Works Approval Supporting Document

Rhodes Ridge Temporary Exploration Camp

Wastewater Treatment Plant & Sprayfield

May 2024

RTIO-

Disclaimer and Limitation

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Document Status					
Rev	Author/s	Reviewer/s	Review Issue Date	Approved for Issue	
				To Whom	Date
A	[redacted]		7/05/2024	Department of Water and Environmental Regulation	TBC

TABLE OF CONTENTS

TABLES

FIGURES

PLATES

Abbreviations

AER	Annual Environmental Report
ANZECC	Australian and New Zealand Environment and Conservation Council
BGL	Below ground level
CEMP	Construction Environmental Management Plan
CPS	Clearing Permit
DMIRS	Department of Mines, Industry Regulation and Safety
DoH	Department of Health
DRF	Declared Rare Flora
DWER	Department of Water and Environmental Regulation
EPA	Environmental Protection Authority
EPAS	EPA Services
EP Act	*Environmental Protection Act 1986*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
GWL	Groundwater Licence
HEC	Heritage and Environment Committee
HSEC	Health, Safety, Environment and Communities and Social
IBRA	Interim Biogeographic Regionalisation of Australia
ILUA	Indigenous Land Use Agreement
LIC	Local Implementation Committee
LV	Light Vehicle
Mining Act	*Mining Act 1978*
ML	State Agreement Mineral Lease
P	Priority
PEC	Priority Ecological Community
PDWSA	Public Drinking Water Source Area
PIL3	Pilbara Bioregion
RBC	Rotating Biological Contactor
RiWI Act	*Rights in Water and Irrigation Act 1914*
RTIO	Rio Tinto Iron Ore
TEC	Threatened Ecological Community
WA	Works Approval
WWTP	Wastewater Treatment Plant

1 LICENSEE DETAILS

This document provides the supporting information for a Works Approval (WA) application being submitted by Rhodes Ridge Management Services Pty Ltd for the proposed works at the Rhodes Ridge Temporary Construction Camp.

The occupier (the Licensee) of the land subject to this WA application is:

Rhodes Ridge Management Services Pty Ltd
Level 18, Central Park
152-158 St Georges Terrace
Perth WA 6000
ACN: 662 895 927

The contact person for the WA application is:

2 INTRODUCTION

Rhodes Ridge Management Services Pty Ltd (the Licensee) is proposing to construct and operate a temporary (~3 years) 220 person multipurpose camp to support its ongoing regional exploration activities and development of the Rhodes Ridge Iron Ore Project. Supporting infrastructure for the camp will include a Wastewater Treatment Plant (WWTP) and irrigation sprayfield.

The WWTP and sprayfield area are referred to in this application as the 'Project Area' (Figure 3-1: Prescribed Premises Boundary). Project Area is located within the Shire of East Pilbara approximately 63 km from the Newman township. The Project Area is on Temporary Reserve (TR) 70/4882 (Figure 2-1: Regional Location and Tenure).

This WA application is seeking approval for construction, commissioning and time limited operation of a Category 85 sewage facility (WWTP, pipeline and irrigation sprayfield) with a throughput of 70m^3/day.

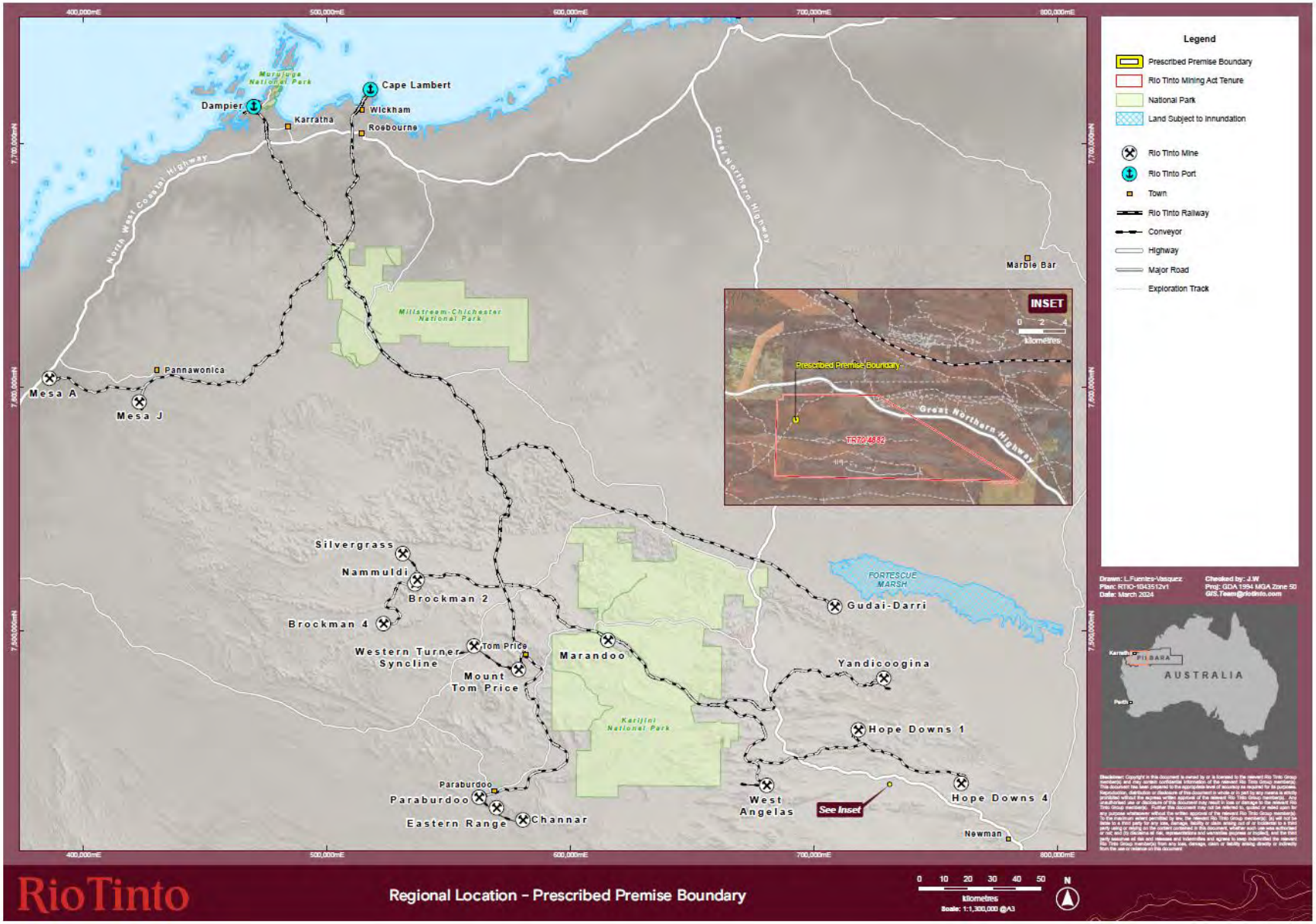

Figure 2-1: Regional Location and Tenure

3 PREMISES DETAILS

3.1 Premises Description

The Rhodes Ridge Iron Ore Project is located within the East Pilbara Region of Western Australia (WA), approximately 52 km north-west of the township of Newman. The Proposal is located within the Native Title Determination Area of the Nyiyaparli People.

The Project Area subject to this WA application is made up of the WWTP and the sprayfield. The indicative coordinates for the facility are provided in Table 3-1 below.

Table 3-1: Indicative coordinates of the proposed Project Area/Premise Boundary

Corner	Easting (m)	Northing (m)
WWTP		
1	730925	7436964
2	730925	7436965
3	731119	7437010
4	731169	7437004
5	731213	7436993
6	731219	7436669
7	730928	7436670

All coordinates are provided using map projection GDA2020 Zone 50

3.2 Legal Land Description

The project area is located on TR 70/4882 which operates pursuant to the *Iron Ore (Rhodes Ridge) Agreement Authorisation Act1972 (WA)*. The tenement is jointly held by Hamersley Resources Limited and Wright Prospecting Pty Ltd. The joint venture is managed by Rhodes Ridge Management Services Pty Ltd (the licensee).

