BHP

Marillana Creek (Yandi) Life of Mine Proposal Significant Amendment

Referral Supporting Document

May 2025

Document amendment record

Version	Description of version	Key changes	Date
0	Draft for Traditional Owner review	Original document	19/07/2024
1.0	Submission to EPA	Revised Document incorporating Banjima Native Title Aboriginal Corporation feedback	9/05/2025

Abbreviations

Term	Meaning
2D	Two-dimensional
3D	Three-dimensional
A6.4 of PA	Article 6.4 of the Paris Agreement
AAR	Annual Aquifer Reviews
ACCU	Australian Carbon Credit Units
AEP	Annual Exceedance Probability
AER	Annual Environmental Reports
AH Act	*Aboriginal Heritage Act 1972* (WA)
ANZECC	Australian and New Zealand Environment and Conservation Council
AMD	Acid mine drainage
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
AUD	Australian Dollars
AWT	Above water table
BAM Act	*Biosecurity and Agriculture Management Act 2007*
BC Act	*Biodiversity Conservation Act 2016* (WA)
BEMP	Biodiversity Environmental Management Plan
BHP	BHP Iron Ore Pty Ltd
BIF	Banded Iron Formation
BNTAC	Banjima Native Title Aboriginal Corporation
BWT	Below water table
CCA	Climate Change Authority
CY	Calendar Year
CC Act	*Climate Change Act 2022*
CCS	Crown condition score
CER	Clean Energy Regulator
CH4	Methane
CID	Channel Iron Deposit

Term	Meaning
CHMP	Cultural Heritage Management Plan
CO2	Carbon dioxide
CPH	Central Pilbara Hub
CREP	Charter on Corporate Responsibility for Environment Protection
DBCA	Department of Biodiversity, Conservation and Attractions
DEMIRS	Department of Energy, Mines, Industry Regulation and Safety
DCCEEW	Department of Climate Change, Energy, the Environment and Water (Commonwealth)
DWER	Department of Water and Environmental Regulation
EOM	end of mine
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EP Act	*Environmental Protection Act 1986* (WA)
EPA	Environmental Protection Authority (Western Australian)
ERD	Environmental Review Document
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
EWR	Ecological Water Requirements
FullCAM	Full Carbon Accounting Model
FY	financial year
GDE	Groundwater Dependent Ecosystem
GDV	Groundwater dependant vegetation
GHG	Greenhouse Gas
GIS	Geographical Information System
GL/a	giga litres per annum
GWL	Groundwater Licence
ha	hectare
HAC	Heritage Advisory Council
HFCs	Hydroflurocarbons
IBRA	Interim Biogeographic Regionalisation for Australia

Term	Meaning
IBSA	Index of Biodiversity Surveys for Assessments
IEA	International Energy Agency
IC-VCM	Integrity Council for the Voluntary Carbon Market
ICROA	Carbon Reduction & Offset Alliance
ILUA	Indigenous Land Use Agreement
JV	Joint Venture
kL	kilolitre
kL/annum	kilolitres per annum
km	kilometre
km2	square kilometre
LULUCF	Land use, land use change and forestry
m	metre
m3/s	cubic metres per second
mAHD	metres Australian Height Datum
mbgl	metres below ground level
MCDMP	Marillana Creek Diversion Management Plan
MCP	Mine Closure Plan
MCWRMP	Marillana Creek Water Resource Management Plan
mg/L	milligrams per litre
ML	Mining Lease
ML/a	mega litres per annum
ML/day	mega litres per day
MNES	Matters of National Environmental Significance
m3/s	meters cubed per second
mAHD	meters Australian height datum
mRL	metres Relative Level
MS	Ministerial Statement
Mtpa	million tonnes per annum

Term	Meaning
N2O	Nitrous oxide
NGER Act	*National Greenhouse and Energy Reporting Act 2007*
NVCP	Native Vegetation Clearing Permit
OEPA	Office of the Environmental Protection Authority
OSA	Overburden storage area
PEC	Priority Ecological Community
PEAHR	Project Environmental and Aboriginal Heritage Review
PEOF	Pilbara Environmental Offsets Fund
POW	Programme of Works
PFAS	Per- and polyfluoroalkyl substances
PFCs	Perfluorocarbons
RiWI Act	*Rights in Water and Irrigation Act 1914 (WA)*
RTIO	Rio Tinto Iron Ore
RVMP	Riparian Vegetation Monitoring Plan
SCHEMP	Social Cultural Heritage Environmental Management Plan
SF6	Sulphur hexafluoride
SME	Subject Matter Expert
SMC	Safeguard Mechanism Credit
SRE	Short-range Endemic
SWGWMP	Surface Water Groundwater Management Plan
TAR	Triennial Aquifer Review
tCO2-e	tonnes (t) of carbon dioxide (CO2) equivalent (e)
tpa	tonnes per annum
TDS	Total dissolved solids
TEC	Threatened Ecological Community
TSI	Targeted Site Investigation
UNDP	United Nations Development Programme
WAIO	Western Australia Iron Ore

Term	Meaning
WPMM	Western Pebble-mound Mouse mound
WRM	Wetland Research and Management

Glossary

Term	Meaning
Approved Proposal	The works and activities for mining operations within the Yandi Life of Mine Proposal comprising the Approved Proposal under the existing Ministerial Statements: 679 (as amended by 1039)
BHP	BHP Iron Ore Pty Ltd, as manager and agent for and on behalf of the Yandi Joint Venture. The Yandi Joint Venture comprises the following listed companies: BHP Billiton Minerals Pty Ltd (ABN 93 008 694 782), Itochu Minerals & Energy of Australia Pty (ABN 44 0009 256 259), Mitsui Iron Ore Corporation Pty Ltd (ABN 16 050 157 456)
Combined Proposal	The combination of the Significant Amendment (Proposal) together with the Approved Proposal
Commonwealth Strategic Approval	The approval of the taking of an action or class of actions within the Strategic Assessment Area, granted by the (Federal) Minister for the Environment on 19 June 2017 in accordance with the Program given under section 146B of the EPBC Act
Development Envelope	The maximum area within which the Combined Proposal will be located
Existing disturbance	The indicative total area that has been cleared for the Approved Proposal, based on BHP spatial data as of 30 June 2023 (FY23)
Indicative Footprint	The location where the Proposal elements are planned to occur
Marillana Creek (Yandi) Life of Mine Proposal Significant Amendment (the Proposal)	The works and activities for which approval is sought (i.e. the Significant Amendment to the Approved Proposal)
Proposal	The Marillana Creek (Yandi) Life of Mine Proposal Significant Amendment (see definition above)
Significant Amendment	An amendment to an Approved Proposal that is significant according to the definition in the *Environmental Protection Act 1986* and requires referral under s38 (i.e. the Proposal)

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Executive summary

Table ES-1: General proposal content description

Proposal title	Marillana Creek (Yandi) Life of Mine Proposal
Proponent name	BHP Iron Ore Pty Ltd
Short description	The Combined Proposal is to mine the entire Yandi orebody within Mining Lease 270SA and subsequently rehabilitate the disturbed areas. The Yandi orebody occurs within an ancient channel iron deposit, which is subdivided into a series of mine areas known as the central mesa pits (C1 to C5), eastern mesa pits (E1 to E8) and the western mesa pits (W1 to W6). The Proposal is located 90 kilometres (km) northwest of the town of Newman (Figure 1). The Combined Proposal comprises: • open cut mining of overburden and ore from the channel iron deposit above and below water table • dewatering of the orebody during mining operations • surplus water discharge to Marillana Creek • placement of overburden in mine voids and out-of-pit storage areas • processing, loading and transportation of ore • supply and distribution of power and raw material • linear infrastructure (haul roads, pipeline corridors etc.) • service infrastructure (e.g. main access roads, workshops, administration areas, accommodation village and airstrip) • permanent diversion of sections of Marillana Creek • creek crossings, permanent changes to the final landforms, including hill-like features of the out-of-pit overburden storage areas and pit lakes created in the final voids.

Table ES-2: Proposal content elements

Element	Location / description	Existing proposal maximum extent, capacity or range (Approved Proposal)	Proposed amendment extent, capacity or range (the Proposal – Significant Amendment)	Combined maximum extent, capacity or range (Combined Proposal)
Physical elements				
Mine and associated infrastructure	Figure 2-2	**Part IV Approved** MS679: Clearing of no more than 4,558 hectares (ha) of native vegetation within the total approved development envelope of 13,158 ha including: • Clearing of no more than 393 ha for Marillana Creek Diversion • Clearing of no more than 18 ha for Marillana Creek Crossings	**Additional clearing of up to 95 ha of native vegetation, including additional clearing of no more than 48 ha of riparian vegetation.**	Clearing of no more than 4,653 ha of native vegetation, within the 13,158 ha development envelope including: • Clearing of no more than 393 ha for Marillana Creek Diversion • Clearing of no more than 18 ha for Marillana Creek Crossings • Clearing of no more than 48 ha of riparian vegetation for the Proposal.
Operational elements				
Overall Production rate	Figure 2-2	**Part IV Approved** MS679: Approximately 87 megatonnes per year	**No change**	Overall production rate to remain within the current authorised limit of approximately 87 megatonnes per year

Element	Location / description	Existing proposal maximum extent, capacity or range (Approved Proposal)	Proposed amendment extent, capacity or range (the Proposal – Significant Amendment)	Combined maximum extent, capacity or range (Combined Proposal)
Marillana Creek diversions	Figure 2-2	**Part IV Approved** MS679: Diversion of sections of Marillana Creek to maximise resource use in W5 mine area and the E1 to E6 mine area will be designed and constructed in accordance with the Marillana Creek Diversion Management Plan.	**No change**	Diversion of sections of Marillana Creek to maximise resource use in W5 mine area and the E1 to E6 mine area will be designed and constructed in accordance with the Marillana Creek Diversion Management Plan.
Pit depth	Figure 2-2	**Part IV Approved** MS679: Typically, 60 metres (m) (ranges from 55 to 80 m)	**No change**	Maximum pit depth up to approximately 80 m below ground level.
Groundwater abstraction – mine pit dewatering and water supply	Figure 2-2	**Part IV Assessed** *MS679*: Groundwater abstraction was originally assessed by the Environmental Protection Authority (EPA) as part of the original proposal. Limit removed under section 45C of *Environmental Protection Act 1986 (WA) (EP Act)* (10 December 2013). *MS1039:* Not specified. • Groundwater abstraction regulated under 5C Groundwater Licence GWL89501(11) (June 2018-June 2028) issued	**No change**	Groundwater abstraction will remain within the current authorised limit of 20.65 GL/a and regulated under RiWI Act.

Element	Location / description	Existing proposal maximum extent, capacity or range (Approved Proposal)	Proposed amendment extent, capacity or range (the Proposal – Significant Amendment)	Combined maximum extent, capacity or range (Combined Proposal)
		under the *Rights in Water and Irrigation Act 1914 (WA)* (RiWI Act). • GWL89501(11) Annual Water Entitlement 20.65 giga litres per annum (GL/a)L/a • Total groundwater abstracted for Financial Year (FY) 24 was 4.54 GL		
Surplus water management – discharge to creeks	Figure 2-2	**Part IV Assessed** • Regulated under Part V Operating Licence L6168/1991/11 • 15,000,000 tonnes per annum (tpa) current limit • Dewater discharge to Marillana Creek • 6,732,481 tonnes (6.7GL) dewater discharged FY23	**No change**	Maximum surplus water discharge will remain 15,000,000 tpa and regulated under Part V Operating Licence.
Greenhouse Gas Emissions				
Peak annual				
Scope 1	Mine Emissions covered by Safeguard Mechanism	**Part IV not assessed** *MS679*: Not specified[14] *MS1039:* Not specified.	**Additional 17,238 tCO_2-e per annum (FY2027)**	Up to 89,791 tCO2-e per annum (FY2028)
Scope 2	Electricity supply-(Grid-connected electricity demand)	**Part IV not assessed** *MS679*: Not specified *MS1039:*	**Additional 12,252 tCO_2-e per annum (FY2027)**	Up to 25,460 tCO_2-e per annum (FY2026)

Element	Location / description	Existing proposal maximum extent, capacity or range (Approved Proposal)	Proposed amendment extent, capacity or range (the Proposal – Significant Amendment)	Combined maximum extent, capacity or range (Combined Proposal)
		Not specified.		
Scope 3	Downstream emissions (including rail transport, port, iron ore shipping and steel making)	**Part IV not assessed** *MS679*: Not specified[14] *MS1039:* Not specified.	**Additional 9,538,704 tCO_2-e per annum (FY2027)**	Up to 20,851,796 tCO_2-e per annum (FY2026)
Annual average GHG Emissions life of mine				
Scope 1	Mine Emissions covered by Safeguard Mechanism	**Part IV not assessed** *MS679*: Not specified[14] *MS1039:* Not specified.	**Additional 8,986 tCO_2-e per annum)**	Up to 49,553 tCO2-e per annum
Scope 2	Electricity supply-(Grid-connected electricity demand)	**Part IV not assessed** *MS679*: Not specified *MS1039:* Not specified.	**Additional 5,478 tCO_2-e per annum)**	Up to 9,873 tCO_2-e per annum
Scope 3	Downstream emissions (including rail transport, port, iron ore shipping and steel making)	**Part IV not assessed** *MS679*: Not specified[14] *MS1039:* Not specified.	**Additional 4,315,551 tCO_2-e per annum**	Up to 18,312,706 tCO_2-e per annum
Other elements which affect extent of effects on the environment				
Maximum project life		**Part IV assessed and approved**	**Additional approximate 5 years of operations**	Approximately five (5) years from the date of issue of the Ministerial Statement

Element	Location / description	Existing proposal maximum extent, capacity or range (Approved Proposal)	Proposed amendment extent, capacity or range (the Proposal – Significant Amendment)	Combined maximum extent, capacity or range (Combined Proposal)
		MS679: Approximately 17 years		Decommissioning Phase up to approximately ten (10) years following cessation of mining
Commissioning				
Commissioning of the additional dewatering and surplus water management infrastructure will be undertaken subject to the operational elements above				
Rehabilitation and closure				
Progressive rehabilitation will be undertaken, where practicable, when disturbed areas are no longer required for operations. Any permanent pit lake that forms following the permanent cessation of dewatering (if backfilling above the water table cannot be achieved) will be designed and managed to be safe and non-polluting.				

