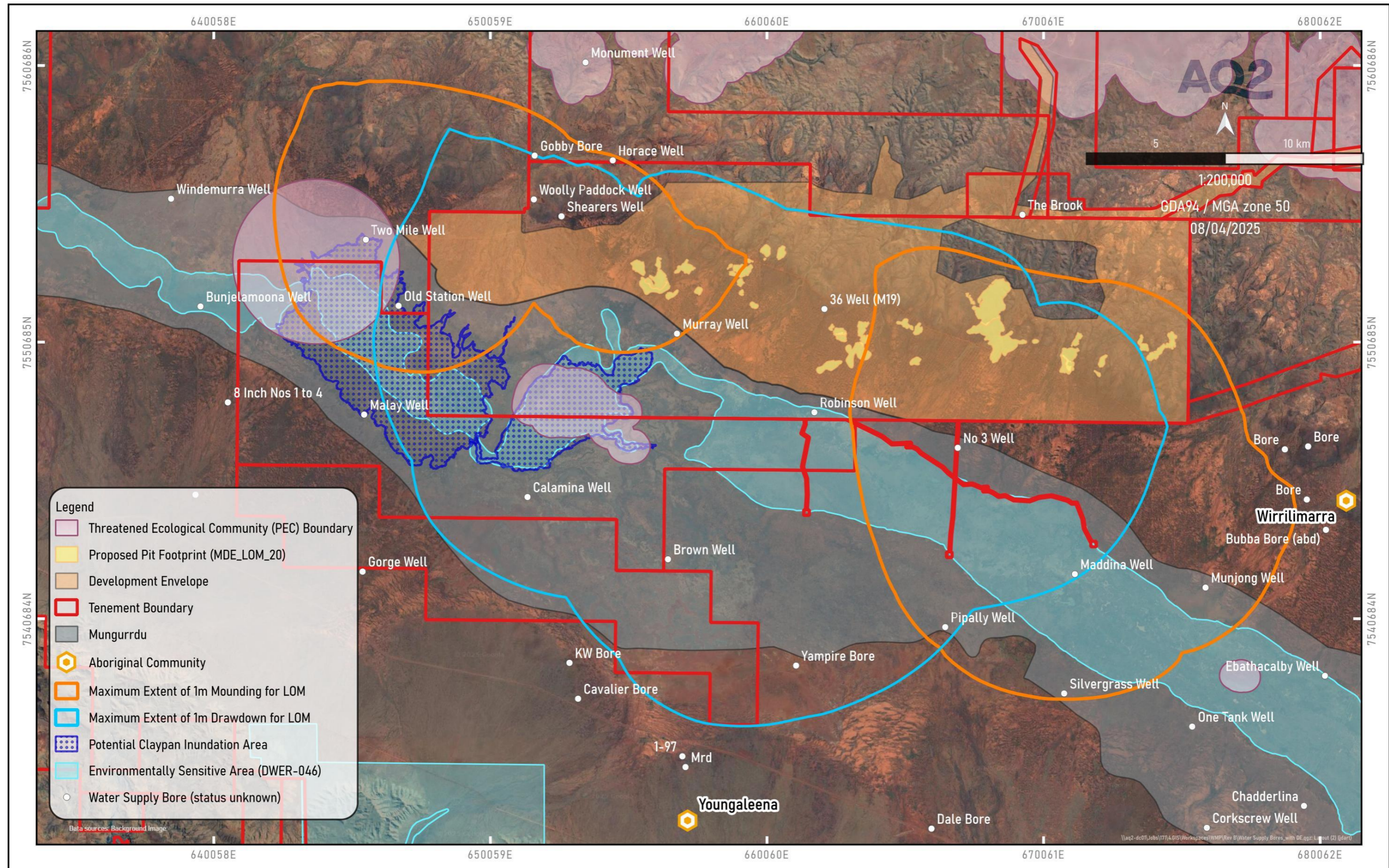


Figure A3-1: Ground user Water Supply Bores