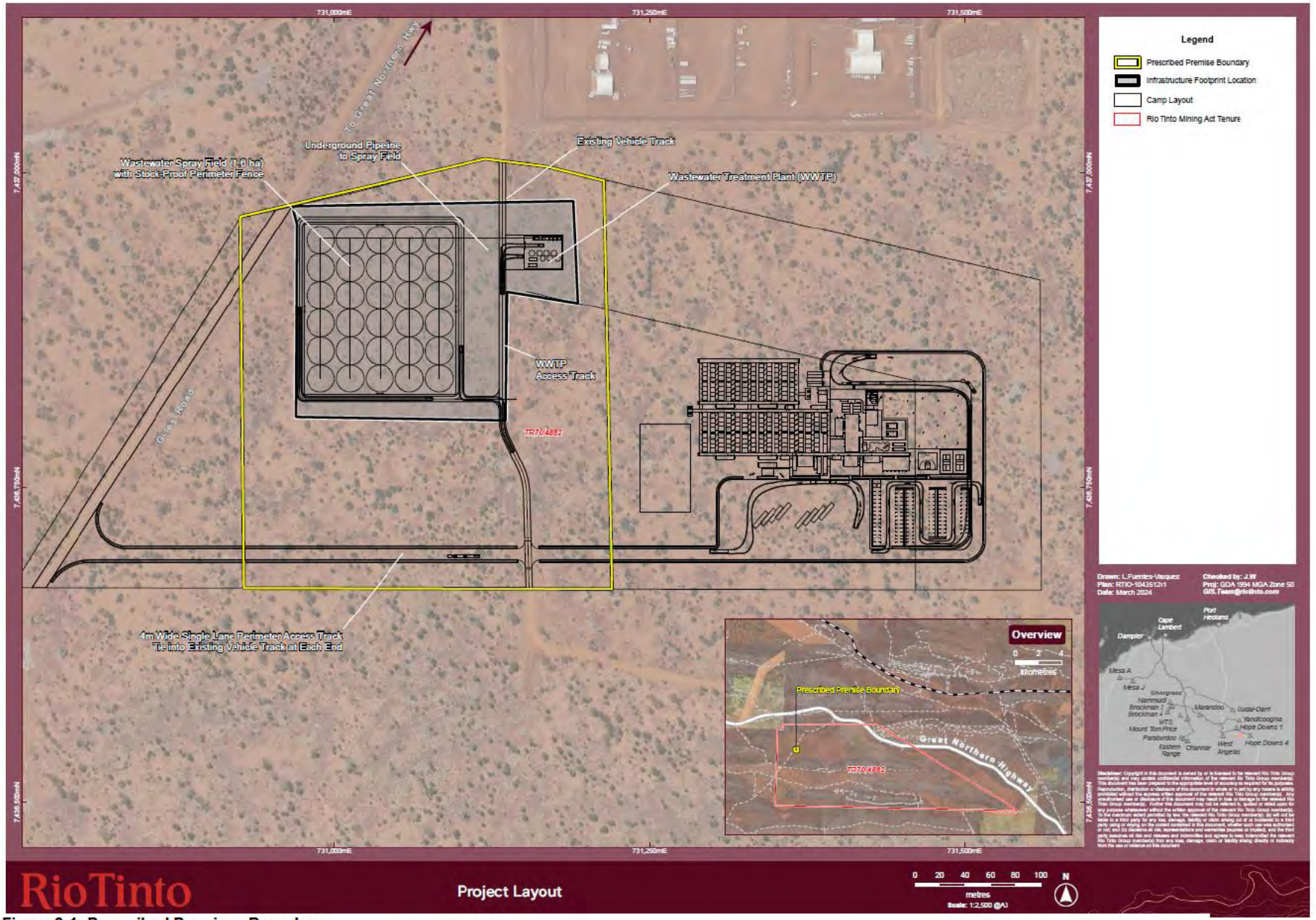

Figure 3-1: Prescribed Premises Boundary

4 CATEGORY 85: WWTP & IRRIGATION SPRAYFIELD

4.1 Overview

The Licensee is proposing to install and operate a wastewater treatment plant (WWTP) based on Rotating Biological Contactor (RBC) technology and irrigation sprayfield to treat sewage produced from the proposed 220 bed multipurpose camp at Rhodes Ridge. The maximum throughput of the WWTP is 75m^3/day.

The WWTP will be operational 24 hours per day, seven days a week. Plant process descriptions and technical detail for the RBC WWTP is attached in Appendix 1. Schematics for the sprayfield are attached in Appendix 2. The WWTP footprint is approximately 460m^2 and the sprayfield is approximately 27,000m^2 to meet the principles of treating wastewater to a Soil Risk Category D as per the *Water Quality Protection Note 22: Irrigation with nutrient-rich wastewater* (DoW 2008).

4.2 Design and Construction

Construction of the WWTP and sprayfield will take approximately 4-6 weeks and activities will include:

- Installation of "plug and play" pre-assembled modular sewage plant skids
- Installation of effluent discharge pipeline
- Installation of sprayfield irrigation area (sprinklers, pipework, signage, and perimeter fence)
- Construction of spill containment bunding around WWTP
- Dust suppression with water tankers as required

Tables 4-1 and 4.2 provide a list of the key infrastructure and capacities associated with the WWTP.

Table 4-1: Major Equipment List for Construction

Equipment	Size / Capacity
Inlet pump station	1.1m x 1.66m
Inlet bar screen	2.0 mm Bar Space
Balance tank	50 kL
Sedimentation tank	38 kL
(Mixed Liquor Recycle) MLR tank	38 kL
RBC tanks	3 x MX-1 (25m^3 each = 75m^3 total)
Break tank	4.5kL
Lamella clarifier	LS30 (30m^2 plate area)
Irrigation tanks	2 x 9kL (18kL total)

Table 4-2: Wastewater Treatment Plant Specifications

Process	Treatment Type
Biological Treatment Process	Fixed Film Process
Pre-Treatment	Anaerobic settling and digestion
Post-Treatment	Tertiary filtration
Effluent Disposal	Spray irrigation
Type of Aeration	
Sludge Disposal	Sludge Removal via geo bags
Design Max. Hydraulic Load	

4.3 Process and Operations

4.3.1 Inputs

Raw sewage is fed to the WWTP from a pump station sized to absorb the incoming flows. The pumpstation is fitted with grinder pumps operating on duty/standby with control panel, guide rails and an external valve pit.

Power required for the operation of the WWTP will be sourced from a set of generators located at the camp power station. It is estimated that ~74 kW of power will be required.

4.3.2 Balance Tanks

The raw sewage is then pumped from the pumpstation to the balance tank via a bar screen which screens any incoming solids. The balance tank provides suitable retention to cater for variations in the diurnal flows.

4.3.3 Sedimentation Tank

From the balance tank the screened influent is transferred to the Sedimentation Tank by the balance pump which then overflows to the MLR tank by gravity. This tank removes the remaining inorganic matter and digests the solids from the influent.

4.3.4 MLR Tank

MLR tank also known as the anoxic tank receives screened sewage from the primary tank and mixed liquor from the break tank. The tank allows nitrate-specific bacteria to use nitrate (NO^3) as an oxygen source and a nutrient in a process called de-nitrification. De-nitrification occurs when oxygen levels are depleted, and nitrate becomes the primary oxygen source for microorganisms.

4.3.5 Rotating Biological Contactor

Wastewater is then gravity-fed from the MLR Tank to the RBC units, which are known as one of the reliable fixed film technologies, where biological treatment is conducted.

The RBCs consist of plastic discs attached to a chrome plated steel mill which are arranged so that 40% of its surface area is submerged in the effluent at any time. As the RBC rotates, the surface of the discs is subjected alternately to sewage and air, encouraging an aerobic,

biologically active film of micro-organisms (biomass) to become established on each side of them.

The micro-organisms use the wastewater as a substrate and as they do so, multiply in number, maintaining a specific 1 – 2.5 mm biomass thickness to ensure optimum process efficiency in about 8 -14 days.

4.3.6 Break Tank

Mixed Liquor from the RBC's is gravity-fed to the Break tank. To improve nutrient reduction a portion of the mixed liquor from the break tank is returned to the MLR Tank for further treatment whilst the remainder is fed forward to the lamella clarifier for solids removal.

4.3.7 Lamella Clarifier

Mixed Liquor is gravity-fed from the Break Tank to the lamella clarifier. The lamella clarifiers remove heavier solids by means of settlement and separation from the liquid phase. The hopper bottom channels the sediment to the centre of the tank and is returned via the RAS pump to Primary Tank. Clear liquor from the top of the Clarifier then overflows by gravity into the lift tank.

4.3.8 Lift Tank

Gravity conveys clarified water from the Lamella clarifiers to the lift tank, positioned just below the clarifier outlets. The clarified water to is then pumped to the irrigation tanks for the next stage of processing.

4.3.9 Irrigation Tanks

Within the irrigation tanks, the treated effluent undergoes chlorination within a recirculation line before being discharged. After chlorination, the treated water is pumped to the irrigation field using the irrigation pumps. To monitor the volume of treated water distributed to the irrigation field, a flowmeter will be installed.

4.3.10 Sprayfield

The effluent is evenly spread over the sprayfield through a network of pipes allowing it to percolate through the soil.

4.3.11 Sludge Handling System (Geo Bags)

The Waste Activated Sludge (WAS) pump automatically transferred sludge from the primary tank to the GEO bags There are two bags in total with one bag been filled whilst the other one is awaiting filling or drying out prior to disposal.

4.3.12 Outputs

The WWTP is designed to meet the effluent target discharge criteria as outlined in Table 4-3 below:

Table 4-3: Target Discharge Criteria for proposed MBBR WWTP

Parameters	Value
Biochemical oxygen demand	<20mg/L
Total Suspended Solids	<30mg/L
Total Nitrogen	<40mg/L
Total Phosphorus	<10mg/L
pH	6.5 - 8.5
Thermotolerant coliforms	<1000cfu/100mL

4.4 Environmental Commissioning

Once constructed, the WWTP will be commissioned for a period of 12 weeks. At the end of the commissioning period, a commissioning compliance report will be submitted to the Department of Water and Environmental Regulation (DWER) to demonstrate the WWTP has stabilised towards the discharge quality target values (Table 4-3).

There will be two key stages of environmental commissioning – wet commissioning and biological commissioning. Monitoring of treated wastewater discharges will be undertaken fortnightly during the 12 week commissioning period.

See Table 4-4 below for the proposed environmental commissioning plan for the WWTP and sprayfield.

Table 4-4: Environmental Commissioning Plan

Commissioning Stage	Activity Description	Input	Output	Monitoring & Controls
Stage 1				
Wet Commissioning	Energisation of the system. Leak testing, flow testing, testing of level and flow instrumentation and testing of the complete automated process. Undertake Site Acceptance Test (SAT) to verify all components meet performance and functional requirements. Duration of ~1 week.	~75m³/day clean (potable) water.	Up to 75m³ of clean water discharged to the sprayfield.	Fortnightly samples of effluent discharge quality. Monthly volumes (kL) Daily inspection by competent plant operator and recorded in log sheet
Stage 2				
Biological Commissioning	The WWTP process may be 'seeded' with healthy activated sludge from a nearby sewage plant imported by a licensed waste cartage contractor and in accordance with regulatory requirements. The process is optimised to produce the required treated effluent quality. Duration of 3 months (12 weeks).	~70m³/day of Village sewage.	Initially approximately 70m³/day of treated effluent discharged to the sprayfield. Quality of treated effluent/wastewater will be trending towards discharge criteria outlined in Table 4-3. Any waste sludge built up within the WWTP is removed by a licensed waste disposal	Fortnightly samples of effluent discharge. Monthly volumes (kL). Daily inspection by competent plant operator and recorded in log sheet. Review of sampling analysis. Any significant exceedances of discharge quality criteria will be reported and corrective action plan implemented immediately. This may

Commissioning Stage	Activity Description	Input	Output	Monitoring & Controls
			contractor and disposed of offsite in an approved landfill in accordance with regulatory requirements.	include a representative of the plant manufacturer to attend site and make process adjustments.
Once commissioning is completed, monitoring of discharge quality will reduce to quarterly and volumes will continue to be monitored monthly (Table 4-5).				

4.5 Time Limited Operations

Once commissioning has been completed, it is requested that the WWTP enters a time limited operations (TLO) period of 180 days. TLO activities will be the same as those proposed during normal operations (see Section 4.6 directly below).

4.6 Monitoring and Maintenance

During operations, treated wastewater samples will be collected quarterly from the sample point located at the discharge from the effluent pump to ensure the discharge quality criteria (Table 4-3) is being met. Discharge volumes are registered on the effluent flow meter and will be recorded weekly (reported as cumulative monthly volumes).