Table ES-3: Summary of potential impacts, proposed mitigation and proposed environmental outcomes of the Combined Proposal

Inland Waters	
Potential impacts	• Changes to surface water regimes to Marillana Creek from discharge of surplus water, decrease in catchment and installation of infrastructure (direct) • Changes to groundwater regimes from groundwater abstraction for mine pit dewatering (direct) • Changes to water quality from pit excavation and infrastructure, and discharge of surplus water (indirect)
Mitigation hierarchy	• Manage the potential impacts of surplus water discharge from the Combined Proposal 's mine pits on groundwater levels and groundwater quality in accordance with the updated Marillana Creek Water Resource Management Plan • Continue to monitor and manage actual and potential impacts from groundwater drawdown on environmental receptors for the Combined Proposal through the implementation of the updated Marillana Creek Water Resource Management Plan • Continue with dewatering reduction, with off-tenure reinjection for Flat Rocks. • Continue to manage rehabilitation and closure according to the measures in the Yandi Mine Closure Plan • Continue to limit impacts from groundwater drawdown and surplus water discharge by adhering to current authorised limits as required by the current 5C Groundwater Licence GWL89501(11) (June 2018-June 2028) issued under the RiWI Act 1914 and the Operating Licence (L6168/1991/11) issued under Part V of the EP Act (discharge)
Residual impacts, including assessment of significance	Residual impacts on Inland Waters following application of the mitigation hierarchy: • Decrease in groundwater levels (drawdown) from dewatering of the Proposal (not significant) • Surplus water discharge to Marillana Creek (not significant) • Decrease in surface water catchment runoff (not significant) • Changes to flow regimes (not significant) • Changes to water quality (not significant) • Decrease in groundwater levels at Flat Rocks (groundwater dependent ecosystem) beyond the Approved Proposal (significant) with mitigation strategies currently being implemented
Proposed environmental outcomes	Environmental outcomes for the residual impacts on Inland Waters: • Decrease in groundwater levels in the channel iron deposit (CID) and the Weeli Wolli Basement within the Development Envelope and off-tenure at Flat Rocks. • Discharge of surplus water at a maximum of 15,000,000 tpa

	• Decrease in Marillana Creek catchment by 0.64% associated with the Combined proposal (not significant) or 1.6% of the catchment when considering cumulative • Use of flood bunds to prevent ingress of flood waters to mine pits
Assessment of offsets (if relevant)	N/A: No significant residual impacts after mitigation
Flora and Vegetation	
Potential impacts	• Loss of vegetation and flora from clearing (direct) • Loss of and changes to vegetation from changes to groundwater regimes (indirect) • Changes to vegetation from changes to surface water regimes (indirect) • Changes to vegetation and flora from dust, fire and weeds (indirect)
Mitigation hierarchy	• Limit clearing for the Combined Proposal to 4,653 ha of native vegetation, including additional clearing of up to 95 ha of native vegetation for this Proposal • Continue to manage potential impacts to Flora and Vegetation for the Combined Proposal according to the updated Yandi Biodiversity Environmental Management Plan • Monitor and manage riparian tree health in accordance with the updated Marillana Creek Water Resource Management Plan • Continue to manage rehabilitation and closure according to the measures in the updated Yandi) Mine Closure Plan • Continue with dewatering reduction and off-tenure reinjection currently being investigated at Flat Rocks
Residual impacts, including assessment of significance	Residual impacts on Flora and Vegetation following application of the mitigation hierarchy: • Clearing of up to 593 ha of native vegetation in Good to Excellent condition from the Combined Proposal (508 ha from the Approved Proposal and 85 ha for the Proposal) (in the Pilbara Interim Biogeographic Regionalisation for Australia [IBRA] region) (significant) • Clearing of up to 48 ha of riparian vegetation for the proposal (significant) • Loss of 2 ha of riparian vegetation off tenure at Flat Rocks as a result of groundwater drawdown from the Approved Proposal (significant) • Clearing of 0.2% of one Beard vegetation association (82) (not significant) • Clearing of <2% of known populations of *Rostellularia adscendens* var. *latifolia* (Priority 3) (not significant)
Proposed environmental outcomes	Environmental outcomes for the residual impacts on Flora and Vegetation: • Contributes to the cumulative clearing of Good to Excellent condition vegetation in the Pilbara bioregion

	• The representation of Beard vegetation associations (18 and 82) in the Pilbara bioregion will be maintained • No impacts to regionally significant vegetation (Threatened Ecological Communities [TECs] and Priority Ecological Communities [PECs]) • Locally significant vegetation will be impacted through clearing of riparian vegetation • No impacts to Threatened flora • The viability of the Priority flora known from the Development Envelope will be maintained in the Pilbara bioregion • The viability of riparian vegetation and Groundwater dependent vegetation within the Development Envelope and upstream along the CID around Flat Rocks will be maintained
Assessment of offsets (if relevant)	Clearing of riparian vegetation and vegetation in Good to Excellent condition for the Proposal is a significant residual impact and requires an offset. BHP proposes to contribute funds to the Pilbara Environmental Offsets Fund for the clearing of up to 85 ha of Good to Excellent condition vegetation in the Pilbara IBRA region, of this 48 ha is riparian vegetation. In addition, BHP proposes to contribute funds to the Pilbara Environmental Offsets Fund for the 2 ha of riparian vegetation which has deceased at Flat Rocks due to groundwater drawdown from the Approved Proposal.
Terrestrial Fauna	
Potential impacts	• Loss of fauna habitats and/or significant fauna individuals/species records from clearing (direct) • Changes to and loss of fauna habitats from changes to groundwater regimes (indirect) • Changes to fauna habitats from changes to surface water regimes (indirect) • Disturbances to fauna from light, noise, vibration and dust (indirect) • Mortality or injury to fauna from vehicle strike or interactions with machinery/infrastructure (indirect) • Impact to fauna from invasive or introduced species (indirect)
Mitigation hierarchy	• Limit clearing for the Combined Proposal to 4,653 ha of fauna habitat, including clearing for the Proposal of up to 95 ha of fauna habitat • Implement the revised Yandi Biodiversity Environmental Management Plan to minimise impacts to significant fauna • Continue to monitor and manage degradation of fauna habitats associated with riparian or groundwater dependant vegetation in accordance with the revised Marillana Creek Water Resource Management Plan • Continue with dewatering reduction and off-tenure reinjection currently being investigated for Flat Rocks to prevent further degradation of fauna habitats • Continue to manage rehabilitation and closure according to the measures in the Yandi Mine Closure Plan
Residual impacts, including assessment of significance	Residual impacts on Terrestrial Fauna following application of the mitigation hierarchy include • Total clearing of up to 4,653 ha of fauna habitat within the Development Envelope

	• Clearing a total of 72 ha of critical foraging and dispersal habitat for Pilbara Olive Python (25 ha), Ghost Bat (72 ha) and Grey Falcon (43 ha) (significant) • Clearing a total of 72 ha of supporting habitat for Northern Quoll (72 ha), Pilbara Leaf-nosed Bat (39.1 ha), Pilbara Olive Python (0.3 ha) and Grey Falcon (0.3 ha) (significant) • Clearing two historical records of Pilbara Olive Python which represents 1.1% of known species records within the Pilbara bioregion (not significant) • Clearing known records of two Uncertain SRE species that are currently only known from the Development Envelope: *Afrosternophorus* `BPS506' and *Beierolpium* 8/4 small `BPS505 (not significant) • Loss of 2 ha of critical and supporting habitat associated with riparian vegetation/GDV at Flat Rocks from the Approved Proposal (significant) • Potential decline in condition/health of terrestrial and aquatic fauna habitat within the Marillana Creek Pools from the Approved Proposal (potentially significant)
Proposed environmental outcomes	Environmental outcomes for the residual impacts on Terrestrial Fauna: • Clearing of critical habitat in the Pilbara bioregion that will require an offset • Clearing of supporting foraging habitat in the Pilbara bioregion that will require an offset • Loss of critical and/or supporting habitat off-tenure at Flat Rocks that will require an offset • No further decline in surface water pool levels at Flat Rocks and MARC5 Pool attributable to drawdown associated with the Combined Proposal • No further decline in the health or condition of terrestrial or aquatic fauna habitats at Flat Rocks attributable to drawdown associated with the Combined Proposal • The viability of the Pilbara Olive Python population known from the Development Envelope will be maintained • The viability of the SRE fauna known from within the Development Envelope will be maintained
Assessment of offsets (if relevant)	Significant residual impacts to Pilbara Olive Python, Northern Quoll, Ghost Bat, Pilbara Leaf-nosed Bat and Grey Falcon as a result of clearing critical and/or supporting habitat which require offsets. BHP proposes to contribute funds to the Pilbara Environmental Offsets Fund for the clearing of up to 72 ha of critical and/or supporting habitat for Pilbara Olive Python, Northern Quoll, Ghost Bat, Pilbara Leaf-nosed Bat and Grey Falcon. Significant residual impacts to critical and/or supporting habitat for significant fauna off-tenure at Flat Rocks which requires an offset. BHP proposes to contribute funds to the Pilbara Environmental Offsets Fund for the loss of 2 ha of groundwater dependant vegetation which represents critical and/or supporting habitat for significant fauna.
Subterranean Fauna	
Potential impacts	• Changes to stygofauna habitat and species assemblage from groundwater drawdown (direct)

	• Degradation of stygofauna habitat through vegetation clearing and/or land or water contamination (indirect) • Changes to troglofauna habitat and species assemblages from mine pit excavation (direct) • Degradation of troglofauna habitat through desiccation from groundwater drawdown, vegetation clearing, blasting and vibration and/or land or groundwater contamination (indirect)
Mitigation hierarchy	• Potential impacts to subterranean fauna and habitat from dewatering and surplus water discharge to Marillana Creek will continue to be managed in accordance with the Marillana Creek Water Resource Management Plan • Groundwater abstraction will be minimised to that which is required for implementation of the Combined Proposal and will be compliant with existing licence GWL89501 • Vegetation clearing will be minimised to that which is necessary for implementation of the Combined Proposal (i.e. no more than 4,653ha of vegetation to be cleared) • During the mine planning phase, BHP will minimise the removal of potential troglofauna habitat from mine pit excavation as far as practical • BHP will continue with dewatering reduction and off-tenure reinjection currently being investigated for Flat Rocks • Rehabilitation and closure will continue to be managed in accordance with the Yandi Mine Closure Plan
Residual impacts, including assessment of significance	Residual impacts on Subterranean Fauna following application of the mitigation hierarchy: • Loss and/or modification of suitable BWT stygofauna habitat within the groundwater drawdown contours of the Proposal (not significant) • Loss of stygofauna individuals due to groundwater drawdown (not significant) • Localised loss and/or modification of suitable AWT troglofauna habitat from mine pit excavation (not significant) • Localised loss of troglofauna individuals due to mine pit excavation (not significant)
Proposed environmental outcomes	Environmental outcomes for the residual impacts on Subterranean Fauna: • Retention of suitable below water table (BWT) stygofauna habitat within and extending beyond the drawdown contours of the Proposal • No adverse impact to stygofauna habitats in areas outside the drawdown contours as a result of the Proposal • No further loss or modification of stygofauna habitat at Flat Rocks as a result of dewatering • No adverse impacts to local stygofauna assemblages as a result of groundwater drawdown for the Proposal • Maintenance of suitable above water table (AWT) troglofauna habitats within the Development Envelope • No adverse impact to the local or regional troglofauna assemblage as a result of the Proposal
Assessment of offsets (if relevant)	N/A: No significant residual impacts after mitigation

Social Surroundings	
Potential impacts	• Disturbance of social, cultural and heritage sites and values (direct and indirect) • Impacts to access, landscape, and amenity (direct) • Degradation of social, cultural and heritage values (indirect)
Mitigation hierarchy	• The Proposal has been designed to avoid direct impacts to three heritage sites. • The Social Cultural Heritage Environmental Management Plan (SCHEMP) will be implemented to manage potential impacts of the Proposal on Social Surroundings, including (but not limited to): access to Country, culturally significant plants and animals, water values and amenity, and to provide a specific mechanism for ongoing consultation and engagement throughout the life of the Proposal. • The Cultural Heritage Management Plan which details site-specific management measures pertaining to heritage sites for the Proposal will be implemented. • Measures in the relevant environmental management plans will be implemented to minimise and mitigate impacts to cultural heritage values, particularly at Flat Rocks including culturally significant animals and plants and water values. • Continue with dewatering reduction and off-tenure reinjection currently being investigated for Flat Rocks. • Development of a Flat Rock Springs Tree Restoration Program • Rehabilitation and closure will continue to be managed according to the measures in the Yandi Mine Closure Plan.
Residual impacts, including assessment of significance	Residual impacts on Social Surroundings following application of the mitigation hierarchy above: • Potential direct and indirect impacts to Aboriginal social, cultural and heritage values within the Development Envelope and off-tenure at Flat Rocks (significant).
Proposed environmental outcomes	Environmental outcomes for the residual impacts on Social Surroundings: • Direct impact to no more than 6 heritage sites from the Proposal • Avoidance of 3 heritage sites within the Indicative Footprint of the Proposal outside of pit areas • Implementation of mitigation/management measures as soon as possible if additional potential impacts are identified
Assessment of offsets (if relevant)	• BHP propose to contribute funds to the Pilbara Environmental Offsets Fund should there be any unforeseen additional riparian vegetation loss from the implementation of the Combined Proposal on and off BHP tenure.
Greenhouse Gases	

Potential impacts	• Cumulative greenhouse gas (GHG) emissions are a contributor to climate change. The cumulative emissions from the Combined Proposal will contribute to WA's GHG emissions
Mitigation hierarchy	• Reduce greenhouse gas emissions through adoption of emission reduction initiatives and in accordance with the NGER Act and Safeguard Mechanism • Implement offsets according to the National Greenhouse and Energy Reporting Act and the Safeguard Mechanism
Residual impacts, including assessment of significance	Residual impacts on the environment following application of the mitigation hierarchy: • Generation of GHG emissions (potentially significant)
Proposed environmental outcomes	Environmental outcomes for the residual impacts on the environment: • Contribution of 445,794 t CO_2-e of Scope 1 emissions (residual using the indicative Safeguard Mechanism decline rate from the Yandi over the life of the Combined Proposal • Contribution of 88,859 t CO_2-e of Scope 2 emissions (residual) over the life of the Combined Proposal • Contribution of 73,340,971 t CO_2-e of Scope 3 emissions (residual) over the life of the Combined Proposal
Assessment of offsets (if relevant)	The significant residual impact of contribution of GHG emissions from the Combined Proposal will be counterbalanced by available abatement measures or offsets applied. GHG emissions will also be avoided and reduced over the life of the project, in accordance with the NGER Act and the Safeguard Mechanism.

1 Introduction

1.1 Purpose and scope of this document

The purpose of this document is to present the environmental impact assessment undertaken by BHP Iron Ore Pty Ltd (BHP) for the Marillana Creek (Yandi) Life of Mine Proposal Significant Amendment (the Proposal) (Figure 1-1). Given that the Proposal is a significant amendment to the Approved Proposal, the impact assessment has been undertaken in the context of the existing Approved Proposal, having regard to combined and cumulative effects on the environment. The Marillana Creek (Yandi) Life of Mine Proposal is located approximately 90 kilometres (km) northwest of Newman, in the Hamersley Ranges of the Pilbara Region.

This document is provided as a supplementary report to the referral of a significant amendment to the Approved Proposal under the existing Ministerial Statement (MS) 679, as amended by MS 1039. As provided for in the Environmental Impact Assessment (Part IV Divisions 1 and 2) Procedures Manual (Environmental Protection Authority [EPA] 2021a), where a proponent aims to provide sufficient information with the referral to enable the EPA to set 'Referral Information' as the level of assessment, the proponent may prepare a supplementary report/s for the referral consistent with the requirements of an Environmental Review Document.