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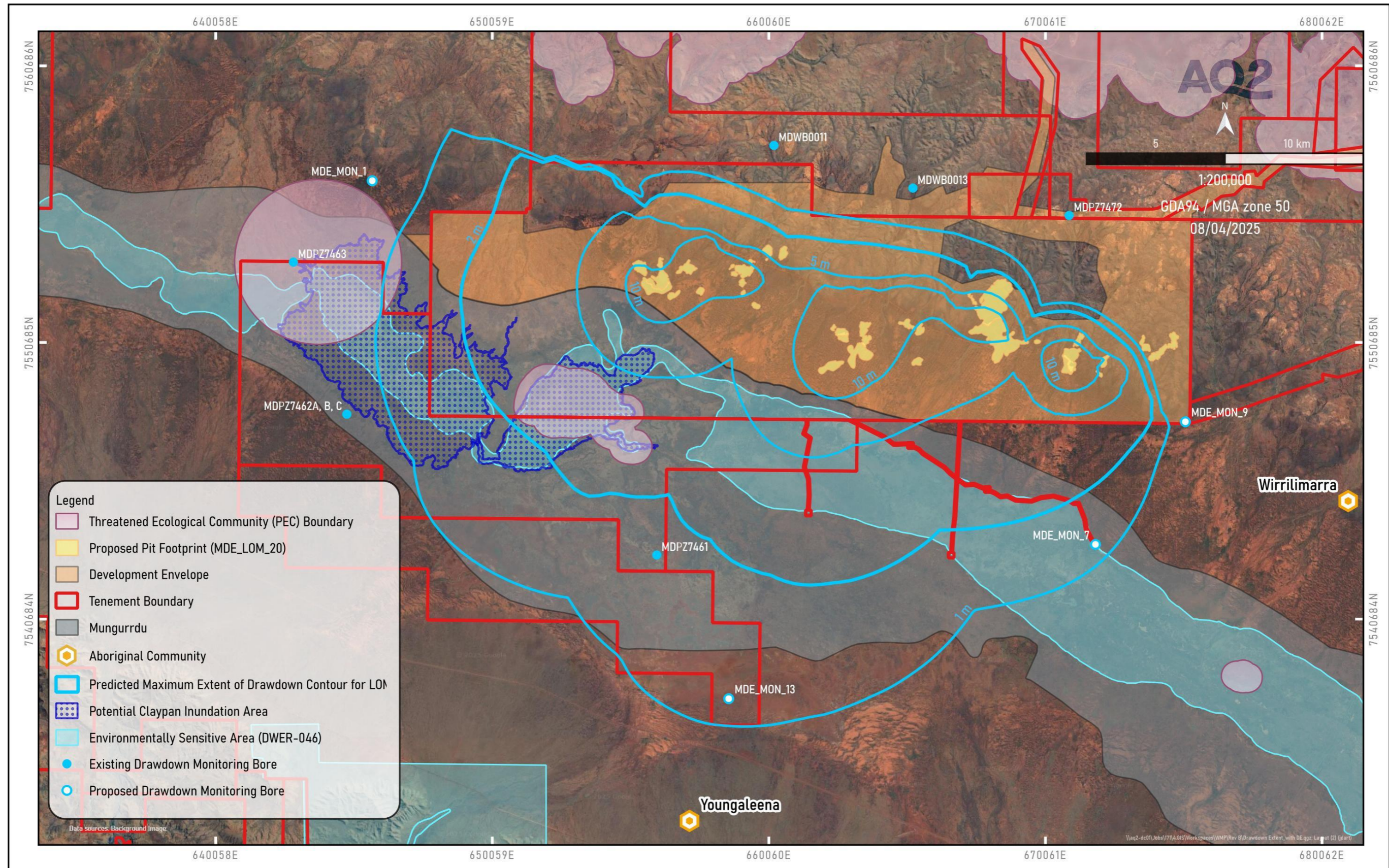