Table 4-5: Proposed monitoring regime for treated wastewater from WWTP

Sampling Location	Parameter	Frequency
Multipurpose Camp WWTP	5 Day Biochemical oxygen demand (mg/L)	Quarterly
	Total Suspended Solids (mg/L)	
	Total Nitrogen (mg/L)	
	Total Phosphorus (mg/L)	
	pH (pH units)	
	Thermotolerant coliforms (cfu/100mL)	
	Volumes (kL)	Monthly

Routine daily operational and maintenance inspections will be undertaken as per the "Daily Check Sheet" in Section 6 of Appendix 3. This will involve ensuring operational aspects of the WTTP are functioning properly (e.g. screens, levels, mixing, aeration, flotation, switches etc.).

Routine weekly inspections will be undertaken as per the "Weekly Check Sheet" in Section 7 of Appendix 3. This will involve measuring and recording levels of nitrogen, phosphorous, waste sludge and pH as well as the clarity of effluent.

5 STAKEHOLDER AND COMMUNITY CONSULTATION

5.1 Regulator Consultation

Rio Tinto meets with the DWER quarterly to provide an overview of upcoming proposals. This WA application was discussed during the November 2023 meeting.

5.2 Community Consultation

The Licensee has a long-term commitment to working with Pilbara communities and recognises that local communities have a direct interest in their activities. Substantial community consultation and public review of existing nearby and proposed future operations in the region has occurred as part of environmental approval processes. Community consultation will continue to be undertaken to keep relevant communities up to date throughout the operations and during closure of the Rhodes Ridge operation.

5.3 Traditional Owners

The proposed temporary construction camp located within the boundaries of the recognised Native Title Determination Areas of the Nyiyaparli People (WCD2018/008). Karlka Nyiyaparli Aboriginal Corporation (KNAC) is the Registered Native Title Body Corporate representing Nyiyaparli Common Law Holders.

The identification and management of cultural heritage within the traditional lands of the Nyiaparli People is in accordance with the principles and practices outlined within Rio Tinto's Communities and Social Performance Guidelines, the Rio Tinto Cultural Heritage Group Procedure, and the heritage protocols within the Participation Agreement and Indigenous Land Use Agreement (The RTIO and Nyiyaparli ILUA).

RTIO has a number of agreed forums to consult with the Nyiyaparli People and overview of each and their purpose is provided below table

Table 6: Summary of Engagement

Engagement with Nyiyaparli
Technical Group - this is a non-decision making forum consisting of RTIO and Karlka Nyiyaparli Aboriginal corporation staff. The purpose of this forum is to provide a technical review of engagement items prior to engagement with the Nyiyaprli People to ensure there aren't any gaps in information, sufficient detail ahs been provided and their is alignment on the ask of Nyiyaparli. This forum was established in 2023 to improve engagement quality. Local Implementation Committee - this is the formal engagement forum established under the Claim-Wide Participation Agreement that is decision-making and has a minimum of 6 elected representatives of the Nyiyaparli People involved and supported by key KNAC staff. The purpose of this forum to to consult and make decisions on all of RTIOs activities including but not limited to all Environmental and Government approvals. Heritage Sub-Committee - this is a formal engagement forum established under the Claim-Wide Participation Agreement and is decision-making for all heritage matters including but not limited to heritage approvals. This forum consists of 12 senior Nyiyaparli People with cultural authority elected by the KNAC Board as their Local Cultural Heritage Services Committee. They are supported by a number if key kNAC staff. Life of Mine Planning forum - this is a forum established under the Life of Mine Regional Standard as part of the Regional Framework Deed. It is a consultative forum and consists of the 6 Local Implementation Committee member representatives and key KNAC staff. the purpose of the forum is to consult on all matters relating to RTIOs life of mine and includes engagement on the long term mine plan, new developments and closure. To progress the Rhodes Ridge temporary camp engagement commenced in 2022 through the Life of Mine and Heritage Sub-Committee and culminated in a technical review by the Technical Group in February 2024 and decision on the heritage approach and support for the project design and scope at the February 2024 Local Implementation Committee meeting. Consultation and update on the project as it progresses will continue via the Heritage sub-Committee for heritage matters and the Life of Mine Planning forum for project updates throughout the approval and construction period.

6 OTHER APPROVALS, LICENCES AND PERMITS

6.1 State Agreement Act

The project operates under the existing *Iron Ore (Rhodes Ridge) Agreement Authorisation Act 1972* (WA), however as the works are associated with an exploration camp, further approvals are not required under the state agreement act.

6.2 Environmental Protection Act 1986 (Part IV)

The works proposed subject to this works approval application are not included in the scope of the Rhodes Ridge Iron Ore Project Part IV proposal currently under assessment by the Environmental Protection Authority (EPA).

The proposed works are not regarded as warranting referral to the EPA under Section 38 of the *Environmental Protection Act 1986* (EP Act) by virtue of its minimal impact on the environment.

6.3 Environmental Protection Act 1986 (Part V)

6.3.1 Part V, Division 2: Native Vegetation Clearing

All clearing completed for the Project Area is authorised under Native Vegetation Clearing Permit (NVCP) CPS 9751/1. Clearing will be controlled through the NVCP conditions and by the Rio Tinto internal approval process. This ensures that the following is completed prior to commencing clearing activities: all heritage and biological reviews are undertaken; legal access to the land is in place; other necessary approvals are obtained; and the critical clearing boundary is inspected prior.

Ground disturbance activities will be planned to ensure minimal disturbance is achieved through the use of appropriate ground engaging plant, use of designated tracks, roadways and use of pre-existing disturbed areas.

6.4 Rights in Water and Irrigation Act 1914

Current groundwater abstraction occurs under Groundwater Licences (GWL) 110695, GWL 158835 and GWL 176257, issued under the *Rights in Water and Irrigation Act 1914*. The combined abstraction under these instruments is 350,000 kL. Water volumes required for the operation WWTP are within the allocated abstraction limit, however amendments to increase groundwater abstraction are planned for submission to meet future demands.

7 SITING AND LOCATION

There are no sensitive receptors that are located within or in the immediate vicinity of the Project Area (Figure 7-1). Table 7-1 summarises the nearby environmentally sensitive receptors and proposed controls to prevent or mitigate any potential adverse impacts are detailed in Section 10. Receptors identified in Table 7-1 are shown in Figure 7-1 to Figure 7-5.

Table 7-1: Nearby environmentally sensitive receptors and aspect

Type/Classification	Description	Distance & Direction to premises boundary (if within 25km)	Proposed control to prevent or mitigate adverse impacts (if applicable)
Sensitive land uses			
Townsites	None occur within a 25 km radius (local area).	N/A	Due to the separation distance and type of activities proposed, adverse impacts to townsites are not anticipated. No controls are proposed.
Occupied homesteads	None occur the local area.	N/A	Due to the separation distance and type of activities proposed, adverse impacts to occupied homesteads are not anticipated. No controls are proposed.
Bores	Two pastoral bores are known within the local area.	The two pastoral bores are situated 700m and 1 km from the premise boundary respectively.	Groundwater abstraction is managed in accordance with approved RIWI Act 5C licences. The WWTP and spray field will be managed as outline in Section 10.
Nearby Environmentally Sensitive Receptors and Aspects			
Environmentally Sensitive Area (ESA)	None occur the local area.	N/A	Due to the separation distance and type of activities proposed, adverse impacts to ESAs are not anticipated. All areas proposed to be cleared/disturbed have been subject to flora/fauna surveys to understand potential impacts. No further controls are proposed.
Threatened Ecological Communities (TEC)	None occur the local area.	N/A	Due to the separation distance and type of activities proposed, adverse impacts to TECs are not anticipated. All areas proposed to be cleared/disturbed have been subject to flora/fauna surveys to understand potential impacts. No further controls are proposed.
Threatened and/or priority fauna	No fauna species of conservation significance are known to occur within the prescribed premise boundary.	The closest species Ghost bat (Macroderma gigas - VU), is located more than 7 km from the presmise boundary.	Due to the separation distance and type of activities proposed, adverse impacts to local fauna species are not anticipated. All areas proposed to be cleared/disturbed have been subject to flora/fauna surveys to understand potential impacts. No further controls are proposed.
Threatened and/or priority flora	No Threatened flora are known to occur within the local area. The only priority flora species know to occur within the search radius was Rhagodia sp. Hamersly (M.Tudgen 17794) – P3.	The closest Rhagodia sp. Hamersly (M.Tudgen 17794) record was located within the prescribed premise boundary.	Proposed activities are to occur within the boundary of approved clearing permit CPS 9751/1. This permit has specific conditions that require the protection of priority flora species and there known local populations.
Aboriginal and other heritage sites	None are known to occur within the local area.	N/A	Due to the separation distance and type of activities proposed, adverse impacts to heritage values are not anticipated. All areas proposed to be cleared/disturbed have been subject to archaeological and ethnographic surveys. No further controls are proposed.
Public drinking water source areas	None are known to occur within the local area.	N/A	Due to the separation distance and type of activities proposed, adverse impacts to PDWSA are not anticipated. All areas proposed to be cleared/disturbed have been subject to desktop surveys. The WWTP and spray field will be managed as outline in Section 10.
Groundwater Dependent Ecosystems	None are known to occur within the local area.	N/A	Due to the separation distance and type of activities proposed, adverse impacts to GDEs are not anticipated. All areas proposed to be cleared/disturbed have been subject to desktop and field surveys. The WWTP and spray field will be managed as outline in Section 10.
Rivers, lakes, oceans, and other bodies of surface water, etc.	None are known to occur within the local area. The closest feature (located 1.3 km west) is a minor creek (non-perennial)	N/A	Due to the separation distance and type of activities proposed, adverse impacts to water related environments are not anticipated. All areas proposed to be cleared/disturbed have been subject to hydrological and hydrogeological assessment and/or investigation. The WWTP and spray field will be managed as outline in Section 10.
Other areas of interest	A file notation area is located within the local area. Two Priority Ecological Communities (PECs) have been identified within the local area.	The Proposed Mulga Land Conservation Area is located ~1.8 km from the prescribed premise boundary. The Coolibah Lignum Flats and West Angelas Cracking Clay PECs are also located ~1.8 km from the premise boundary.	Due to the separation distance and type of activities proposed, adverse impacts to conservation areas and PECs are not anticipated. All areas proposed to be cleared/disturbed have been subject to desktop and field flora/fauna surveys. No further controls are proposed.