The scope of this document is an assessment of the potential significant environmental impacts from the Combined Proposal which includes the full scope of the Approved Proposal, as well as an extension of mining operations at E8 pit East and E8 pit West, and additional clearing to support ongoing mining operations. This document and supporting information comprise the following:

- Environmental Review Document for the Proposal - Main document
- Proposal Content Document (Appendix 1)
  - Significant Amendment requirements:
  - Analysis of Ministerial Statements for the Approved Proposal (Appendix 2)
  - Compliance with Approved Proposal Ministerial Statements (Section 2.1.2)
  - Environmental Performance Report (Section 2.1.3)
- Proposed implementation conditions for the Combined Proposal (Appendix 3)
- Supporting study and survey reports (Appendix 4, Appendix 8, Appendix 12, Appendix 15)
- Environmental Management Plans (Appendix 5, Appendix 6, Appendix 10, Appendix 16, Appendix 17)
- Index of Biodiversity Surveys for Assessments (IBSA) data package (Appendix 9)
- Offsets template and draft Impact Reconciliation Procedure (Section 14 and Appendix 18).

BHP has considered guidance in the Environmental Impact Assessment (Part IV Divisions 1 and 2) Procedures Manual: Requirements under the *Environmental Protection Act 1986* (Procedures Manual) (EPA 2021a), including the following EPA Instructions, to prepare this document:

- *Referral of a proposal under section 38 of the Environmental Protection Act 1986: Instructions (Referral Instructions)* (EPA 2024a)
- *How to prepare an Environmental Review Document: Instructions (ERD Instructions)* (EPA 2024b)
- *How to identify the content of a Proposal: Instructions and template (Proposal Content Instructions)* (EPA 2024c)

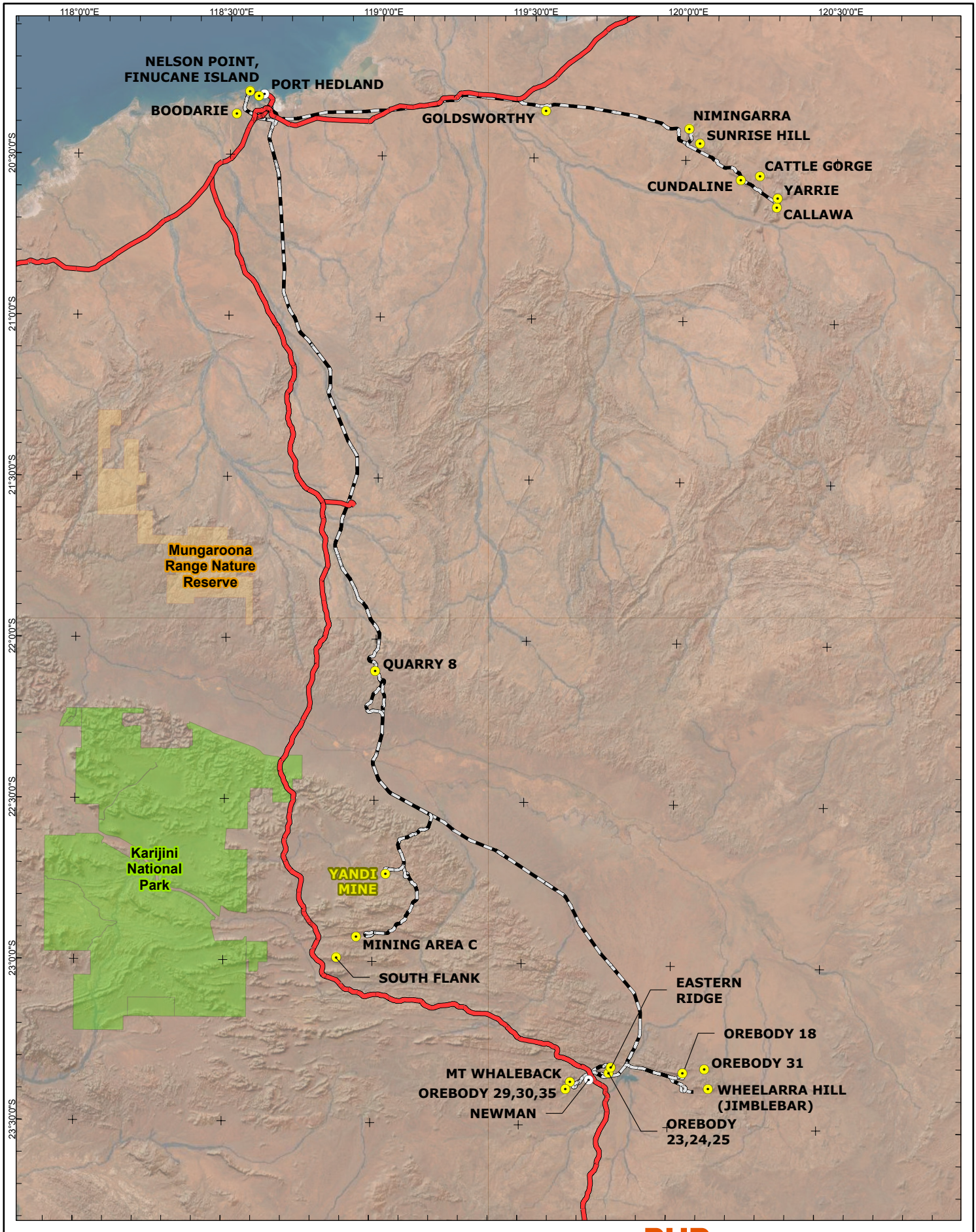
- *How to prepare Environmental Protection Act 1986 Part IV Environmental Management Plans (EMP Instructions)* (EPA 2024d)
- EPA factor guidelines and technical guidance (see details under relevant factor).

1.2 Significant Amendment requirements

Table 1-1 outlines where in this document BHP has addressed the additional requirements for Significant Amendments, as required by the EPA's Referral Instructions (EPA 2024a).

Table 1-1: Significant Amendment requirements

Significant Amendment requirement	Location in document
1. Type of significant amendment	Section 3.1.1.1
2. Information on the approved proposal	Section 2.1
3. Combined effects	Sections 7.4, 7.6, 8.3.2.3, 8.6, 9.4, 9.6, 10.3.2.4, 10.6, 11.4, 11.6, 0 and 12.6
4. Existing implementation conditions	Section 3.1.1.2 and Appendix 2, Sections 7.7, 8.7, 9.7, 10.7, 11.6.4 12.7
5. Previous changes to the proposal and / or implementation conditions	Section 2.1.1
6. Compliance	Section 2.1.2
7. Environmental performance	Section 2.1.3
8. Control of implementation of significant amendment	Sections 7.5.4 and 7.7, 8.5.4 and 8.7, 9.5.4 and 9.7, 10.5.4 and 10.7, 11.5.4 and 11.6.4, 12.5.4 and 12.7



BHP WAIO operation
Town
National highway
Rail
National park
Nature reserve

N

0 25 50 75
KILOMETRES

GDA 1994 MGA ZONE 50

BHP

PUBLIC

MARILLANA CREEK (YANDI) SIGNIFICANT AMENDMENT
REGIONAL LOCATION

WAIO PLANNING, TECHNICAL & ENVIRONMENT

SCALE @ A4:	1:1,700,000	PREPARED:	GEOMATICS	FIGURE:	1-1
DATE:	1/04/2025	REQUESTOR:	ENV APPROVALS	NO:	A1205-008-RevC

Document Path: Y:\Jobs\A1001_A1500\A1205\3Project\A1205_008_E_Yandi_S38_RegionalLocation_RevC.aprx

2 Proposal

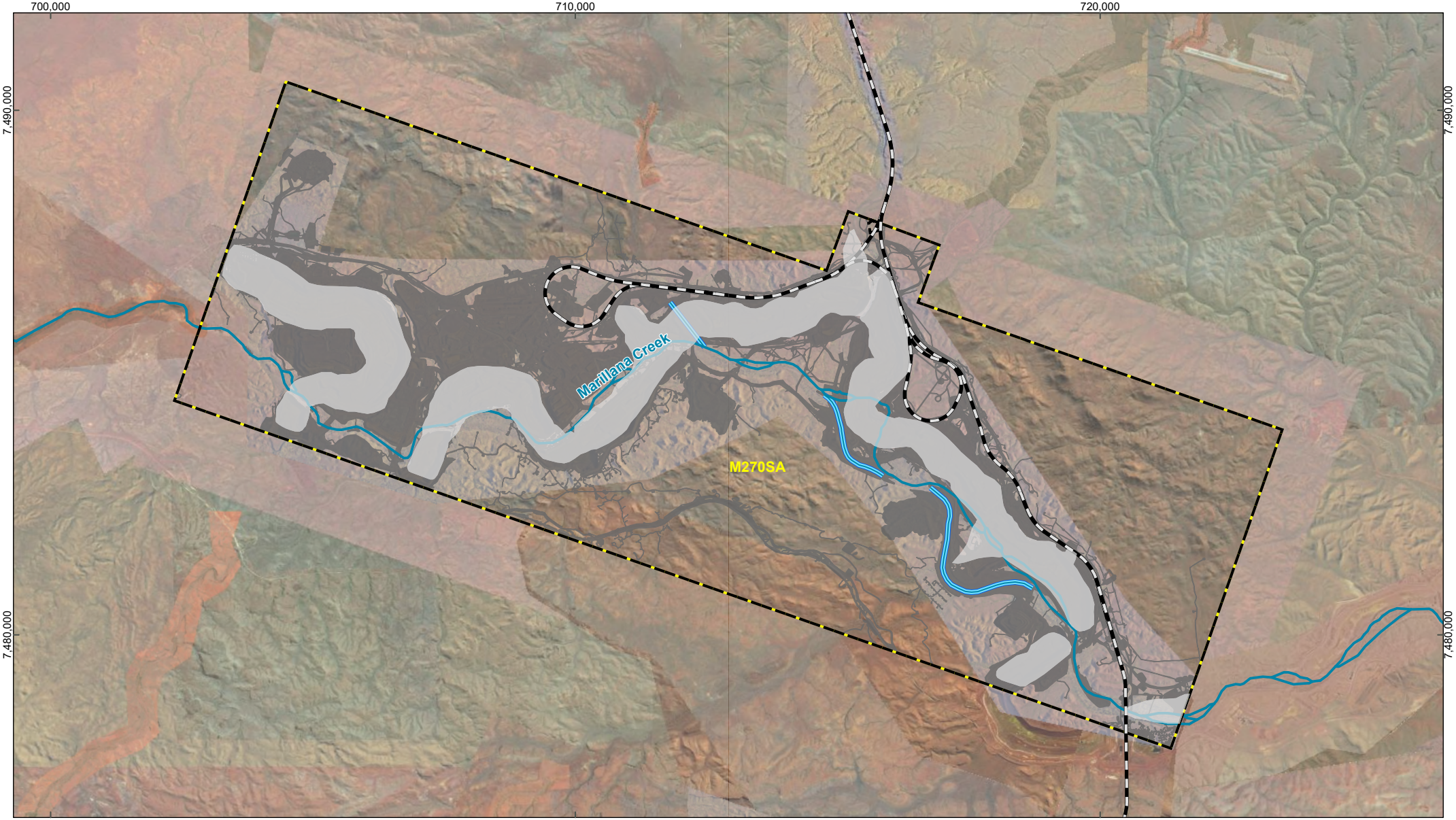
2.1 Approved Proposal

Mining operations at Yandi were first approved in 1988, and mining commenced in 1991. Since that time, the Approved Proposal has undergone several modifications, which authorised increased rates of production and mining of additional pits. The Approved Proposal is authorised under Part IV of the EP Act MS 679 (issued 06 July 2005), as amended by MS 1039 (issued 04 October 2016) (Figure 2-1). The implementation stage for the Approved Proposal is currently operations.

The above MSs grant BHP approval to mine the entire orebody within the Development Envelope subject to conditions. The deposit is a near surface Channel Iron Deposit (CID), which for mining purposes, has been sub-divided into a series of mine areas. Ore is mined using both conventional and continuous mining methods before being transported by rail to Port Hedland for export.

The key activities and elements of the Approved Proposal as set out in the above MS are summarised below:

- open cut mining of overburden and ore from the channel iron deposit
- dewatering of the orebody during mining operations
- permanent diversion of sections of Marillana Creek
- placement of overburden in mine voids and out-of-pit storage areas
- processing, loading and transportation of ore
- possible mining of the lower channel iron deposit
- supply and distribution of power and raw materials
- provision of existing service infrastructure (e.g. main access roads, workshops, administration areas, accommodation village and airstrip).



- BHP rail
- Marillana Creek
- Constructed Creek Diversion
- Development Envelope
- BHP Tenement
- Indicative Location of Deposits
- Existing Disturbance

N

0 1 2 3 4
kilometres

GDA 1994 MGA ZONE 50

BHP

PUBLIC

MARILLANA CREEK (YANDI) SIGNIFICANT AMENDMENT
APPROVED PROPOSAL

WAIO PLANNING, TECHNICAL & ENVIRONMENT

SCALE @ A4:	1:98,000	PREPARED:	GEOMATICS	FIGURE:	2-1
DATE:	24/04/2025	REQUESTOR:	ENV APPROVALS		

A1205-009-RevE

Document Path: Y:\Jobs\A1001_A1500\A1205\3Project\A1205_009_E_Yandi_S38_ApprovedProposal_RevE.aprx

2.1.1 Previous changes to the Approved Proposal and implementation conditions

As required by the Referral Instructions (EPA 2024a) and ERD Instructions (EPA 2024b), Table 2-1 summarises the original Part IV approvals for the Approved Proposal and subsequent approved changes. No amendments have been approved since the amendments to the EP Act came into force in 2021.