Figure A3-2: Drawdown Monitoring Bores

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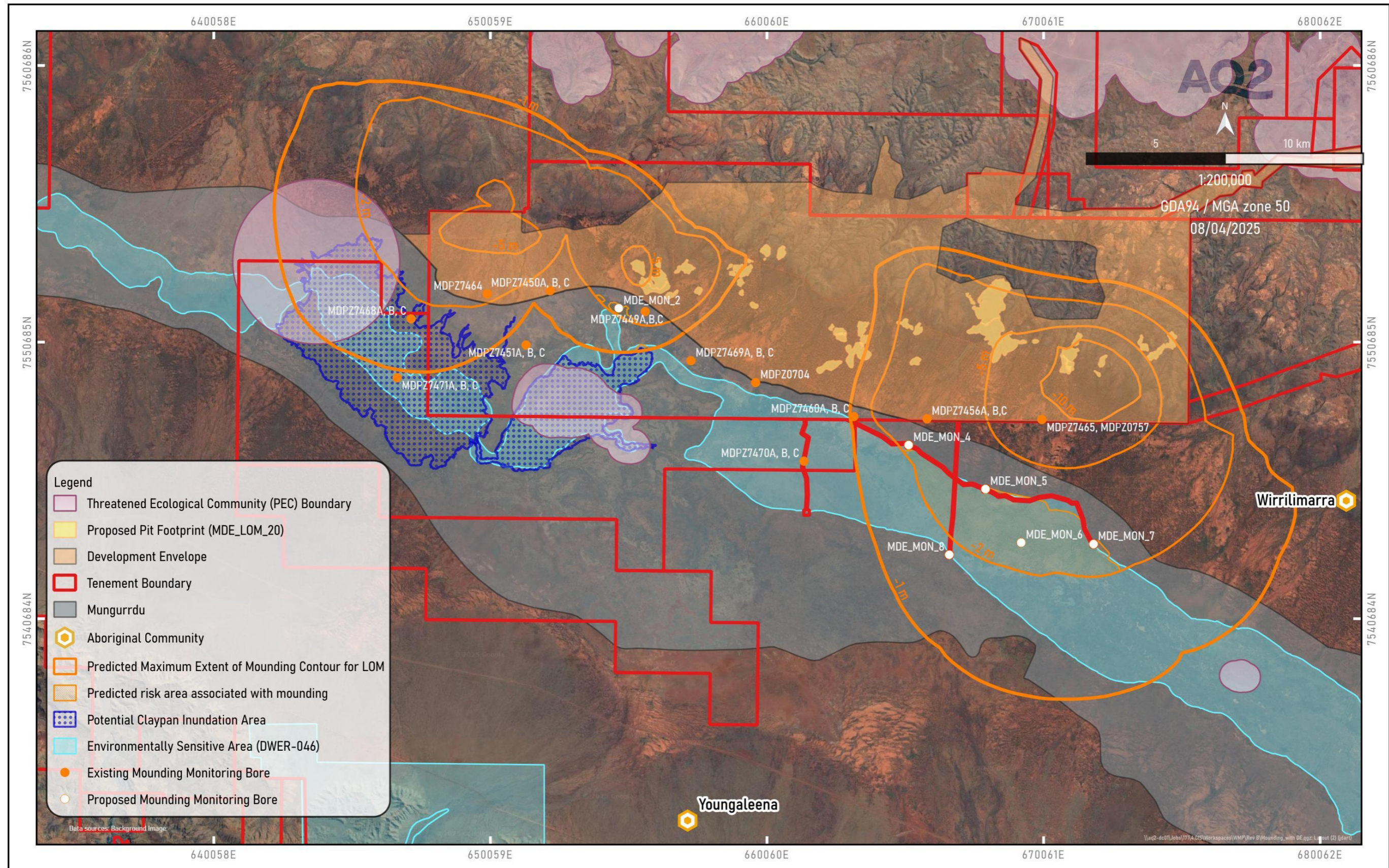