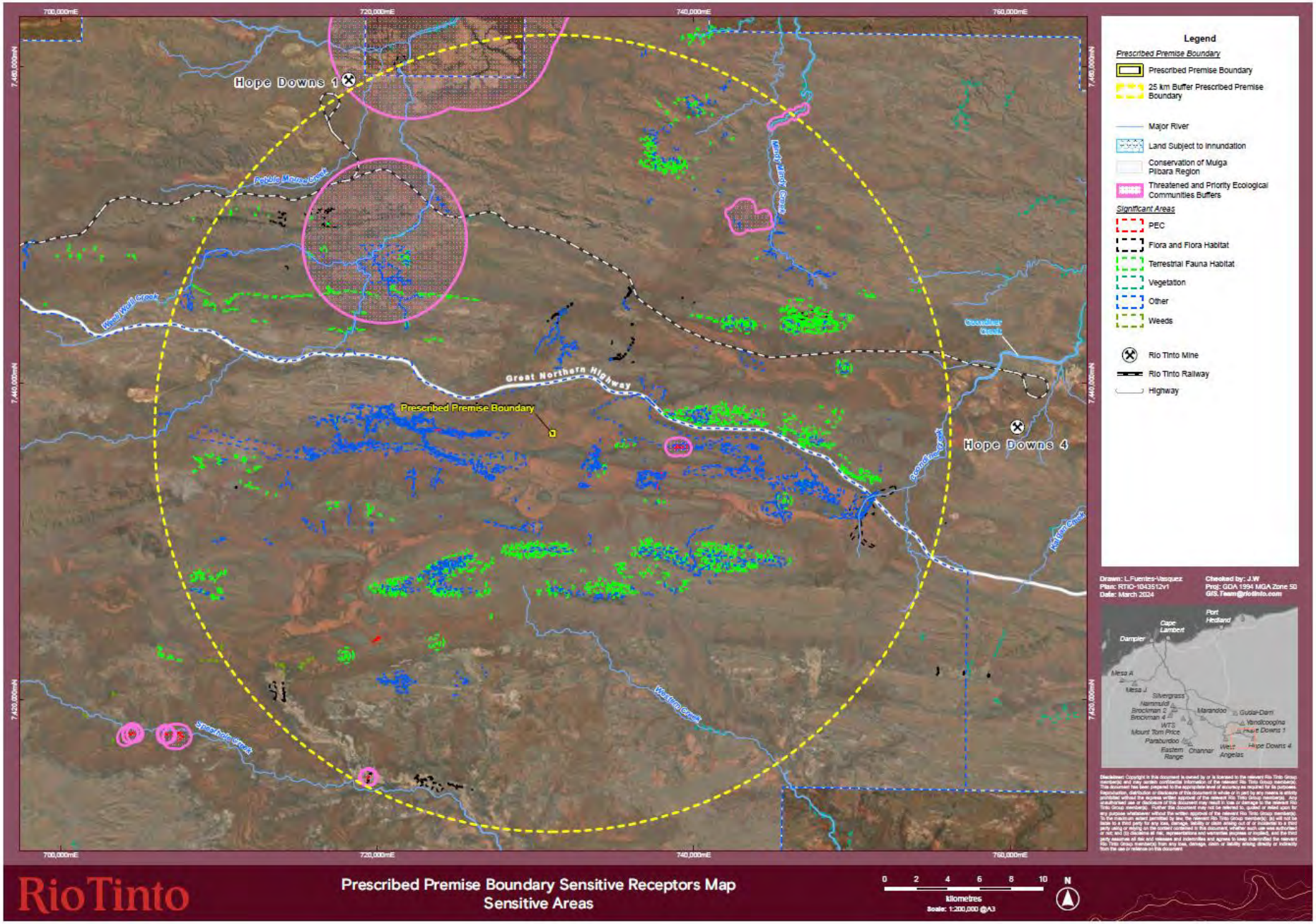

Figure 7-1: Nearest Sensitive Receptors

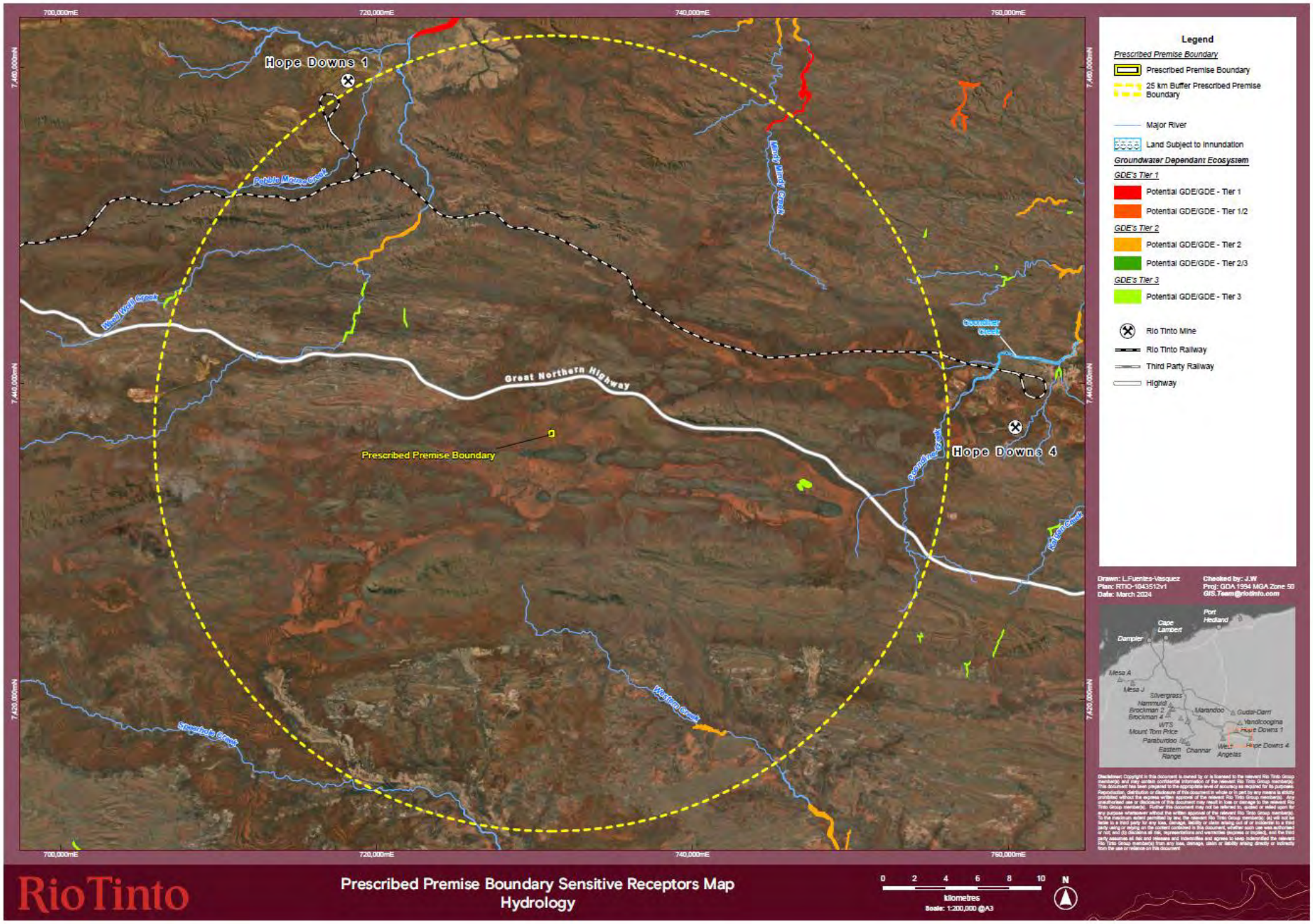

Figure 7-2: Project Siting - Hydrological Receptors

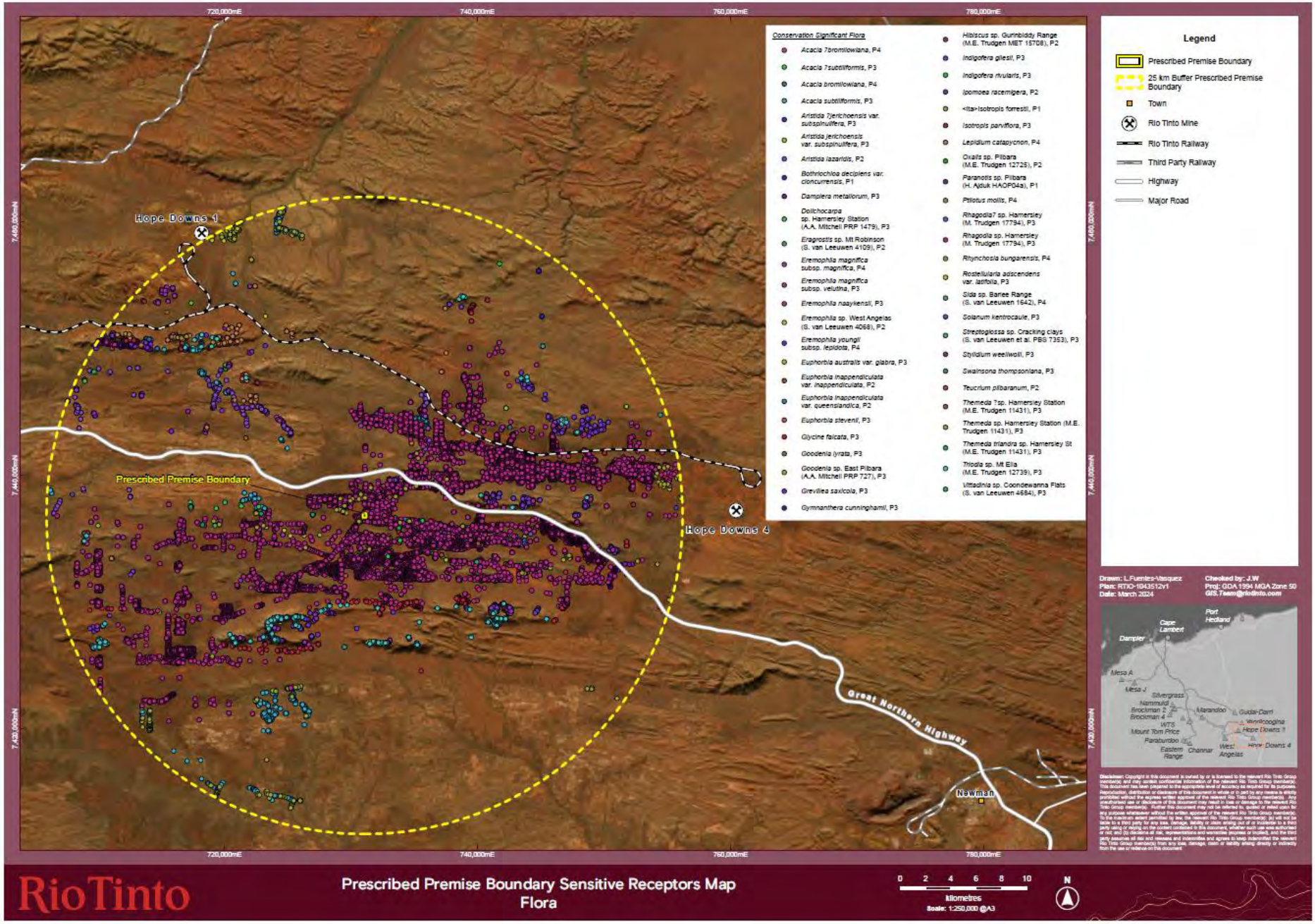

Figure 7-3: Project Siting - Ecological Receptors – Surrounding Flora

Figure 7-4: Project Siting – Ecological Receptors – Surrounding Fauna

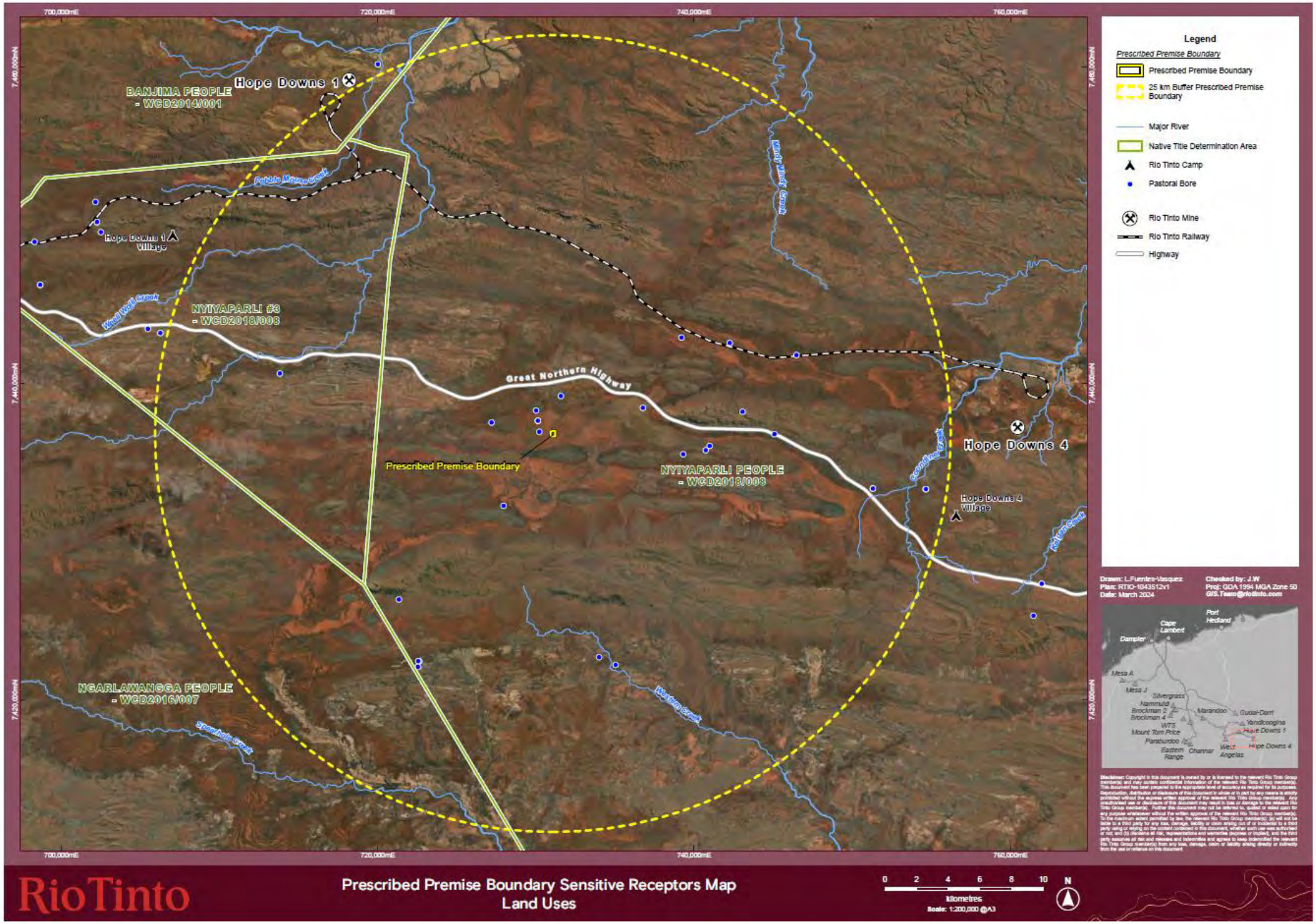

Figure 7-5: Project Siting - Surrounding Heritage Sites

8 ENVIRONMENTAL SITING CONTEXT

8.1 Climate

The climate of the Pilbara region of Western Australia is classified as arid tropical with two distinct seasons: a hot, wet summer (October – April) and a mild, dry winter (May – September) (BoM 2023).

Based on long-term climatic data from the nearest Bureau of Meteorology (BoM) weather station at Newman Aero (Station 007176) (approximately 34 km south-east of the survey area), the mean annual rainfall since 1971 is 317 mm (BoM 2023). The mean maximum daily temperatures since 1996 range between 23.0°C and 39.3°C and exceed 30°C for much of the year (BoM 2023).

8.2 Topography

Regional topography is denominated by two main landscape features; the Hamersley Range to the north of the Prescribed Premises and the lower areas of flats and undulating plains. The top of the Hamersley Range plateau is a series of rounded hills and narrower ridges, reaching an elevation of 1,245 m above sea level at its highest point. The plateau forms the watershed between the Fortescue River to the north and the Ashburton River to the south. Numerous rivers and streams have dissected the plateau, forming gorges and broader scree and rubble-filled valleys (Copp 2005). The Newman Land System makes up the greatest proportion of the Hamersley Range (including the Project Area) and is characterised by rugged plateaus, ridges and mountains supporting spinifex grassland (van Vreeswyk et al. 2004).

8.3 Geology and Soils

The geology of the Pilbara region is dominated by the Hamersley Province which is a depositional basin of the Lower Proterozoic sediments. The sediments of the Hamersley Province lie in a sequence of supercrustal rocks comprising of the Fortescue, Hamersley and Turee Creek groups. The Proposal is situated within the Hamersley Plateau Province, which is primarily a complex of Lower Proterozoic rocks of the Hamersley and Fortescue groups. The rocks are mainly jaspilite and basalt with pockets of dolomite, shale, silt stone and acid volcanics.

The sparse vegetation cover and the erosive force of heavy summer cyclonic rains causes much of the soil on the hill slopes to be transported down to the valleys and plains. This is an intermittent and slow process which occurs over a long period of time. Thus, species and associations of vegetation on the hills and slopes tend to be correlated to geology rather than soil type. Along drainage lines, superficial deposits influence the distribution of vegetation, but the presence of surface and ground water is also a major determining factor.

The Department of Agriculture produced mapping of the state which broadly classifies Land Systems (Rangelands) (Van Vreeswyck et al. 2004). These units broadly describe regions by