Table 2-1: Part IV Approved Proposal and summary of changes

Date	EP Act Section	Summary of Approved Proposal and changes/amendments
Superseded Approved Proposals		
MS 29: Yandicoogina (Marillana) Iron Ore Project (Assessment 069, EPA Report 323)		
May 1988	s. 38	**Original proposal:** Mining operation on ML 270SA to mine E2 and C5 at a rate of 5 million tonnes per annum (Mtpa), with a mine life of 16 years as authorised by MS 29
May 1992	s.46	**Change to conditions (MS 259):** Increase in production from 5 Mtpa to a rate of 10 Mtpa, an increase in mine life from 16 years to 32 years, as authorised by MS 259
June 1994	s.46	**Change to conditions (MS 357):** Increase in production rate from 10 Mtpa to 15 Mtpa as authorised by MS 357
MS405: Duplication of Iron Ore Mining Operation, Yandi Mine, Mining Lease 270SA (Assessment 969, EPA Report 802)		
February 1996	s. 38	**Original proposal:** Development of a second open-cut iron ore mining operation on Mineral Lease (ML) 270SA at C1 and C2 to be mined simultaneously with the existing E2 pit. Mine life of 40 years. Authorised by MS 405.
Current Approved Proposal		
MS 679: Marillana Creek (Yandi) Life of Mine Proposal (Superseded statements 29, 259, 375 and 405) (Assessment 1555, EPA Report 1166)		
July 2005	s. 38	**Revised proposal:** Life-of-mine proposal to mine iron ore within ML 270SA and 47/292, ML47/69, ML47/70 and ML47/71 at a rate of approximately 45 Mtpa, and subsequent rehabilitation and decommissioning of the site, as documented in schedule 1 of MS 679. The proposal incorporated the existing mines at E2, C1, C2 and C5.
May 2006	s. 45C	**Attachment 1:** Expansion of footprint to include one unsealed access road and deviations to one sealed road, including a floodway crossing at Iowa Creek.
December 2007	s. 45C	**Attachment 2:** Increasing mining rate from 45 Mtpa to 65 Mtpa. Increasing groundwater use from 4,000 cubic metres per day to 6,000 cubic metres of groundwater per day recovered from dewatering to support operations. Mobile crushing and screening facilities to support new rate.
September 2008	s. 45C	**Attachment 3:**

Date	EP Act Section	Summary of Approved Proposal and changes/amendments
		Increasing the mining rate from 65 Mtpa to 87 Mtpa and construction and operation of an additional ore handling facility and supporting infrastructure. 350 hectares (ha) of additional disturbance associated with the construction of infrastructure. Increase of water use to up to 10,200 cubic metres per day for dust suppression, ore processing and potable purposes.
December 2013	s. 45C	**Attachment 4:** Increasing the 'mining disturbance area' from 3,450 ha to 4,050 ha Other administrative changes including removing elements from the Key Characteristics Table that are either not considered environmentally relevant or not considered a significant Key Characteristic or that will be managed under the revised 'mining disturbance area' element or by other regulatory authorities.
April 2015	s. 45C	**Attachment 5:** Reallocation of 82 ha from the 'Pits and Overburden Storage Areas' disturbance figure to the 'infrastructure' disturbance figure. Formalising the disturbance allocation by allocating 18 ha of riparian vegetation to a new element 'Marillana Creek Crossings'. Update of figures and include table of coordinates defining Development Areas.
May 2016	s. 45C	**Attachment 6:** Increase the total mining and infrastructure disturbance area by 345 ha to 4,558 ha. Increase the disturbance area associated with diverting Marillana Creek by 163 ha to 393 ha. Amalgamate the 'pits and overburden storage disturbance area' and the 'infrastructure disturbance area'. Remove references to mining leases from the key characteristics table.
October 2016	s. 46	**Change to conditions (MS 1039) (EPA Report 1577):** Amendment of Conditions 5, 7 and 13 of MS 679: Condition 5: Rehabilitation and Decommissioning: • Replaced condition with contemporary wording. Condition 7: Marillana Creek Diversion: • Replaced condition, including amended timeframe for the submission of a Marillana Creek Diversion Plan. Condition 13: Offsets • New condition required the contribution of funds to the Pilbara Environmental Offset Fund (PEOF)for hectares of native vegetation disturbed.

2.1.2 Compliance

BHP reports annually on compliance in Annual Environmental Reports (AERs) submitted to the Department of Water and Environmental Regulation (DWER), with a separate chapter for each MS Compliance Assessment Report. As required by the Referral Instructions (EPA 2024a), BHP has provided the current status and history of compliance with the MS for the current Approved Proposal in Table 2-2.

Table 2-2: Current status and history of compliance

Year	AER	Summary of compliance
MS679 and MS1039: Marillana Creek (Yandi) Life of Mine Proposal		
Current **2023-2024**	AER 2024 (BHP 2024a)	There was one potential non-compliance with MS679 identified within the Financial Year (FY) 2024 reporting period. MS679 *Condition 8-1: Within 12 months following the formal authority issued to the decision-making authorities under section 45(7) of the Environmental Protection Act 1986, the proponent shall prepare a Surface Water and Groundwater Management Plan, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.* *The objectives of this Plan are to:* *• monitor the impact of the proposal on key water parameters; and* *• maintain the quantity and quality of water so that existing and potential environmental values, including ecosystem maintenance, are protected.* BHP have observed tree health decline (and tree mortality) to riparian vegetation, off tenure at "Flat Rocks", where the Marillana Creek intersects with the Channel Iron Deposit (CID). This was first identified in 2019, when BHP determined this tree health decline is a result of lowered groundwater levels attributable to dewatering activities at the western pits at BHPs Yandi operations. BHP has continued to see a decline in tree health since 2019, including through the current reporting period. The current footprint of this impact is approximately 2 ha of riparian vegetation. From August 2022, BHP trialed reduced dewatering activities at the Yandi Western pits. This mitigation has progressively increased and from April 2023 all dewatering activities in W0 have ceased, except for emergency use to supply the standpipe. Since dewatering activities ceased at the western pits, groundwater levels in the area have increased between 16 m at W0 and 0.8 m at the Marillana Creek road crossing. BHP are engaging directly with DWER, DBCA and the Banjima People to progress a mitigation strategy to return water to this area (via reinjection), abate

Year	AER	Summary of compliance
		further tree health decline and rehabilitate affected areas. BHP will continue to implement the Marillana Creek Water Resource Management Plan, including monitoring of groundwater levels across the project area, and continue to engage with DWER, DBCA and the Banjima people to progress a mitigation strategy.
History		
2022-2023	AER 2023 (BHP 2023a)	There was one potential non-compliance with MS679 identified within the FY2023 reporting period. **MS679** *Condition 8-4: The proponent shall implement the Surface Water and Groundwater Management Plan required by condition 8-1.* • To address Condition 8-1 regarding monitoring, the Surface Water Groundwater Management Plan requires Discharge location(s) to be inspected by Environmental personnel/or contractors for indications of environmental harm, in particular the presence of weeds and pest animal species at least every three months. The three-monthly requirement was completed by external contractors for three out of the four quarters. The initial quarter was missed by BHP Environmental personnel due to an administrative error. In response to the potential non-compliance a one monthly statutory weeds inspection workorder was issued to ensure quarterly inspections are completed at discharge location(s) by BHP Environmental personnel/contractors.
2021-2022	AER 2022 (BHP 2022a)	There were two potential non-compliances with MS679 and one potential non-compliance with MS1039 identified within the FY2022 reporting period. **MS679** *Condition 8-4: The proponent shall implement the Surface Water and Groundwater Management Plan required by condition 8-1.* • To address Condition 8-1 regarding monitoring, the Surface Water Groundwater Management Plan (SWGWMP) requires discharge point (MCSW040) and supplementary discharge point (MCSW031) to be analysed as per the parameters in Table 5.1 of the SWGWMP. The parameters in Table 5.1, temperature, Total Nitrogen (total N), Total Phosphorus (total P) and lead (Pb) analytes were excluded during the sampling run, because of an administrative error

Year	AER	Summary of compliance
		following the FY2022 amendment of the Operating Licence. There has been no suspected environmental impact to Marillana Creek because of the excluded analytes. The draft Marillana Creek Water Resource Management Plan has been updated to reflect the amended Operating Licence parameters and a requirement has been added to the annual review of the Monitoring Register to verify back to source that the register has the correct sample points, analytes and trigger values. • To address Condition 8-1 regarding monitoring, the SWGWMP requires for surface water monitoring sites MCSW005 (referred to as YNSWPC001 in L6168/1991/11 Operating Licence) and MCSW002 (referred to as YNSWPC002 in L6168/1991/11 Operating Licence) within the Marillana Creek diversion are required to be sampled and analysed post-flow events as per the parameters set out in Table 5.1. Due to the recent internal deployment of the Environmental Data Management System at BHP the parameters entered into the monitoring register within the system reflected the requirements in the recent amended Operating Licence (13 December 2021), which are different to those stated in Table 5.1 of the SWGWMP. This caused both lead (Pb) and tin (Sn) analytes to be excluded, which are required to be sampled under Table 5.1 of the SWGWMP. There has been no suspected environmental impact to Marillana Creek because of the excluded analytes. Both the Monitoring Register and the chain of custody form to the laboratory has been amended and a requirement has been added to the annual review of the Monitoring Register to verify back to source that the register has the correct sample points, analytes and trigger values. **MS1039** *Condition 7-2: The proponent shall implement the Marillana Creek Diversion Management Plan required by condition 7-1, employing the most suitable design option referred to in 7-1 (3).* • It was identified that the Marillana Creek Diversion Management Plan (MCDMP) has not been fully implemented during the FY2022 reporting period. To address Condition 7-2 (MS 1039) regarding monitoring the MCDMP includes the requirement for three Rising Stage Samplers (RSS's) within the diversion to be sampled and analysed post-flow events as per the parameters set out in Table 4.1 of the MCDMP. However, due to a major review post rainfall event of the parameters required as per

Year	AER	Summary of compliance
		Table 4.1 it was identified that lead (Pb) and tin (Sn) analytes were excluded for RSS's YNSWPC003, YNSWPC004 and YNSWPC005. Data collected from other RSS's was indicative of the creek diversion performing as expected during its establishment phase. Both the Monitoring Register and chain of custody forms have been amended to reflect the parameters required in Table 4.1 and a requirement has been added to the annual review of the Monitoring Register to verify back to source that the register has the correct sample points, analytes, and trigger values.
2020-2021	AER 2021 (BHP 2021)	There were two non-compliances with MS679 and one non-compliance with MS1039 identified within the FY2021 reporting period. **MS679** *Condition 11-2: The proponent shall review and revise the Significant Species Management Programme required by condition 11-1 at intervals not exceeding five years.* The Significant Species Management Plan Rev. 2.0 was required to be implemented under condition 11-1 under Ministerial Statement 679 until it was superseded by the Biodiversity Environmental Management Plan (BEMP) which was endorsed on 16 April 2021. It was identified that the following activities under the SSMP were not conducted or implemented within the FY2021 reporting period: • annual review of the development of State and Commonwealth weed management strategies and action plans where they pose a risk to a significant species (Section 3.3.1, No. 3) • annual review of developments in significant species management methods in the Minerals Industry, via relevant literature and regular consultation with the Department of Biodiversity, Conservation and Attractions (DBCA) (Section 3.3.1, No. 3). Whilst these reviews were not formally conducted, BHP undertakes the following activities which contribute to maintaining contemporary practice: • the Weed Management Procedure lists out the weeds of concern and is updated every 2 years • updates in weed management are discussed at industry and regulator forums including Pilbara Rehabilitation Group • contributing to the development of Western Australian Biodiversity Science Institute weed program

Year	AER	Summary of compliance
		• involvement with the CRC Time research program which will be considering weed management as incidental to several of the projects aimed at sustainable rehabilitation. No further action was proposed as these activities were not included in the revised Biodiversity Environmental Management Plan (BEMP). BHP implemented an improved compliance management system to ensure more reliable implementation of obligations. *Condition 11-3: The proponent shall implement the Significant Species Management Programme required by condition 11-1.* • As per the above non-compliance it was identified that the activities under the Significant Species Management Programme listed above were not conducted or implemented within the FY2021 reporting period. **MS1039** *Condition 7-2: The proponent shall implement the Marillana Creek Diversion Management Plan required by condition 7-1, employing the most suitable design option referred to in 7-1 (3).* *Condition 7-1 (3): design options for the section of Marillana Creek to be diverted.* *Independent technical peer review will be required:* • *to compare the various design options* • *to ensure that the option selected is the most suitable and practicable, consistent with current best practice; and* • *to ensure that at each diversion there is continuous improvement, based on adaptive management and benchmarking against similar projects in Australia and internationally.* There were two flow events during the reporting period that allowed samples to be collected at other Rising Stage Samplers in Marillana Creek on 17 January 2021 and 4 March 2021. It was identified that the Marillana Creek Diversion Management Plan (MCDMP) had not been fully implemented during the reporting period. To address Condition 7-1:10 regarding monitoring, the MCDMP included the requirement for three Rising Stage Samplers (RSS's) within the diversion to be sampled and analysed post-flow events. However, despite several flow events occurring, two years had lapsed (FY2019 and FY2020) since the last water samples were taken from the three RSS's located within the Marillana Creek Diversion at Yandi.

Year	AER	Summary of compliance
		Data collected from other RSS's was indicative of the creek diversion performing as expected during its establishment phase. The Monitoring Register was amended and the RSS's were serviced to ensure that samples could be collected during the next flow event. While there was a process in place to conduct an annual review of the Monitoring Register, it did not include a step to verify that all obligations were included. This was addressed with a requirement to verify back to source that the register has the correct sample points, analytes and trigger values.
2019-2020	AER 2020 (BHP 2020a)	There were two non-compliances or potential non-compliances with Ministerial Statement 679 or Ministerial Statement 1039 identified within the FY2020 reporting period. **MS679** *Condition 1-1: The proponent shall implement the proposal as documented in schedule 1 of this statement, subject to the conditions of this statement.* The proposal is to mine the entire Yandi orebody within Mining Leases 270SA and 47/292 and subsequently rehabilitate all the disturbed areas. A review of the land disturbance activity pursuant to the Ministerial Statement identified that approximately 0.11 ha of land has been cleared outside of the nominated boundary within the FY2020 reporting period. The unauthorised clearing was a result of grading a light vehicle track adjacent to the boundary where the graded material was inadvertently pushed over the boundary for an approximately 200 metre linear length. Resurveying of the boundary was undertaken, with signage and flagging erected in the area. A Project Environmental and Aboriginal Heritage Review (PEAHR) was completed and in place, however this did not prevent the event occurring. **MS1039** *Condition 5-2: The proponent shall review and revise the Mine Closure Plan referred to in condition 1039:M5-2, on the advice of the Department of Mines and Petroleum and to the satisfaction of the CEO, in accordance with the Guidelines for Preparing Mine Closure Plans, May 2015 and any updates, at intervals not exceeding three years from the issue of this Statement, or as otherwise agreed in writing by the CEO.* The Marillana Creek (Yandi) Mine Closure Plan (Revision No. 4, October 2016) was approved by the Office of the Environmental Protection Authority (OEPA) on 17 March 2017. The condition requires

Year	AER	Summary of compliance
		that a revised Mine Closure Plan is updated within three years. The Mine Closure Plan (MCP) Revision 5 was under preparation, however, was not submitted in this timeframe. A letter advising DWER of a delay in completing MCP Revision 5 was submitted on 22 June 2020. The Mine Closure Plan Revision 5 was scheduled for submission by 30 September 2020. While the need for periodic review of the MCP was understood and the work was progressing, the link to a compliance requirement was not identified and an extension was not requested prior to the due date. A review of management plan revision dates was to be inserted into routine compliance monitoring activities within the environmental management system.
2018-2019	AER 2019 (BHP 2019)	There were no non-compliances or potential non-compliances with MS 679 or MS 1039 identified during the FY2019 reporting period.