Figure A3-3: Mounding Monitoring Bores

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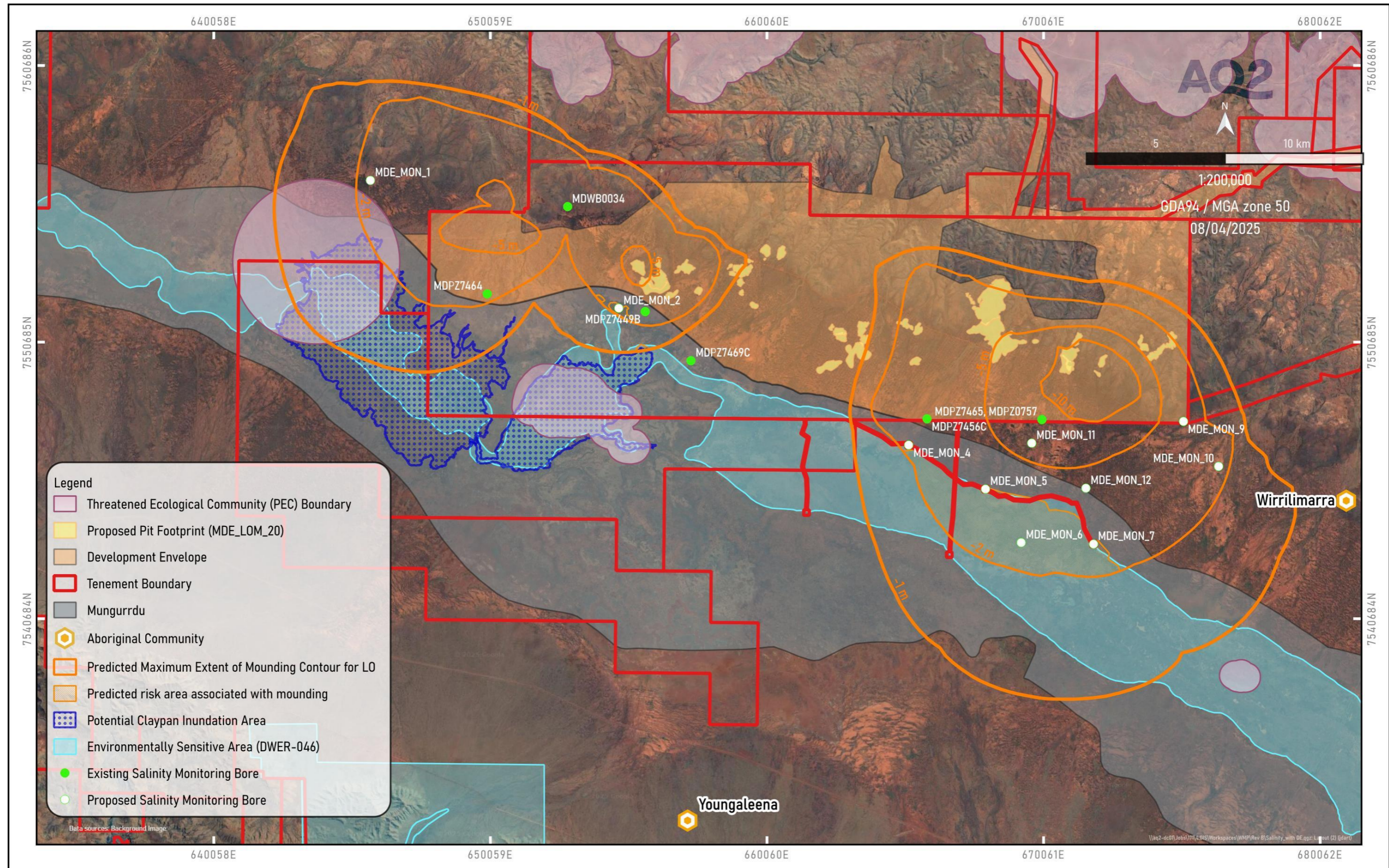


Figure A3-4: Salinity Monitoring Bores

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