their physiographic classification. The Project Area occurs within the Newman land system. The following land system descriptions are adapted from Van Vreeswyck et al (2004):

- Newman Land System – rugged jaspilite plateaux, ridges and mountains with hard spinifex

8.3.1 Soils

Tille (2006) classified the soil landscapes of the Pilbara region categorising them into various provinces. The project area falls within the Hamersley Plateau Zone where the soils can be described as "Hills and dissected plateaux (with some stony plains and hardpan wash plains) on sedimentary and volcanic rocks of the Hamersley Basin with Stony soils, Red shallow loams and some Red/brown non-cracking clays and Red loamy earths".

A site-and-soil evaluation was undertaken at the proposed sprayfield area in which five representative soil samples were taken to assess the suitability of the site for on-site disposal of effluent by percolation in accordance with the WA Department of Health's Guidance on *Site-and-soil evaluation for on-site wastewater*. (Calibre 2023; Appendix 4).

The evaluation described the soils across the sprayfield as Qw: ALLUVIUM and COLLUVIUM: Red-brown sandy and clayey soil.

The generalised subsurface conditions encountered during the investigation are summarised as:

- ALLUVIUM: Sandy CLAY (CL): red-brown, clay is low plasticity, sand is fine to coarse grained, sub-rounded, between 0.5 and 1m thick, overlying,
- CLAY Hardpan, with localised Gravelly Clayey SAND pockets.

This 'hardpan' horizon was encountered between 0.4m below ground level (bgl) and 0.8m bgl.

Based on the soil types and infiltration rates it was determined that the soils present across the sprayfield area are suitable for disposal of secondary treated effluent (Galt Geotechnics 2021).

The risk of irrigation has been assessed in general accordance with Water Quality Protection Notice 222 (WQPN22). In terms of the risk from irrigation, the sprayfield is not within proximity to any surface water bodies or wetlands, including creek lines. Additionally, there is a sufficient separation distance between the sprayfield and any underlying groundwater, with this distance being in excess of the required 2m separation distance. The sprayfield is also outside of any identified PDWSA. In accordance with Table 1 of WQPN22, the sprayfield would have a Low eutrophication risk, with a Risk Category of D. (Calibre, 2023).

8.4 Hydrology

They are no creeks or surface water bodies within proximity to the proposed construction camp, including the proposed sprayfield location. However, surface water may pond in low lying areas across the site due to the relatively low permeability of the soils encountered.

8.5 Hydrogeology

During investigative works, groundwater was not encountered in any of the test pits. Available groundwater data indicates that the groundwater level at the site is approximately 30 m below ground level (approximately RL 655 m AHD). The data also indicates that the groundwater flows in an easterly direction, i.e. west to east.