2.1.3 Environmental performance

BHP includes reporting on environmental performance in AERs. As required by the Referral Instructions (EPA 2024a), BHP has provided a report on the current environmental performance of the current Approved Proposal against the EPA's objectives for environmental factors relevant to the Proposal, and any MS implementation condition environmental outcomes and/or objectives in Table 2-3. As discussed in Table 2-3, BHP considers that BHP's performance against the EPA's objectives for the environmental factors relevant to the Approved Proposal have been met, aside from Inland Waters and Social Surroundings, where BHP are currently investigating mitigation measures associated with dewatering impacts off-tenure at Flat Rocks (see Section 7.5.2.2) and regional dewatering impacts at Yandicoogina Gorge (see Section 7.5.2.3). BHP considers that the existing conditions require amendments to ensure consistency of the ongoing elements of the Combined Proposal and with the EPA's environmental factor objectives. Therefore, as provided for under s40AA(3), BHP considers that the EPA should inquire into the implementation conditions as part of the assessment of the Proposal. See Appendix 3 for proposed draft conditions.

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Table 2-3: Environmental performance report for the Approved Proposal

Ministerial Statement conditions and environmental outcomes/objective	Summary of current environmental performance
Inland Waters: *To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected*	
MS679 Condition 8: Surface Water and Groundwater (preparation of a Surface Water and Groundwater Management Plan) Environmental objective 8-1: • Monitor the impact of the proposal on key water parameters; and • Maintain the quantity and quality of water so that existing and potential environmental values, including ecosystem maintenance, are protected. Condition 9: Pit Lake Salinity Environmental Outcome 9-1 • At all times up to the relinquishment of the leases by the proponent, the proponent shall not cause or allow the Total Dissolved Solids (TDS) concentration in any pit lake to exceed the "critical" level of 8,000 milligrams per litre (mg/L) on one or more occasion in each of three consecutive years. **MS1039** Condition 7: Marillana Creek Diversion (preparation of a Marillana Creek Diversion Management Plan) Environmental objective 7-1:	**MS679 – Condition 8** *Marillana Creek (Yandi) Mine Surface Water and Groundwater Management Plan* (SWGWMP) (BHP Billiton 2014) objectives: 1. Monitor the impact of the proposal on key water parameters 2. Maintain the quantity and quality of water so that existing and potential environmental values, including ecosystem maintenance, are protected. With respect to the following Condition 8 objective: *'monitor the impact of the proposal on key water parameters'* BHP considers the objective has been met. The SWGWMP does not duplicate monitoring and/or controls in other statutory decision-making processes for water-related activities at the Yandi Mine. This includes regulation administered by DWER, i.e. EP Act Part V and RiWI Act. Groundwater quality and abstraction is managed via the RiWI Act 5C Licence to Take Water Groundwater Licence (GWL) 89501(11), which allows for the annual abstraction of 20,650,520 kL of groundwater. The groundwater abstraction is carried out in accordance with the GWL Operating Strategy for Yandi (Marillana Creek) Operations Version 2.0 (BHP Billiton 2018) as stipulated in Condition 3 which: • specifies monitoring at the source (production and dewatering bores) - abstraction rate, abstraction volume, groundwater levels and water quality, noting that the measurement of surplus water quality is not a requirement; and • specifies monitoring along the pathway (regional bores) and receptor (tree health monitoring bores) – groundwater levels. BHP submits Annual Aquifer Reviews (AARs) and Triennial Aquifer Reviews (TARs) to the DWER which describe the aquifer, borefield and abstraction at the Yandi Mine as required by conditions of the GWL 89501. Changes to aquifer levels and aquifer water quality are monitored and reported annually to DWER as per 5C licence requirements. Surplus discharge to Marillana Creek (including water quality) is regulated under the EP Act Part V Environmental Licence L6168/1991/11. The EP Act Licence allows for discharge of excess mine dewatering water (of up to 15,000,000 tpa) to

Ministerial Statement conditions and environmental outcomes/objective	Summary of current environmental performance
• Ensure that diverted sections of Marillana Creek function as a fluvial system in a similar manner to the existing creek system.	Marillana Creek to dispose of water abstracted to facilitate mining below the water table, as well as contingency for discharge to Marillana Creek during wet weather events. Compliance with water quality Licence conditions are reported in the Annual Environment Report. Conditions relevant to this MCWRMP include: • Condition 1: Controls the rates of emissions (discharge of excess mine water) to Marillana Creek; • Condition 12: Specifies the location of the point source emissions (discharge of excess mine water) to Marillana Creek; • Condition 18, 22: Specifies monitoring at the point source of emissions (Marillana Creek) – volumetric flows, physical and chemical properties; averaging period, monitoring frequency, monitoring standards and • Condition 14: Specifies Emission and Discharge limits. With respect to the following Condition 8 objective: *'maintain the quantity and quality of water so that existing and potential environmental values, including ecosystem maintenance, are protected'* BHP considers that this objective has been achieved for water quality, but not water quantity. Based on the data obtained in the FY2024 reporting period, the quality of the water has been maintained, noting certain analytes were excluded in the reporting period. The review of the monitoring implemented demonstrates the quality of groundwater and surface water are reflective of the local environments. Concerning the dewatering impacts on riparian vegetation (i.e. the quantity), this objective has not been achieved during the FY2024. BHP continues to monitor the situation and are actively seeking environmental and tenure approvals to allow implementation of management measures. The management approach of the SWGWMP utilises data collection gained through BHP's Marillana Creek (Yandi) Riparian Vegetation Monitoring Program (RVMP). BHP commenced tree-health monitoring in 1991, to meet proponent commitments related to earlier Ministerial Statements issued for the Yandi mine, both in areas affected by dewatering and areas of surplus-water discharge. The Riparian Vegetation Monitoring Plan (RVMP) was established to meet the requirement of MS 679 Condition 8-1 with respect to monitoring the effects of drawdown from dewatering on phreatophytic vegetation communities within the project area. The RVMP is designed to measure groundwater dependent vegetation (GDV) health and assess the state of riparian vegetation along Marillana Creek, both within the BHP Yandi lease area and in areas west of the lease boundary. Subdivisions at this scale are defined as management zones. Monitoring covers the potential impacts with sub-zonation to reflect key environmental values, defined by demarcation of high value strands of live *Melaleuca argentea* within each zone.

Ministerial Statement conditions and environmental outcomes/objective	Summary of current environmental performance
	There are currently eight active on-ground monitoring sites distributed across the three management zones and a reference map which are used to monitor riparian vegetation currently influenced by dewatering and discharge (Figure 8-15; Section 8.4.2). These sites monitor *M. argentea* stands and are subject to full on-ground assessment. There are also four rapid assessment sites that are all within the drawdown management zones, encompassing the remaining demarcated *M. argentea* stands, which were established in February 2022. These sites were incorporated into the RVMP to address the need to monitor high value stands of live *M. argentea*. These sites are subject to lower intensity on-ground assessment, comprising tree visual health ratings, site condition assessments, and photographs. The sites monitored during the FY2023 and FY2024 reporting period were MC1, MC4, MC4a, MC4b, MC5b, MC7, MC8 and MC9. In the 2023-24 monitoring period, on-ground monitoring was completed in November 2023 and May 2024. Total rainfall received between June 2023 and May 2024 at the Yandi mine was 223.8 mm, which was 112.7 mm below the long-term mean of 336.5 mm and 52.4 mm less than the 276.2 mm received during the previous monitoring period. Within full assessment sites comprising *M. argentea, E. camaldulensis*, and *E. victrix*, visual health scores reflected good to very good tree health at most sites in November 2023, though *M. argentea* tree health at site MC8 remains in poor condition. Plant health criteria exceeded at MC8 (drawdown impact monitoring site) in November 2023, with consecutive exceedance in November 2022 and June 2023. *M. argentea* plant health has trended below control limits at MC8 since the site was established in 2016. In May 2024, the mean Crown Condition Score at potential impact sites MC1, MC5b, and MC8, as well as reference sites MC7, and MC9 were impacted by fire events. Falling groundwater levels within this area since 2016, suggest there is a potential relationship to plant health decline and groundwater drawdown from by BHP. BHP continues to monitor and assess the situation and is actively seeking environmental and tenure approvals to allow implementation of management measures. Overall, monitoring results indicated GDV health declined substantially across much of Marillana Creek during the 2023-24 monitoring period due to bushfire damage, with major negative changes in tree health of high value stands of live *M.argentea* observed. The eucalypt canopy was also impacted by fire, with a recent death of 12 eucalypt sample trees recorded across the survey area. Exceedance of the Pre-Dawn Leaf Water Potential trigger criteria at four sites (MC4, MC4a, MC5b, MC8) across the potential impact survey area in November 2023 may also be an early indication of tree health decline which warrants further investigation. BHP continues to investigate the situation and is actively seeking environmental and tenure approvals to allow implementation of management measures. Groundwater levels within the Drawdown Impact MZ ranged between 423.7 metres relative level (mRL) (in March 2024) to 558.3 mRL between November 2012 and May 2024. Groundwater levels located within the Discharge Impact MZ, ranged between 523.7 mRL (January 2024) to 526.5 mRL (February 2014) between November 2012 and May 2024. Water levels predominantly showed relatively stable trends punctuated by increases, and subsequent decreases, most likely due to short-term recharge after high rainfall events. Water Levels within the CID immediately west of the Yandi lease at Flat rocks have declined by approximately 20 m since 2011.

Ministerial Statement conditions and environmental outcomes/objective	Summary of current environmental performance
	MS679 – Condition 9 Pit Lake Salinity Pit lakes have not been established at this stage and so the associated Ministerial Statement monitoring conditions have not been triggered. **MS1039 - Condition 7** *Marillana Creek Diversion Management Plan* (BHP Billiton 2016) objective: 1. *Ensure that diverted sections of Marillana Creek function as a fluvial system in a similar manner to the existing creek system.* BHP considers that this objective has been achieved in the FY2024 reporting period. Diversion works commenced October 2017 and were completed in November 2019. The Marillana Creek Diversion Management Plan Rev 0 is currently implemented. BHP has complied with all components of the Marillana Creek Diversion Management Plan Rev 0 during the FY2024 reporting period. The Marillana Creek Diversion Management Plan requires Level III monitoring for new diversions until at least three Level III monitoring events have been undertaken. Level 1 monitoring of the diversions was undertaken in FY2024 in accordance with the endorsed Marillana Creek Diversion Management Plan and ARI (average recurrence interval). The highest water level recorded at Flat Rocks Gauging Station during the FY2024 period was 0.597 metres. Using the flood model this represents a peak flow of 40 m^3/s. This recording is well below the peak discharge of 152 m^3/s for an average recurrence interval of two years. A full walk-through of diversions E1 and E4, upstream and downstream reaches was undertaken during the FY2024 reporting period. As part of the monitoring conducted in FY2024, photographs from FY2021, FY2022 and FY2023 were compared with any changes in the landscape noted. LIDAR imagery was additionally undertaken. Overall, no significant changes were observed from FY2022 due to a lack of rainfall, with additional visible improvements to banks identified, and vegetation growth evident.
Flora and Vegetation: *To protect flora and vegetation so that biological diversity and ecological integrity are maintained*	
MS679 Condition 8: Surface Water and Groundwater (preparation of a Surface and Groundwater Management Plan) (Flora and Vegetation)	**MS679 – Condition 8** *Marillana Creek (Yandi) Mine Surface Water and Groundwater Management Plan (MCSWGWMP)* (BHP Billiton 2014) objectives: 1. Monitor the impact of the proposal on key water parameters

Ministerial Statement conditions and environmental outcomes/objective	Summary of current environmental performance
Environmental objective 8-1 (Management Plan 1): • monitor the impact of the proposal on key water parameters; and • maintain the quantity and quality of water so that existing and potential environmental values, including ecosystem maintenance, are protected Condition 11: Conservation of Significant Flora and Fauna (preparation of a Significant Species Management Programme) (Flora and Vegetation) Environmental objective 11-1: • To maintain the abundance, diversity, geographic distribution, conservation status and productivity of flora and fauna at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge. Condition 12: Weeds (preparation of a Weed Management Plan) Environmental objective 12-1 • Minimise the spread of weeds	2. Maintain the quantity and quality of water so that existing and potential environmental values, including ecosystem maintenance, are protected With respect to the following Condition 8 objective: '*maintain the quantity and quality of water so that existing and potential environmental values, including ecosystem maintenance, are protected*' BHP considers that this objective has been achieved for water quality, but not water quantity. See above. **MS679 – Condition 11** *Yandi Biodiversity Environmental Management Plan* (BEMP) (BHP 2020b) objective: *'to maintain the abundance, diversity, geographic distribution, conservation status and productivity of flora and fauna at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge.'* BHP considers that this objective has been achieved. BHP has used a risk-based approach (in addition to specific requirements of Condition 11-1) to identify the management actions, which has considered the following: • No threatened flora or Priority 1 species have been recorded. • Records of seven of the eight priority species known to occur in the Development Envelope are in uncleared areas, mostly along Marillana Creek. • All Priority species are known to occur within 50 km of the Development Envelope (from BHP and DBCA database). • Identification of High risk weed areas. • The priority for weed management detailed in BHP's *Environmental Weed Management in Western Australia Procedure* (BHP 2023b). • Timing of rainfall and weed growth. The key impact to significant flora species at Yandi is the loss of individuals from land clearing. The management actions and targets focus on the tracking of the location of conservation significant flora and the remaining approved clearing allocation and avoiding disturbance to known locations of Priority Flora, where practicable. The key indirect impact to flora and vegetation at Yandi is the potential decline in vegetation condition from the spread of weeds. The management actions and targets (Table 4) focus on the identification and treatment of weeds (particularly in 'high risk' areas) to minimise the spread of weeds and review of weed species that have the potential to be introduced in the Development Envelope.