Borelog information (Bore Reference: WB21BKN0010) suggested groundwater sits within a 'clay/detrital' weathered horizon. Hydraulic conductivity for such aquifers can range between 5x10-6 m/s and 5x10-9m/s1.

No PDWSAs are located within the Project Area or vicinity.

8.6 Flora and Fauna

The Project Area occurs within the Hamersley Subregion (PIL3) of the Pilbara Bioregion. This subregion is described as mountainous area of Proterozoic sedimentary ranges and plateaux, dissected by gorges (basalt, shale and dolerite). Mulga low woodland over bunch grasses on fine textured soils in valley floors, and *Eucalyptus leucophloia* over *Triodia brizoides* on skeletal soils of the ranges (Kendrick, 2001).

Several biological surveys have been undertaken across the Rhodes Ridge Iron Ore Project development envelope in 2022 and 2023 by Astron Environmental Services and GHD. In addition to these, multiple surveys have been undertaken across the Proposal to support Native Vegetation Clearing Permit (NVCP) applications, which have informed the detailed surveys.

Key points for the Project Area:

- It is not within an Environmentally Sensitive Area (ESA)
- None of the Vegetation represents a PEC or TEC or is considered a Groundwater Dependant Ecosystem (GDE).
- None of the weeds are declared pests.
- No threatened flora occur within or near to the Project Area or are expected to occur. A P3 priority flora species, Rhagodia sp. Hamersly (M.Tudgen 17794), is known to occur within the Project Area.

Additional details are provided in the Section 8.6.1 and 8.6.2 below.

8.6.1 Vegetation and Flora

The Project Area is located within the Fortescue Botanical District (Eremaean Botanical Province) of Western Australia (Beard 1975a, 1975b). Broad scale vegetation mapping for the Pilbara region has been completed by Beard (1975) with only one Beard mapping unit occurring in the project area, Hamersley 175. This unit is described as Short bunch grassland - savanna/ grass plain (Pilbara).

Vegetation and flora surveys undertaken within the Rhodes Ridge Iron Ore Project area have mapped and described the vegetation, providing a detailed understanding including conservation significance of the vegetation communities and condition present. Astron (2023a) provides a consolidated coverage and combined assessment of all previous detailed flora and vegetation surveys and is considered the most relevant report for the Project Area.

The vegetation units described by Astron (2023a) that occur in the project area are described below in Table 8-1.

Table 8-1: Vegetation Types within the Project Area

Vegetation Code	Vegetation Description
Stony Plains	
P5	(*Eucalyptus victrix* scattered low trees to low open woodland over) *Acacia aptaneura* tall open shrubland to tall shrubland over (*Rhagodia eremaea* and/or Ptilotus obovatus var. *obovatus* scattered low shrubs to shrubland over) *Aristida latifolia* and *Chrysopogon fallax* scattered tussock grasses to open tussock grassland over *Iseilema vaginiflorum, Urochloa occidentalis* var. *occidentalis* and *Enneapogon polyphyllus* very open annual grassland to annual grassland over **Bidens bipinnata* scattered herbs on crabhole clay plains.

Within or surrounding the Project Area there were no TECs listed under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) or State *Biodiversity Conservation Act 2016* (BC Act), or PECs listed by the Department of Biodiversity, Conservation and Attractions (DBCA).

No flora species of conservation significance, listed under the EPBC Act or the BC Act have previously been recorded within the Project Are. A P3 priority flora species, Rhagodia sp. Hamersly (M.Tudgen 17794), is known to occur within the Project Area.

8.6.2 Fauna

The area has been surveyed, resulting in a detailed understanding including conservation significant species present and habitat values. Astron (Astron 2023b) presents an integrated report that consolidates the results of numerous surveys and is considered the most relevant report for the Project Area. No fauna species of conservation significance, listed under the EPBC Act or the BC Act, or listed as Priority by DBCA were recorded within the Project Area. The closest species Ghost bat (Macroderma gigas - VU), is located more than 7 km from the presmise boundary.

9 RISK IDENTIFICATION AND ASSESSMENT

A risk assessment has been prepared to identify the potential emissions from the proposed activities and the potential sources, pathways and receptors of those emissions, and proposed controls to manage potential emissions to determine a risk rating. The risk assessment has been based on the DWER *Guideline: Risk Assessments* (DWER 2017) and the Rio Tinto risk assessment process, based on the following risk rating matrix (Table 11-1).

Table 9-1: Risk Rating Matrix

	Consequence				
Likelihood	**Slight**	**Minor**	**Moderate**	**Major**	**Severe**
Almost Certain	**Medium**	**High**	**High**	**Extreme**	**Extreme**
Likely	**Medium**	**Medium**	**High**	**High**	**Extreme**
Possible	**Low**	**Medium**	**Medium**	**High**	**Extreme**
Unlikely	**Low**	**Medium**	**Medium**	**Medium**	**High**
Rare	**Low**	**Low**	**Medium**	**Medium**	**High**

Risk = consequence x likelihood

The following criteria (DWER 2017) are used to determine the consequence and likelihood of a risk event occurring (Table 11-2 and 11-3).

Table 9-2: Consequence Matrix

Consequence	Consequence description	
	Environment	**Health**
Severe	On-site impacts: catastrophic Off-site impacts (local scale): high level Off-site impacts (wider scale): mid level Mid to long term or permanent impact to an area of high conservation value or special significance	Loss of life Adverse health effects: high level or ongoing medical treatment Local scale impacts: permanent loss of amenity
Major	On-site impacts: high level Off-site impacts (local scale): mid level Off-site impacts (wider scale): low level Short term impact to an area of high conservation value or special significance	Adverse health effects: mid level or frequent medical treatment Local scale impacts: high level impact to amenity
Moderate	On-site impacts: mid level Off-site impacts local scale: low level Off-site impacts wider scale: minimal	Adverse health effects: low level or occasional medical treatment Local scale impacts: mid level impact to amenity
Minor	On-site impacts: low level Off-site impacts (local scale): minimal Off-site impacts (wider scale): not detectable	Local scale impacts: low level impact to amenity
Slight	On-site impacts: minimal	Local scale impacts: minimal impacts to amenity

Table 9-3: Likelihood Matrix

Likelihood	Likelihood description
Almost certain	The risk event is expected to occur in most circumstances.
Likely	The risk event will probably occur in most circumstances.
Possible	The risk event could occur at some time.
Unlikely	The risk event will probably not occur in most circumstances.
Rare	The risk event may only occur in exceptional circumstances.

The potential emissions, sources, pathways and receptors that have been identified for the construction, commissioning and operation of the proposal are outlined in Table 9-4. Table 9.4 also identifies the potential impacts, proposed controls and associated risk ratings. Further consideration (via additional management measures) will be given any activity which has been identified as having a 'Medium' risk rating or higher (Section 10.1). Further consideration includes:

- A description of the potential emissions, sources, pathways and receptors.
- Any controls that have been identified for the risk event.
- An assessment of the consequence and likelihood.
- Risk rating.

Table 9-4: Risk Assessment – Category 85 WWTP and Irrigation Sprayfield

Source		Potential Emissions	Potential Pathway	Potential Receptors	Potential Impacts	Proposed Controls	Consequence	Likelihood	Risk Rating	Further consideration required?
Category 85: WWTP & Irrigation Sprayfield	Construction of WWTP	Dust: Release of particulate matter from construction activities and vehicular movements.	Air: Transport through air then transport through the respiratory system	Residential: None, the nearest receptors consist of mining camps, the closest of which (exploration camp) is located ~13km NE. Newman is located more than 50 km from the project area.	Human health Impacts – respiratory illness. Given the large distance to the nearest receptor and short-term duration of construction activities, impacts to public health or amenity from nuisance dust are expected to be limited.	Dust will be managed via the requirements of the Works Approval, Native Vegetation Clearing Permit (CPS 9751/1) and standard operating procedures, including: - Clearing will be managed to ensure that areas are only cleared as required and rehabilitation of cleared areas is implemented as construction is completed; and - Dust suppression will be implemented (including use of water trucks, control of vehicle movements / restricted speeds). - Works that have the potential to generate high dust levels may be restricted during times of high winds. Construction Environmental Management Plan (CEMP) will be implemented and adhered to. Standard management procedures are expected to effectively mitigate the risk of dust emissions during construction.	Minor	Rare	Low	Risk pathway is low, further consideration or assessment is not required.
			Air: Transport through air then deposition	Terrestrial ecosystems: Riparian vegetation (associated with minor ephemeral creek 1.3km west of the Project Area	Smothering and the potential suppression of photosynthetic and respiratory functions of vegetation.					
				Terrestrial ecosystems: Native fauna	Dust may impact habitats which represent shelter, foraging and dispersal habitats for native fauna. Given the large distance to the nearest receptor and short-term duration of construction activities, dust is expected to have a negligible impact on native fauna.					
		Noise and vibration: associated with construction activities and vehicular movements.	Air or other physical medium: Vibration of particles.	Residential: None, the nearest receptors consist of mining camps, the closest of which (exploration camp) is located ~13km NE. Newman is located more than 50 km from the project area.	Human health impacts – amenity or nuisance. Given the large distance to the nearest receptor and short-term duration of construction activities, impacts to public health or amenity from nuisance noise are expected to be limited.	*Environmental Protection (Noise) Regulations 1997* and standard operating procedures are expected to effectively mitigate the risk of noise during construction. CEMP will be implemented and adhered to. Construction activities limited to daylight hours only. Specific controls are not proposed.	Minor	Rare	Low	Risk pathway is low, further consideration or assessment is not required.
				Terrestrial ecosystems: Nocturnal native fauna	No potential impacts as no construction activities proposed at night	Construction activities will be limited to daylight hours only. Specific controls are not proposed				
		Light	Air: light spill generated during construction activities.	Residential: None, the nearest receptors consist of mining camps, the closest of which (exploration camp) is located ~13km NE. Newman is located more than 50 km from the project area.	No potential impacts to health and amenity given the large distance to the nearest receptor and no night works proposed.	Construction activities will be limited to daylight hours only. Specific controls are not proposed. CEMP will be implemented and adhered to.	Minor	Rare	Low	Risk pathway is low, further consideration or assessment is not required.
				Terrestrial ecosystems: Nocturnal native fauna	None, given no night works will be conducted during construction.	Construction activities will be limited to daylight hours only. Specific controls are not proposed	Minor	Rare	Low	Risk pathway is low, further consideration or assessment is not required.
		Wastes	General wastes generated during construction activities	Residential: None, the nearest receptors consist of mining camps, the closest of which (exploration camp) is located ~13km NE. Newman is located more than 50 km from the project area.	Health and amenity: Given the large distance to the nearest receptor and short-term duration of construction activities, impacts to public health or amenity from general wastes are expected to be limited.	General wastes will be managed via the requirements of the Works Approval, Part V Licence L5275/1972 and standard operating procedures including: - Sufficient recycling and general waste collection areas will be established and labelled with the relevant waste type to facilitate the management of waste;	Minor	Rare	Low	Risk pathway is low, further consideration or assessment is not required.

Source		Potential Emissions	Potential Pathway	Potential Receptors	Potential Impacts	Proposed Controls	Consequence	Likelihood	Risk Rating	Further consideration required?
				Terrestrial ecosystems: Native fauna.	Local increase in feral fauna (scavengers attracted to putrescible wastes) could result in predation and replacement of native fauna.	- Recyclable materials will be separated from other waste and recycled wherever possible; and - Non-recyclable materials will be disposed of at an approved landfill facility. Standard waste management procedures are expected to effectively mitigate the risk of general wastes during construction.	Minor	Rare	Low	Risk pathway is low, further consideration or assessment is not required.
Category 85: WWTP & Irrigation Sprayfield	Commissioning /Operation of WWTP	Odour	Air	Residential: None, the nearest receptors consist of mining camps, the closest of which (exploration camp) is located ~13km NE. Newman is located more than 50 km from the project area.	Health and amenity: Negligible odour impacts, given the distance to the receptors, odour emissions are not expected to affect health or amenity.	The WWTP will be appropriately designed and operated to mitigate the risk of odour emissions. Inspection and maintenance will be undertaken. Standard maintenance procedures are expected to effectively mitigate the risk of odour emissions	Minor	Rare	Low	Risk pathway is low, further consideration or assessment is not required.
		Raw sewerage	Sewage spill during operation of the WWTP causing soil contamination / seepage to groundwater / eutrophication of surface water	Terrestrial ecosystems Groundwater (30mbgl throughout the year) Surface Water: A minor ephemeral creek line 1.3 km west of the WWTP	Minimal impacts expected to potential receptors given the distance to each receptor.	The WWTP will be appropriately designed and operated to mitigate the risk of sewage spills Surface water management structures (including perimeter bund and sumps) will ensure any spills are contained. Spill response will be provided. Inspection and maintenance will be undertaken. Standard management procedures are expected to effectively mitigate the risk of sewage emissions. Groundwater monitoring regime as per imposed Part V conditions	Moderate	Rare	Medium	Discussed further in Section 10.1
			Sewage spill during operation of the WWTP causing risk to human health	Residential: None, the nearest receptors consist of mining camps, the closest of which (exploration camp) is located ~13km NE. Newman is located more than 50 km from the project area.	Health: None, given the distance to the nearest receptors spills are not expected to affect health.	Same controls proposed as row directly above.	Minor	Rare	Low	Risk pathway is low, further consideration or assessment is not required.
		Treated effluent	Discharge of inadequately treated effluent to land (spray field) / seepage to groundwater / eutrophication of surface water	Terrestrial ecosystems Groundwater (30 mbgl throughout the year) Surface Water: A minor ephemeral creek line 1.3 km west of the WWTP	Elevated nutrient levels in soil / groundwater. Impacts to native vegetation / ingress or spread of weeds. The above impacts will be minimal given the distance to receptors, the ephemeral nature of the creeks, high evaporation rates and appropriate sizing of the sprayfield.	The WWTP will be appropriately designed and operated to mitigate the risk of sewage spills. The treated effluent will be disposed of to an appropriately sized sprayfield, as per WQPN 22 guidance (DoW 2018). Surface water management structures (including windrow to separate the pipeline from the LV access track). Spill response will be provided. Inspection and maintenance will be undertaken. Monitoring of discharge effluent quality will be undertaken in principle accordance of Category D level of treatment (WQPN 22) and will not exceed target values specified in *Australian Guidelines for Sewerage Systems – Effluent Management* (ANZECC 1997). Standard management procedures are expected to effectively mitigate the risk of elevated nutrient levels in soil / seepage to groundwater as a result of discharge of inadequately treated effluent. Groundwater monitoring regime as per Part V Licence L5275/1972	Moderate	Rare	Medium	Detailed assessment provided in Section 10.1

Source		Potential Emissions	Potential Pathway	Potential Receptors	Potential Impacts	Proposed Controls	Consequence	Likelihood	Risk Rating	Further consideration required?
		Treated effluent	Discharge of inadequately treated effluent causing risk to human health	Residential: None, the nearest receptors consist of mining camps, the closest of which (exploration camp) is located ~13km NE. Newman is located more than 50 km from the project area.	Health: None, given the distance to the nearest receptors spills are not expected to affect health.	Same controls proposed as row directly above.	Minor	Rare	Low	Risk pathway is low, further consideration or assessment is not required..

10 EMISSIONS, MANAGEMENT AND CONTROLS

The Licensee operates under an integrated Health, Safety, Environment and Communities and Social (HSEC) Management System which includes processes, procedures and plans that ensure environmental controls are developed for key environmental risks, legal compliance is maintained and continuous improvement is achieved through a formal review process.

Subject to approval, the construction, commissioning and operation of the proposed facility will be in accordance with the requirements of the HSEC Management System and the issued Works Approval (and any amendments, as required).

As mentioned in Section 9 (Table 9.4), risks that have been identified as having a 'Medium' risk rating or higher have been discussed further in the below sections.

10.1 Discharges to Land – Raw Sewage

10.1.1 Description of Risk Event

The operation of the proposed WWTP could potentially result in spills or leaks of untreated raw sewage to soil or groundwater. Sewage is not likely to contaminate surface water with the controls (bunding and sump) in place. The vertical distance to groundwater (30 mbgl) lessens the risk of untreated sewage reaching and contaminating groundwater.

10.1.2 Proposed Environmental Controls

Siting and operational controls are the key controls to minimise any potential risk and impacts of spills or leaks of raw sewage. The proposed WWTP is located in an area away from any sensitive land uses and terrestrial ecosystems (such as major creek lines, sensitive flora and/or vegetation and important native fauna habitat areas). The depth to groundwater in the WWTP area is at least 30 mbgl and therefore any spills are unlikely to reach the groundwater. The nearest sensitive land use (exploration camp located ~13km NE) is unlikely to be impacted in any way buy the operation of the WWTP.

10.1.2.1 Alarms

Operational controls proposed to minimise the risk of spills include alarms. The process has two alarm conditions:

1. High level alarm
2. Motor overload alarm

The "high level alarm" system includes a float switch to initiate an alarm for excessively high tank levels. This alarm generally indicates a failure of the effluent pump to start. The "motor overload alarm" is activated if any of the following motors trip on overload:

- Balance Tank Mixer
- Influent Feed Pump
- Air Blower

- Denitrification Zone Mixer
- Effluent Pump 1
- Effluent Pump 2

10.1.2.2 Overflow Mitigation

The design of the WWTP process ensures that the control system includes interlocks between influent feed pumps and tanks high level in order to prevent the possibility of an overflow from occurring. If the final effluent tank is at maximum capacity, the influent feed pumps are inhibited from operation.

If a “Hi” Hi level is detected in the balance tank, the influent feed pumps are started for each MBBR plant provided that they are not inhibited by a full effluent tank. In this Hi level situation, the influent feed pumps will only operate while the balance tank Hi Hi float switch is activated. This methodology is designed to prevent an overflow during Hi Hi alarm conditions.

Appropriate operation of the WWTP, including regular monitoring and maintenance is also key to preventing spills and leaks. The WWTP will be operated in accordance with the manufacturer’s manual. Daily operational inspections will be undertaken in accordance with Appendix 1 – specifically, Section 3.2 as well as the checklist provided in Appendix A of Appendix 1. These general inspections of the WWTP will help to identify any malfunctions such as leaks, high tanks levels, overflows, electrical malfunctions etc. Weekly inspections will also be undertaken for monitoring and measuring of sewage and effluent treatment functionality, this will be done in accordance with the weekly check sheet provided in Appendix B of Appendix 1.

A perimeter bund and sumps will be placed at the WWTP to capture and contain any potential spills or contaminated storm water runoff.

Appropriate design, particularly distance to ground water levels, management, inspection and maintenance controls are expected to effectively mitigate the risk of potentially contaminated discharges from the WWTP.

10.1.3 Residual Risk to the Environment

After conducting a detailed risk assessment, the Licensee considers that the residual risk to the environment from potentially raw sewage discharges to land (soil contamination, seepage to groundwater or migration to surface waters) from the proposed WWTP is ‘low’ - given the distance from sources to potentially sensitive receptors and the proposed environmental controls to be implemented.

Given the depth to groundwater and distance to the nearest surface water, raw sewage is not expected to seep to groundwater or migrate to surface water. Alarm systems, inspections, overflow mitigation, perimeter bund and sumps will minimise risks of spills and/or leaks. The risk to groundwater quality, surface water quality and any associated terrestrial ecosystems is therefore considered low.

10.2 Discharges to Land – Treated Effluent

10.2.1 Description of the Risk Event

Treated effluent from the WWTP will be discharged to a sprayfield area via a sprinkler system with the potential risk of elevated nutrient levels (eutrophication) in surface water and soils. The vertical distance to groundwater (at least 30 mbgl) minimises the risk of treated effluent reaching and contaminating groundwater.

10.2.2 Proposed Environmental Controls

Location siting, sizing of the sprayfield and ensuring appropriate effluent discharge quality are the key controls for minimising potential risks of elevated nutrient levels in soil from the discharge of treated effluent to land.

The proposed WWTP will be appropriately designed and operated to treat sewerage and will ensure that the nutrient loads in treated effluent do not exceed targets specified in the National Water Quality Management Strategy (NWQMS) which outlines the *Australian Guidelines for Sewerage Systems – Effluent Management* (ANZECC 1997). See Table 10-1 for the NWQMS discharge criteria. These criteria are considered appropriate for the eutrophication risk and the low risk to public health, amenity or the environment.