Ministerial Statement conditions and environmental outcomes/objective	Summary of current environmental performance
	The Yandi Biodiversity Management Plan Revision 0 has been implemented throughout the 2024 reporting period. Any disturbance undertaken at the Yandi mine site undergoes a PEAHR process. BHPs PEAHR process ensures all environmental conditions are considered during an assessment and approval of all clearing activities. Relevant conditions are set within the approved PEAHR prior to the commencement of any vegetation disturbance activities. The PEAHR owner is accountable to ensure that the PEAHR conditions are adhered to during all mining, exploration or projects land disturbance activities. Verification activities are performed to assess compliance. The PEAHR process has continued to be implemented throughout FY2024 and is referenced as a control in the current Yandi Biodiversity Management Plan Rev 0. During the FY2024 reporting period one Targeted Subterranean fauna Survey commenced, with the final round of sampling completed in FY2025. There have been no injuries to significant fauna recorded and no additional unauthorised disturbance of Priority Flora. Feral animal control has continued to be implemented at Yandi in FY2024 including the use of lids on putrescible waste bins, regular covering of waste in the land fill as per the licence requirements and prohibition of domestic animals on site. There have been no increased sightings of dingoes and wild dogs around the Yandi lease from FY2023. BHP are working to implement further management strategies to prevent interactions on site and at accommodation facilities. General alerts and education on the risks of interacting with these animals have been implemented. BHP can confirm that a review of the classification status of the three significant fauna species identified within the development envelope has been undertaken in 2024. All three identified species have not changed in conservation status. Areas containing significant species or habitat within the vicinity of mining have been demarcated and protected via 'exclusion zones' in spatial GIS data provided to teams involved with clearing land. There has been no clearing of significant fauna habitat or current waterways conducted during the FY2024 period. **MS679 – Condition 12** *Yandi Biodiversity Environmental Management Plan (BEMP)* (BHP 2020b) objective: *'Minimise the spread of weed species'*. BHP can confirm that this objective was achieved during the FY2024 reporting period based on a review of the monitoring and management measures implemented during this time. Weed mapping and control occurred in May/June 2024. Multiple sites were targeted and are areas of infrastructure within the lease that see a high volume of vehicle or pedestrian interaction. These areas are likely to be prone to heavy disturbance which is ideal for weed proliferation and spread. These areas include but are not limited to, major light vehicle roads throughout the mining area, crib rooms and office blocks, mining camps, equipment laydown areas, tyre dump area, Eastern and central landfarm, surface water discharge area (MCSW040) and heavy vehicle parking areas. No new weed species were identified within the FY2024 period. This year's program noted a change in the dominant weed species mapped from *Aerva javanica* (kapok bush), *Rumex vesicarius* (ruby dock) and *Cenchrus ciliaris* (buffel grass) in

Ministerial Statement conditions and environmental outcomes/objective	Summary of current environmental performance
	2023 to *Aerva javanica* (kapok bush), *Cenchrus ciliaris* (buffel grass) and *Chloris virgata* (feathertop Rhodes grass) for the FY2024 control period. Between FY2022 and FY2024 there has been a decline in the overall number of each weed species within the development envelope. This can be attributed to the lack of rainfall during the FY2024 period. FY2024 recorded 135mm of rain in the three months prior to the field visit, compared to 138 mm in FY2023, a difference of 3mm. Conditions are outlined within PEAHRs within the Yandi tenure to ensure that earth-moving machinery is free of soil and vegetation prior to entering and leaving the clearing area. BHP considers that the environmental objective in MS679 Conditions 11-1 and 12-1 and the EPA's environmental objective for Flora and Vegetation have been met.
Terrestrial Fauna: *To protect terrestrial fauna so that biological diversity and ecological integrity are maintained*	
MS679 Condition 11: Significant Species Management Program (Terrestrial Fauna) Environmental objective 11-1: • To maintain the abundance, diversity, geographic distribution, conservation status and productivity of flora and fauna at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge.	**MS679 – Condition 11** *Yandi Biodiversity Environmental Management Plan* (BEMP) (BHP 2020b) objective: '*to maintain the abundance, diversity, geographic distribution, conservation status and productivity of flora and fauna at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge.*' BHP considers that this objective has been achieved. BHP has used a risk-based approach, in addition to specific requirements of Condition 11-1 to identify the management actions, which has considered the following: • Threatened fauna have been recorded (Pilbara Olive Python and Northern Quoll), with the Pilbara Olive Python considered more likely to occur within the Development Envelope. • There are large areas of the Major Drainage Line habitat type remaining which is the key habitat type for the Pilbara Olive Python. • The remaining clearing is likely to be adjacent to existing disturbed areas. The key impact to significant fauna species at Yandi is the loss of habitat from clearing. The management actions and targets focus on the tracking of the location of significant fauna and the remaining approved clearing allocation and avoiding disturbance to known records of significant fauna, where practicable. BHP considers that the PEAHR approval process used throughout BHP operational sites to manage ground disturbance activities is the appropriate system to manage the remaining clearing at Yandi, to minimise impacts to significant fauna and their habitat. Key to the PEAHR approval system being effective is the maintenance of current/up to date geographic information system (GIS) spatial layer for records of significant fauna and internal databases using the most current classification of significant

Ministerial Statement conditions and environmental outcomes/objective	Summary of current environmental performance
	fauna. Management actions and targets have been included to ensure the PEAHR approval system reflects the most recent fauna data, and the current classification system of significant fauna is used. As required by Condition 11-1(3), BHP will modify land clearing plans (if required), where practicable, to minimise disturbance to known records of significant fauna records and key habitat (Major Drainage Line). As required by 11-1(4), BHP uses the electronic demarcation of significant species records through 'exclusion zones' in the GIS spatial data, to prevent unauthorised disturbance, and this data is provided to personnel involved with land clearing. BHP considers that electronic demarcation is appropriate because the application of the PEAHR system has avoided most locations of known significant fauna. As required by Condition 11-1(6), BHP will keep records of impacted significant fauna species and their habitat and consult with DWER if a potential significant impact to a significant fauna species is identified. The Yandi BEMP Revision 0 has been implemented throughout the reporting period. The PEAHR process has continued to be implemented throughout FY2024 and is referenced as a control in the current Yandi BEMP Revision 0. During the FY2024 reporting period one Targeted subterranean fauna survey commenced, with the final round of sampling to be completed in FY2025. There have been no injuries to significant fauna recorded. The GIS database for significant fauna and habitats for Yandi is considered current in terms of records and the conservation status of species. The BHP Biodiversity team updates the conservation status of fauna in the Biodiversity GIS layer approximately every six months using updates from the Western Australian Museum, Florabase, gazettes of *Biodiversity Conservation Act 2016* (BC Act) listings and any amendments to DBCA priority listings. Feral animal control has continued to be implemented at Yandi in FY2024 including the use of lids on putrescible waste bins, regular covering of waste in the land fill as per the licence requirements and prohibition of domestic animals on site. There have been no increased sightings of dingoes and wild dogs around the Yandi lease from FY2022. General alerts and education on the risks of interacting with these animals have been implemented. BHP can confirm that a review of the classification status of the three significant fauna species identified within the development envelope has been undertaken in 2024. All three identified species, Northern Quoll - Endangered, EPBC Act; BC Act (2 records); Pilbara Olive Python - Vulnerable EPBC Act, BC Act - (6 records); Western Pebble-mound Mouse - Priority 4, DBCA (1,031 records)have not changed in conservation status. Areas containing significant species or habitat within the vicinity of mining have been demarcated and protected via 'exclusion zones' in spatial GIS data provided to teams involved with clearing land. There has been no clearing of significant fauna habitat or current waterways conducted during the FY2024 period.
Subterranean Fauna: *To protect subterranean fauna so that biological diversity and ecological integrity are maintained*	
MS679	**MS679 – Condition 10**

Ministerial Statement conditions and environmental outcomes/objective	Summary of current environmental performance
Condition 10: Stygofauna (preparation of a Stygofauna Investigation Plan) Environmental Objective 10-1 • To maintain the abundance, diversity, geographic distribution and productivity of stygofauna at species and ecosystem levels through the avoidance or management of adverse impacts and through improvements in knowledge	A regional Stygofauna Investigation Plan was prepared by Biota (2008) and was designed and approved in conjunction with the then Department of Parks and Wildlife and the Western Australian Museum. The Stygofauna Management Plan has not been implemented as significant species were determined from the original surveys to not be impacted within the authorised mining footprint of the Approved Proposal, and it was considered likely that significant species occurred outside of the impacted areas. BHP undertook additional subterranean fauna surveys to support the impact assessment for the proposed E8 pits. During these initial surveys, several subterranean fauna singletons, including troglofauna and stygofauna were identified. BHP undertook further surveys and 3D habitat modelling to positively identify connectivity of subterranean fauna habitat between the current and proposed impact areas with habitat outside those areas, and the occurrence of some of these species outside of the impact area.

2.2 Proposal content

As required by the Proposal Content Instructions (EPA 2024d), the general Proposal content description and Proposal content elements are described in the separate Marillana Creek (Yandi) Significant Amendment Proposal Content Document (Appendix 1).

As the Proposal is a Significant Amendment, the Proposal Content Document describes and tabulates the existing proposal (Approved Proposal), the proposed amendment (the Proposal) and their combination (Combined Proposal).

2.2.1 Proposed Significant Amendment (the Proposal)

As required by the Proposal Content Instructions (EPA 2024d), the general proposal content description and proposal content elements are described in the separate Marillana Creek (Yandi) Life of Mine Proposal Significant Amendment Proposal Content Document (Appendix 1).

As the Yandi mine site heads towards closure, BHP have identified the need to maintain production of iron ore until additional new proposals are defined and assessed. The Proposal is a sustaining tonnes project, vital to ensure continuity of supply. The Proposal (Figure 2-2) includes the following key activities and elements:

- clearing of 95 ha of native vegetation (Indicative Footprint)
- construction of new mine pits, haul roads, light vehicle access tracks and associated infrastructure
- mining of approximately 25 Mt of iron ore from above and below water table over approximately 5 years
- Marillana Creek crossings for haul roads and light vehicle access
- dewatering of up to approximately 4.6 GL/a to access BWT ore in E8 east pit
- discharge of up to approximately 10 GL/a to Marillana Creek.

The Proposal will utilise the existing Ore Handling Plant 3 (OHP 3), authorised under MS 679 and the Part V operating licence, to process the ore mined from the Proposal. The ore will be transported to Port Hedland on the existing rail network. Dewatering and discharge volumes will remain within current authorised limits which are regulated under the RiWI Act and Part V of the EP Act respectively. The Development Envelope for the Combined Proposal is shown in Figure 2-2, and shows the location of the key elements of the Proposal in context with the Approved Proposal including the Indicative Footprint where the key physical elements of the Proposal will occur.

As the Proposal is a Significant Amendment, the Proposal Content Document describes and tabulates the existing Approved Proposal, the Significant Amendment (the Proposal) and the combined maximum extent, capacity or range (Combined Proposal).

2.2.2 Exclusions from the Proposal

The Proposal does not include the following activities assessed for the Approved Proposal:

- Infrastructure and processing of iron ore at the OHP 3, currently approved under the Part V operating licence and existing MS679.

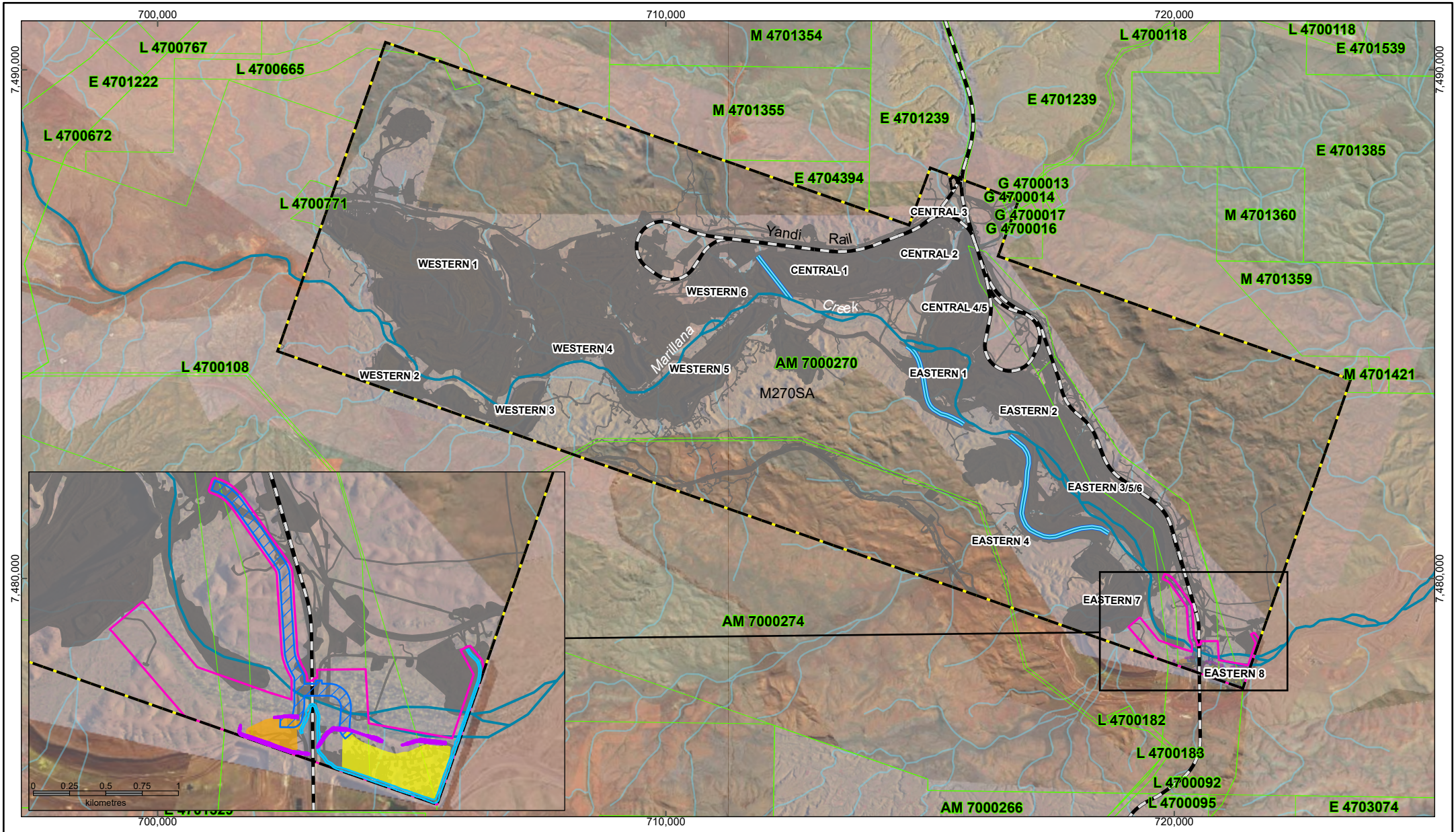
The Approved Proposal authorises production of up 87 Mt/pa of iron ore. The Combined Proposal will only produce approximately 70 Mt of iron ore over a 5-year period, well below the authorised extent of 87 Mtpa currently detailed in Ministerial Statement 679 and the Operating Licence (Category 5 – Crushing and screening activities) L6168/1991/11 issued under Part V of the EP Act.

The Proposal does not include the final closure solution for the Yandi mine. BHP has advanced detailed internal closure studies for Yandi mine since 2019 and continues working towards an optimised and final closure strategy to meet regulatory obligations and an agreed stakeholder solution.

MS 679 and 1039 contain conditions that require the Yandi MCP to be updated at intervals not exceeding three years, and the latest approved MCP (Revision 5) was submitted in 2020. An extension to the submission date for the MS MCP update was approved in 2023 and 2025 to support inclusion of the Proposal into the MCP. BHP will submit an updated Yandi MCP with the referral of the Proposal. That update, once submitted, will detail the latest Yandi closure strategy and knowledge base, including the base E8 closure strategy, whilst acknowledging E8 closure will then need to be considered within the context of the ongoing site-wide Yandi closure study. BHP is actively continuing progressive closure work, such as progressive pit void backfill that proceeds through mining and in parallel with the detailed closure studies, to ensure it continues towards its mine closure objectives.

In conjunction with the detailed closure studies, BHP has, in parallel pursued ongoing discussions and engagements with key stakeholders, especially the Banjima Traditional Owners, to seek input into the closure strategy and inform on closure knowledge. These engagements and ongoing closure investigations will continue in coming years, due to the size and complexity of the Yandi mine. BHP will continue to provide regular progress updates through the Yandi MCP to comply with regulatory requirements as the mine progress towards last ore.

The Proposal does not include mitigation measures for impacts at Flat Rocks (other than reduced dewatering) (see Section 7.5.2.2) or the proposed supplementation trial for Yandicoogina Gorge (See Section 7.5.2.3). Following endorsement from the Banjima Traditional Owners, BHP have committed to a groundwater supplementation trial and hydrogeological investigation using existing approvals to abate groundwater level decline and better understand the observed groundwater decline at Yandicoogina Gorge.



BHP rail
Constructed Creek Diversion
Flood bunds
Indicative Footprint
Development Envelope
BHP Tenement
Adjacent Mining Tenements
Haul Road
LV road
Eastern Pit
Western Pit
Existing Disturbance

N

0 1 2 3 4
kilometres

GDA 1994 MGA ZONE 50

BHP

PUBLIC

MARILLANA CREEK (YANDI)
SIGNIFICANT AMENDMENT
DEVELOPMENT ENVELOPE AND
INDICATIVE FOOTPRINT

WAIO PLANNING, TECHNICAL & ENVIRONMENT

SCALE @ A4:	1:100,000	PREPARED:	GEOMATICS	FIGURE:	2-2
DATE:	24/04/2025	REQUESTOR:	ENV APPROVALS		

A1205-010-RevD

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2.3 Assessment areas

The Proposal elements and activities are located within an Indicative Footprint, within the authorised extent of the Approved Proposal Development Envelope (Table 2-4, Table 2-5). The Development Envelope and the Indicative Footprint are shown in Figure 2-2.

The Development Envelope for the Proposal is the same as the Development Envelope of the Approved Proposal, where impacts have already been assessed and approved.

Table 2-4: Assessment areas

Proposal area	Development Envelope (ha)	Indicative Footprint (ha)	Proposed Clearing (ha)
Approved Proposal (MS679/1039)	13,158	4,558	4,558
Proposal extents – additional area	0	125	95
Total	**13,158**	**4,683**	**4,653**

Table 2-5: Development Envelope breakdown

Component	Area within Development Envelope (ha)
Cleared Area (as at FY2023)[1]	4,492
Approved Proposal Clearing Remaining	66
Proposed Clearing as part of the Proposal	95
Total	**4,653**

1. Includes cleared areas authorised under Part IV of the EP Act only, as at FY2023 when this document was prepared

As required by the Proposal Content Instructions, to provide project flexibility, BHP has assessed potential impacts within all areas that may be subject to a final footprint (i.e. within the Indicative Footprint and within the broader Development Envelope). This provides flexibility for the location of proposal elements, to allow for changes to the project design and/or to avoid or minimise impacts.

2.4 Proposal alternatives

2.4.1 Mine area options

BHP considered a number of strategic options to sustain tonnes of ore from its Yandi mine. Four mine plans were provided for evaluation, these included mining at C3 pit only, mining at E8 pit only, mining at both C3 and E8 pits together and continued mining at existing pits without an expansion into either C3 or E8 pit. Mining of C3 pit was considered with and without the diversion of the Iowa Creek. The C3 option was deprioritised as it would require a diversion of Iowa Creek, which would potentially lead to unfavourable closure outcomes, with the E8 pit being the final preferred option.

2.4.2 Infrastructure options

BHP has undertaken an options analysis of the Proposal as part of the engineering design process and considered various options for the location of non-processing infrastructure at Yandi. In determining the preferred option BHP considered:

- avoiding significant ethnographic and/or archaeological sites

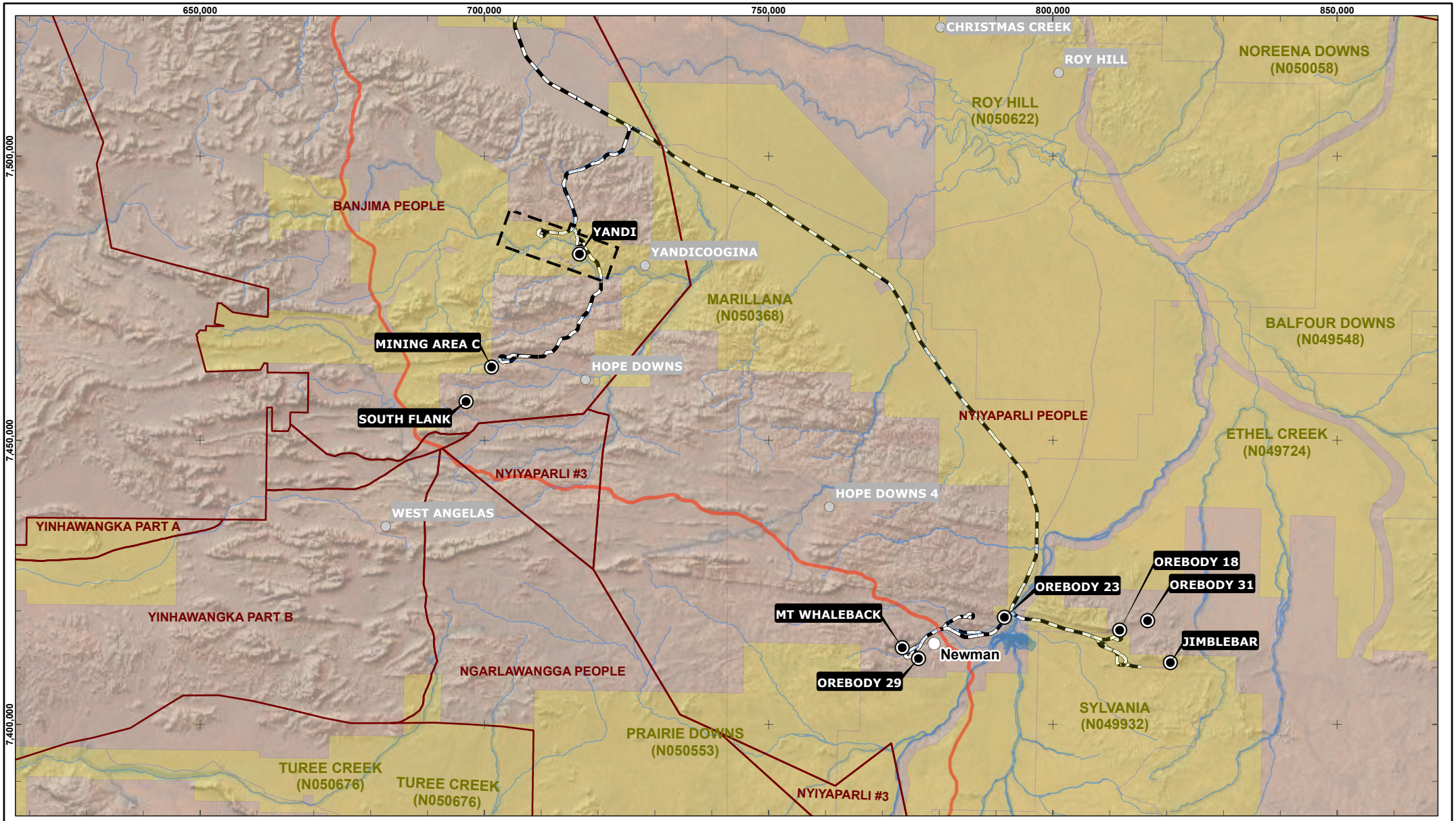
- minimising clearing of native vegetation through project design
- avoiding or minimising physical disturbance to critical habitat for significant fauna
- maximising utilisation of existing disturbed areas.

BHP will utilise the existing ore handling plant located at the Yandi mine site. The Proposal includes the construction of a haul road that will connect to the existing haul road network to facilitate the transport of ore from the E8 pits to the existing Yandi ore handling plant 3.

2.5 Local and regional context

The Proposal is located approximately 90 km to the north-west of the town of Newman in the Pilbara bioregion and Hamersley (PIL3) subregion, as defined by the Interim Biogeographic Regionalisation of Australia (IBRA). The Hamersley subregion is defined 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).

The dominant land use is pastoral and iron ore mining operations, including existing operations at BHP's Yandi and Mining Area C operations and Rio Tinto Iron Ore's (RTIO's) Yandicoogina Mine. Karijini National Park is the nearest conservation reserve, located approximately 34 km to the south-west of the mine site. Mungaroona Range Nature Reserve is located approximately 91 km north-west of the Development Envelope (Figure 2-3).



- BHP mine
- Other mining operations
- Watercourse
- Highway
- BHP rail
- Development Envelope
- Native Title Determinations
- Pastoral lease

N

0 10 20 30

KILOMETRES

GDA 1994 MGA ZONE 50

BHP

PUBLIC

MARILLANA CREEK (YANDI) SIGNIFICANT AMENDMENT

LOCAL AND REGIONAL CONTEXT

WAIO PLANNING, TECHNICAL & ENVIRONMENT

SCALE @ A4:	1:900,000	PREPARED:	GEOMATICS	FIGURE:	2-3
DATE:	1/04/2025	REQUESTOR:	ENV. APPROVALS		

A1205-011-RevC

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3 Legislative context

3.1 Environmental impact assessment process

3.1.1 Part IV of the EP Act

BHP has determined that the proposed amendment to the Approved Proposal is potentially significant and requires referral to the EPA under Part IV, s38 of the EP Act. BHP considers that the significant amendment pathway (as provided for under s40AA) is appropriate as the Proposal extends across the existing Approved Proposal and Development Envelope and is within existing operational areas and new areas.

Should the EPA decide to assess the Proposal, BHP considers that a level of assessment of 'Assess on Referral Information' is appropriate. BHP has undertaken a comprehensive environmental impact assessment, documented in this report and supporting appendices.

3.1.1.1 Type of significant amendment

The type of significant amendment is significant amendment to both the Approved Proposal and the implementation conditions.

3.1.1.2 Existing implementation conditions

As required by the Referral Instructions (EPA 2024a) and ERD Instructions (EPA 2024b), BHP has undertaken an analysis of the existing implementation conditions relating to the Approved Proposal (Appendix 2). BHP considers that the existing conditions require amendments to ensure consistency of the ongoing elements of the Combined Proposal with the EPA's environmental factor objectives. Therefore, as provided for under s40AA(3), BHP considers that the EPA should inquire into and report on the implementation conditions as part of the assessment of the Proposal. As part of the analysis, BHP has also reviewed the extents of the proposal elements in the MSs for the Approved Proposal (Appendix 2).

If the agreement or decision under s45 is that the Proposal may be implemented, BHP requests that the MS for the Approved Proposal (MS679 (as amended by MS1039)), are superseded and one new consolidated MS is issued for the Combined Proposal, as provided for under s40AA(6)(b). This is consistent with BHP's regional hub-based approach. As provided for as an option in the EPA's ERD Instructions, BHP has proposed conditions for the EPA's consideration, in Appendix 3.

3.1.2 Commonwealth EPBC Strategic Approval

BHP has a strategic approval (the Commonwealth Strategic Approval) under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act). The BHP Billiton Iron Ore Pilbara Strategic Assessment Program (BHP 2017a) was endorsed by the Minister for the Environment and Energy on 11 May 2017 and an Approval Decision (with conditions) for taking actions in accordance with the Program was issued on 19 June 2017. The approval covers future activities (actions) within the Strategic Assessment Area. BHP will prepare a Validation Notice for the Proposal.

3.2 Other approvals and regulation

3.2.1 Tenure and State Agreements

The Yandi mining operations are conducted under the *Iron Ore (Marillana Creek) Agreement Act 1991 (WA)* and the *Iron Ore (Mount Goldsworthy) Agreement Act 1964.* The *Iron Ore (Marillana Creek) Agreement Act 1991* will not require amendment to allow implementation of the proposal.

BHP manages tenure holdings and legal structures, as the party to the Yandi Joint Venture (BHP, Itochu Minerals & Energy and Mitsui Iron Ore) and the *Iron Ore (Marillana Creek) Agreement Act 1991* (Marillana Creek State Agreement). BHP currently has legal access to the land where there is existing tenure. The land the subject of the project is Mining Lease 270SA (M270SA) which is granted pursuant to the Marillana Creek State Agreement.

The project interacts with both Miscellaneous Licences 47/92 (L47/92) and 47/95 (L47/95) both held by BHP's Mount Goldsworthy JV under the *Iron Ore (Mount Goldsworthy) Agreement Act 1964*. These licences co-exist with M270SA and are not required for execution of the project.

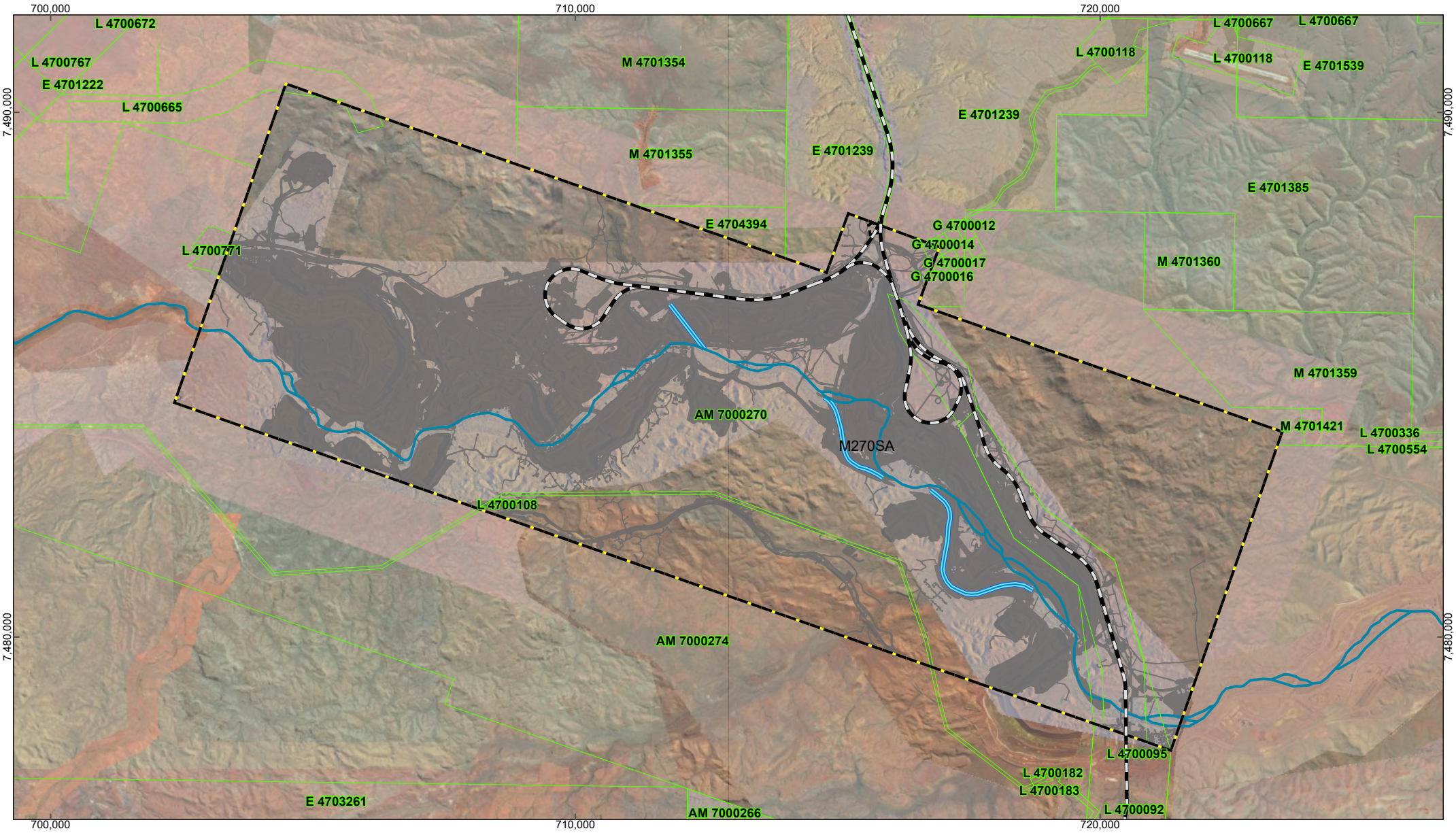
In 2017, Mining Lease 47/292, which is detailed in the original proposal name, was converted into Mining Lease 270SA. As part of the Proposal, BHP will change the description of the proposal to remove reference to Mining Lease 47/292.