The site-and-soil evaluation at the sprayfield area determined the soils to be “Clay loams” and “Light clays” (Galt Geotecnhics 2021) which align to those of Soil Risk Category D as outlined in Table 2 of DWER’s *WQPN 22: Irrigation with nutrient-rich wastewater* (DoW 2018). Treated effluent from the WWTP will be discharged to a designated sprayfield irrigation area of 10 ha. This sprayfield is appropriately sized to ensure nutrient (nitrogen and phosphorus) application rates are appropriate for nutrient application criteria for risk Category D soils. According to the WQPN 22, Risk Category D soils should not exceed a maximum application rate of 480 kg/ha/yr (30 mg/L) for *inorganic* Nitrogen and 120 kg/ha/yr (7.5 mg/L) for *reactive* Phosphorous (DoW 2008). The expected annual nutrient loading for the MBBR sprayfield is 438 kg/ha/yr (<30mg/L) for *Total* Nitrogen and 116.8 kg/ha/yr (<8mg/L) for *Total* Phosphorus. The WWTP has been designed and constructed to achieve effluent quality for Risk Category D. The manufacturers specifications for the Class D facility specify a *Total* Nitrogen concentration in treated effluent of less than <30mg/L and *Total* Phosphorous concentration in treated effluent of less than <8mg/L, as per Table 10-1 below.

Additionally, the site-and-soil evaluation for on-site wastewater management determined that the proposed 10 ha sprayfield location and size and soil types were appropriate for the proposed disposal of secondary treated effluent (Galt Geotechnics 2021).

The sprinkler system at the sprayfield will be manually zoned to allow drying of certain areas as required from time to time. The sprinklers will be evenly spaced and allow for 360° rotation to ensure adequate distribution and maximum spread over the area to avoid soil saturation and pooling. A perimeter bund will be placed around the sprayfield to capture any potential runoff; and a perimeter fence will be installed to restrict access to the irrigation area.

Daily operational checks will be undertaken in accordance with the checklist provided in Appendix A of Appendix 1, and weekly inspections as per Appendix B of Appendix 1. This will include weekly inspections of the pipeline to the sprayfield area, checks for any pooling or malfunctioning sprinklers.

Table 10-1: Treated Effluent Discharge Quality Criteria and Target Values

Outputs	NWQMS Discharge Criteria	WWTP Target Value
5 day biological oxygen demand	20 – 30 mg/L	< 20 mg/L
Total suspended solids	25 – 40 mg/L	< 30mg/L
Total Nitrogen	20 – 50 mg/L	< 30mg/L
Total phosphorus	6 – 12 mg/L	< 8mg/L
pH	-	6.5 - 8.5
Residual free chlorine	-	0.2-2.0 mg/L
E. coli	< 10,000 cfu/100mL	< 1,000 cfu/100 mL

As per Section 4.6, monitoring of treated effluent quality will be undertaken quarterly and discharges volumes will be recorded weekly during operations. Results will be collated and analysed against licenced criteria conditions and reported in the Annual Environmental Report (AER) for L5275/1972.

10.2.3 Residual Risk to the Environment

After conducting a detailed risk assessment, the Licensee considers that the residual risk to the environment from treated effluent discharges to land (soil contamination, seepage to groundwater or migration to surface waters) from the proposed sprayfield is 'low' given the distance from sources to potentially sensitive receptors and the proposed environmental controls to be implemented.

Given the depth to groundwater and distance to the nearest surface water, treated effluent is not expected to seep to groundwater or migrate to surface water. In the unlikely event of potential excess irrigation runoff - the perimeter bund will assist in capturing and containing this. The risk to groundwater quality, surface water quality and any associated terrestrial ecosystems is therefore considered low.

11 SUMMARY OF CONTROLS

Key Emissions	Potential impacts	Proposed Controls	Section
Dust Emissions – Construction	Dust generated from clearing and vehicle traffic on unsealed access tracks.	Water carts will be used during clearing and construction activities and in areas with frequent vehicle movement on unsealed roads. Site clearing and rehabilitation will be managed to ensure that areas are only cleared as required and progressive rehabilitation is implemented as construction activities are completed. Works that have the potential to generate high dust levels may be restricted during times of high winds. Dust will be managed via the requirements of the Works Approval, Part V and Vegetation Clearing Permit (CPS9751/1) and standard operating procedures. CEMP has been developed for the construction of the camp and will be implemented and adhered to (WR-CEMP-N-001)	12
Discharges to land – Raw Sewage/Treated Effluent	Nutrient enrichment of soil, waterways / groundwater from excess nutrient loading in treated effluent irrigation	**WWTP Facility** Surface water management structures (e.g. perimeter bund, and sumps) will ensure any spills or potentially contaminated stormwater runoff are contained. Daily operational checks will be undertaken in accordance with the checklist provided in Appendix A of Appendix 1, and weekly inspections as per Appendix B of Appendix 1. Maintenance in accordance with manufacturer requirements will be undertaken. Overflow alarm systems installed and overflow mitigation tank design, to minimise risks of spills and/or leaks Spill kit response will be provided at the facility. **Sprayfield Area** The treated effluent will be disposed of to an appropriately sized sprayfield, in alignment with WQPN 22 guidance (DoW 2018). A windrow will be placed along the access track to the sprayfield to separate LV's from the effluent pipeline; and a perimeter fence will be installed to restrict access to the irrigation area. Nutrient loads in treated effluent do not exceed targets specified in the National Water Quality Management Strategy (NWQMS) which outlines the *Australian Guidelines for Sewerage Systems – Effluent Management* (ANZECC 1997). Daily operational checks will be undertaken in accordance with the checklist provided in Appendix A of Appendix 1, and weekly inspections as per Appendix B of Appendix 1. This will include weekly inspections of the pipeline to the sprayfield area, checks for any pooling or malfunctioning sprinklers. Quarterly monitoring/sampling of treated effluent quality and weekly monitoring of discharge volumes Groundwater monitoring as per Part V Licence L5275/1972 conditions	12, 13.1.1 – 13.2.2

12 REHABILITATION AND CLOSURE

Closure plans document the most up to date closure knowledge base for the operation, outline the objectives that need to be met upon closure, set out the strategies to achieve the closure objectives and the criteria that will be used to assess the success of closure.

The Project Area will be decommissioned and rehabilitated in accordance with RTIO's closure objectives and completion criteria for the "infrastructure" closure domain; where closure measures will include:

- Where infrastructure requires removal, remove all structures and footings that are above surface or within 1 m of the final land surface
- Actively seek reuse and recycling opportunities for decommissioned infrastructure
- Dispose of inert materials are not retained, reused or recycled in an inert landfill area (may be a used pit area) and then cap landfill with at least 2 m of inert material
- Rehabilitate final surface in accordance with standard procedures, which includes:
    - deep rip the surface where required to address compaction;
    - add a layer of topsoil and subsoil where available; and
    - revegetate with an appropriate mix of species of local provenance

13 PROJECT COSTS

The following information has been provided to support the Total Works Approval Fee calculation of [redacted]

Table 13-1: Estimated Project Costs

Proposed Costs Description	Costs (AUD)
Construction of WWTP and irrigation sprayfield (Cat 85) at capacity of 70m^3/day	[redacted]

Plate 13-1: Works Approval Fee Calculator, available from: Industry Licensing System - Department of Water and Environmental Regulation (dwer.wa.gov.au)

Table 2: Premise Components

Category	Capacity Range
85 – Sewage Facility	More than 20 but less than 100 cubic metres per day

REFERENCES & BIBLIOGRAPHY

Australia and New Zealand Environment and Conservation Council (ANZECC) 1997. *National Water Quality Management Strategy. Australian Guidelines for Sewerage Systems – Effluent Management. 1.* Australian and New Zealand Environment and Conservation Council, Agriculture and Resource Management Council of Australia and New Zealand. Commonwealth of Australia.

ANZECC 2000. *Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 1.* Australian and New Zealand Environment and Conservation Council, Agriculture and Resource Management Council of Australia and New Zealand. Commonwealth of Australia.

Astron 2023a. Rhodes Ridge Vegetation and Flora Assessment. Interim Report. Rev A (Draft)

Astron 2023b. Rhodes Ridge Project Detailed Fauna Survey. Rev A (Draft)

Beard, JS 1975, *Vegetation Survey of Western Australia, Pilbara. 1:1 000 000 Vegetation Series. Explanatory Notes to Sheet 5*, University of Western Australia Press, Nedlands, Western Australia.

Bureau of Meteorology (BoM). 2023. Climate Data Online. http://www.bom.gov.au/climate/data/index.shtml.

Department of Health 2021. Guidance of Site-and-soil evaluation for on-site wastewater management. Government of Western Australia. Accessed 2 November 2021 from: https://ww2.health.wa.gov.au/~/media/Files/Corporate/general%20documents/water/Wastewater/Site-Soil-Evaluation.pdf

Department of Water (DoW) 2008. *Water Quality Protection Note 22: Irrigation with nutrient-rich wastewater.* Government of Western Australia. Accessed 10 August 2021 from: https://www.water.wa.gov.au/__data/assets/pdf_file/0013/4045/82324.pdf.

Department of Water and Environmental Regulation (DWER) 2017. *Guideline – Risk Assessments. Part V, Division 3, Environmental Protection Act 1986.* Government of Western Australia. Accessed 10 August 2020 from: https://www.der.wa.gov.au/images/documents/our-work/licences-and-works-approvals/GS_Risk_Assessments.pdf.

GHD 2022. Rhodes Ridge Targeted Flora Survey. Draft.

Kendrick, P. 2001. Pilbara 3 (PIL3 - Hamersley Subregion). Department of Conservation and Land Management, Perth.

Standards Australia. AS/NZS 1547:2012 On-site domestic wastewater management.

Tille, P J. (2006), *Soil-landscapes of Western Australia's rangelands and arid interior*. Department of Agriculture and Food, Western Australia, Perth. Report 313.

van Vreeswyk, A M, Leighton, K A, Payne, A L, and Hennig, P. (2004), *An inventory and condition survey of the Pilbara region, Western Australia*. Department of Primary Industries and Regional Development, Western Australia, Perth. Technical Bulletin 92.

Appendix 1a

Basis of Design

Appendix 1b

MBBR WWTP Design and Process Flow

Appendix 2

Sprayfield Design & Conceptual Layout

Appendix 3

Discharge Criteria Calculations

Appendix 4

Site and Soil Evaluation