The Yandi mining operations are situated on the tenure listed in Table 3-1. Figure 3-1 shows tenure boundaries.

Table 3-1: Marillana Creek (Yandi) tenure

Lease	Description	Legislation
M270SA	Mining Lease - Activities and ancillary works connected with Mining and Exploration under the State Agreement. Incorporates the area of Mining Lease 47/292 which no longer exists.	*Iron Ore (Marillana Creek) Agreement Act, 1991*
K843924	Construction. provisions, extension, use, operation and maintenance on the Land of a railway spur line and access roads and for ancillary and incidental purposes thereto in accordance with approved proposal.	*Iron Ore (Marillana Creek) Agreement Act, 1991*
L47/92	Miscellaneous Licence - Powerline, Road and Communications to service a mining operation	*Iron Ore (Mount Goldsworthy) Agreement Act 1964*
L47/95	Miscellaneous Licence - To conduct all necessary activities for the design and planning of a railway and associated infrastructure for the purposes of submitting proposals for iron ore transportation under Clause 12 of 'the State Agreement ratified by the *Iron Ore (Mount*	*Iron Ore (Mount Goldsworthy) Agreement Act 1964*

Lease	Description	Legislation
	Goldsworthy) Agreement Act 1964 and, from and after approval of such proposals, for the construction operation and maintenance of the railway and associated infrastructure in accordance with and subject to the approved proposal and the State Agreement.	



- BHP rail
- Constructed Creek Diversion
- BHP Tenement
- Adjacent Mining Tenements
- Development Envelope
- Existing Disturbance

N

0 1 2 3 4
kilometres

GDA 1994 MGA ZONE 50

BHP

PUBLIC

MARILLANA CREEK (YANDI) SIGNIFICANT AMENDMENT

TENURE

WAIO PLANNING, TECHNICAL & ENVIRONMENT

SCALE @ A4:	1:98,000	PREPARED:	GEOMATICS	FIGURE:	3-1
DATE:	24/04/2025	REQUESTOR:	ENV APPROVALS		

A1205-059-RevC

Document Path: Y:\Jobs\A1001_A1500\A1205\3Project\A1205_059_E_Yandi_S38_Tenure_RevD.aprx

3.2.2 Other approvals

Table 3-2 outlines other state approvals that are required for mining operations at Yandi for the Proposal.

Table 3-2: Other approvals

Decision-making authority	Legislation or Agreement regulating the activity	Approval required (and relevant proposal element)	Statutory decision-making process can mitigate impacts on the environment?
Chief Executive Officer (CEO) DWER	EP Act – Part V	Works Approval and /or Licence amendment updating Figure 1 Map of the boundary of the prescribed premises and arrangement of major infrastructure to detail existing ore body and dewater discharge point	**Yes** Licence contains limits and conditions to mitigate certain impacts on the environment relevant to prescribed premises. Regulated through amendment to existing Yandi (Marillana Creek) Iron Ore Mine operating licence L6168/1991/11 authorises dewatering discharge of 15,000,000 tonnes per annum.
Minister for Water DWER	RiWI Act	s26D Licence to construct or alter wells (installation of new groundwater bores) s5C Licence to take water (groundwater abstraction, including for dewatering of E8 east pit) s17 Permit to interfere with bed and banks (creek crossing for haul roads and access tracks)	**Yes** Abstraction licence contains limits and conditions (including Groundwater operating strategy) to mitigate impacts on the environment. Regulated through amendment to existing Yandi (Marillana Creek) Iron Ore Mine licence. Groundwater Licence (GWL) 89501(11) authorises an annual water entitlement of 20.65GL/a. Bed and banks permit contains terms, conditions and limits relating to the design and construction of proposed works.
Minister for Aboriginal Affairs	*Aboriginal Heritage Act 1972* (AH Act)	AH Act s18 consent to disturb, if previously unidentified sites are recorded and cannot be avoided.	**Yes** s18 of the AH Act allows for the approval and conditioning of land uses which may disturb heritage sites.
Minister for State Development	*Iron Ore (Marillana Creek) Agreement Act 1991 (WA)*	State Agreement Act Approval under State Agreement Act for development and operation of mine and associated infrastructure	No
Chief Dangerous Goods Officer Department of Energy, Mines, Industry	*Dangerous Goods Safety Act 2004*	Dangerous goods licence	No

Decision-making authority	Legislation or Agreement regulating the activity	Approval required (and relevant proposal element)	Statutory decision-making process can mitigate impacts on the environment?
Regulation and Safety (DEMIRS)			
State Mining Engineer DEMIRS	*Mines Safety and Inspection Act 1994*	Approval to commence mining operations	No
Department of Climate Change, Energy, the Environment and Water (DCCEEW)	EPBC Act	Approval to undertake a controlled action. Validation Notice	**Yes** Validation Notice contains conditions to limit/mitigate certain impacts on matters of National environmental significance.

4 Stakeholder engagement

4.1 Key stakeholders

During the development of the Proposal, BHP undertook targeted stakeholder engagement based the scale of the Proposal, the interest in the Proposal and proximity to the Proposal location. Further consultation with other key stakeholders will be carried out during assessment of the Proposal. The key stakeholders for the Proposal are summarised in Table 4-1.

Table 4-1: Key stakeholders

Stakeholder group	Stakeholder
State Government	DWER DJTSI DEMIRS
Commonwealth Government	DCCEEW
Traditional Owners, Native Title Claimants and Representative Bodies	Banjima Traditional Owners, through Banjima Native Title Aboriginal Corporation (BNTAC)

4.2 Stakeholder engagement process

BHP meets regularly with the key stakeholders identified in Table 4-1 with the objective of facilitating regular, open and honest dialogue and to understand expectations, concerns and interests of stakeholders and to consider them into business planning.

4.3 Stakeholder consultation outcomes

Table 4-2 summarises stakeholder consultation undertaken specifically for the Proposal.

Table 4-2: Stakeholder engagement

Stakeholder	Date	Topics/issues raised	BHP response / outcome
DWER EPA Services	9 April 2025. Perth	Pre-referral meeting to further discuss the Proposal, discuss key factors in more detail, predicted impacts and proposed management measures	BHP notified DWER that the intention was to refer the Proposal in May 2025
Banjima representatives, BNTAC	21 March 2025, Perth	BHP sought endorsement for the E8 SCHEMP from the Banjima Heritage Advisory Council (Banjima HAC).	The Banjima HAC provided conditional support and the BNTAC Board of Directors formally endorsed the resolution on 8 April 2025.
Banjima representatives, BNTAC	6 September 2024, Perth	BHP sought endorsement from the Banjima Heritage Advisory Council (Banjima HAC) of the E8 SCHEMP	BHP agreed to defer the request to endorse the SCHEMP until the other matters were adequately resolved.
DWER-EPA Services, Northwest Region	4 September 2024, Perth	Pre-referral meeting to further discuss the Proposal, discuss key factors in more detail, predicted impacts and proposed management measures, with a particular focus on Inland Waters.	BHP notified DWER that the intention was to refer the Proposal in late 2024/early 2025.
BNTAC	30 August 2024, Perth	BHP and BNTAC undertook a workshop to review the technical details of environmental impact assessment presented in the Environmental Review Document (ERD), and the management measures provided in the management plans and Mine Closure Plan.	Review of draft ERD and associated management plans. BNTAC raised a number of technical queries regarding the impact assessment and management actions detailed in the ERD and management plans. BHP have responded to the questions raised and updated the ERD and supporting management plans to provide additional information and clarity.
Banjima representatives, BNTAC	6 and 7 June 2024, Perth	BHP provided an overview of the Proposal for E8 and tabled the SCHEMP for endorsement.	Banjima advised they were not in a position to endorse the SCHEMP. BHP agreed to provide the ERD for Banjima review.
DWER-EPA Services	20 March 2024, Perth	Pre-referral meeting to introduce the Proposal, discuss key factors, predicted impacts and proposed management measures.	BHP notified DWER that the intention was to refer the Proposal in April 2024.

Stakeholder	Date	Topics/issues raised	BHP response / outcome
DWER	10 January 2024, Perth	Meeting to discuss implementation of the current Approved Proposal and mitigation strategies for Flat Rocks and Yandicoogina Gorge. BHP provided an overview of the E8 proposal	BHP to provide a technical memo detailing proposed mitigation measures for Yandicoogina Gorge.
Banjima representatives, BNTAC	6-7 December 2023, Perth	BHP provided an overview of the engagement between Banjima and BHP to date for the E8 proposal, including issues raised by Banjima and recommendations/ commitments made by BHP. These include: • Amendment to the Indicative Footprint on the western side to provide options to the Haul road. • BHP to identify and implement mitigation option/s to mitigate tree health decline at Flat Rocks, Yandicoogina and Marillana Creeks • BHP to engage with Banjima on management plans applicable to the Proposal. • BHP to provide opportunity for Banjima to be involved in and undertake environmental monitoring, surveys and rehabilitation activities for the Proposal BHP to share key environmental data metrics which can be monitored through time by Banjima people. BHP sought endorsement of the SCHEMP.	Banjima acknowledged the good work that BHP had undertaken in regard to social surroundings engagement and mitigation planning progress for Flat Rocks and Yandicoogina Gorge. Regardless, Banjima were not in a position to support or endorse the SCHEMP.
Banjima representatives, BNTAC	2 November 2023, Perth	BHP provided an overview of the Proposal for E8 (reduced scope now excluding C3 and Iowa creek diversion) and summary of recommendations from previous engagement.	No further recommendations were provided during this one-day engagement. BHP will continue working with Banjima on ongoing commitments/ recommendations
BNTAC	20 October 2023, Perth	BHP and BNTAC came together following concerns raised by Banjima regarding water values and mine closure at Yandi mine. The objective of the workshop was to develop a mitigation strategy to address these concerns. BNTAC and the Banjima People provided feedback on the SCHEMP.	BHP amended the SCHEMP in accordance with BNTAC and the Banjima People's feedback.

Stakeholder	Date	Topics/issues raised	BHP response / outcome
Banjima representatives, BNTAC	26 – 27 September 2023, Perth	Banjima HAC meeting in Perth, BHP provided a project overview of Yandi E8 including identification of existing values, potential impacts and proposed environmental management to the committee members. The outcomes of the Water and Closure workshop were shared.	Further information on Yandi E8 proposal provided to Banjima and Nov 23 consultation arranged. Requested further engagement on the project does not need to be in the field.
BHP/ RTIO/ BNTAC	25 August 2023, Perth	BHP, Rio Tinto (RTIO) and BNTAC workshop, developing a mitigation strategy for closure outcomes and impacts to water values. RTIO joined workshop, in recognition and acknowledgement that impacts to these water values are shared and cumulative in nature. BHP presented proposed mitigation for Flat Rocks. BHP presented the closure strategy for E8, including backfill of the mine pit to returning groundwater level around invert level of the creek.	BHP/ RTIO agreed on pathway forward to develop collaborative solutions to shared challenges. • Flat Rocks aquifer recovery • Yandi/ Yandicoogina Closure Strategy (long term) • Flat Rocks aquifer recovery • Yandi/ Yandicoogina Closure (long term) • E8 closure solution (near term) BNTAC supported the solution presented for Flat Rocks.
BHP/ BNTAC	14 – 15 July 2023, Perth	BHP and BNTAC came together following concerns raised by Banjima regarding water values and mine closure at Yandi mine. The objective of the workshop was to develop a mitigation strategy to address these concerns including Flat Rocks and the Yandicoogina Gorge groundwater decline observations.	BHP committed to an implementation strategy to abate groundwater decline at Yandicoogina Gorge, including continued engagement with Banjima throughout implementation. • Abatement and implementation strategy further defined. BNTAC supported the development of mitigation strategies
Banjima representatives, BNTAC	23 June 2023, Perth	Banjima HAC meeting in Perth, BHP provided a summary of the Social Surroundings consultation that took place a week prior and responded to comments/ concerns raised by Banjima during the Social Surroundings consultation. BHP presented an understanding of groundwater decline at Flat Rocks, which is understood to potentially be an impact of mine dewatering in the Western Pits. BHP committed to mitigation activities at Flat Rocks. BHP presented monitoring information showing declining groundwater levels across the Ministers North tenement, along with observations of declining groundwater dependent ecosystem health within Yandicoogina Gorge. While the	BHP committed to providing greater clarity on closure challenges and complexity with backfilling all pit voids. BHP committed to backfilling E8 to above water table. BHP committed to an implementation strategy to abate groundwater decline at Yandicoogina Gorge, including continued engagement with Banjima throughout implementation. BHP commit to facilitating a “Water Workshop” between BNTAC and BHP, focusing on water management across Banjima country.

Stakeholder	Date	Topics/issues raised	BHP response / outcome
		potential causes of this decline are still under investigation, potential causes include climate variability (rainfall) or a combination of climate variability and regional groundwater drawdown for mining (BHP and third-party). BHP shared the preliminary proposal for a mitigation trial to stabilise groundwater levels and sought feedback from Banjima. BHP advised Banjima of engagement with RTIO and intended engagement with DWER on the above.	Banjima reinforced feedback from on-country consultation with regards to the proposal. Additionally, Banjima supported BHPs mitigation action at Flat Rocks and advised this is the highest priority, and requested further information is provided on Yandicoogina Gorge.

Banjima representatives, BNTAC,	13-15th June 2023, Yandi Mine	During the consultation, Banjima representatives raised several concerns relating to likely and possible impacts on the physical and biological surroundings and the related potential harm to Social Surroundings.
		
		During and following consultation Banjima provided feedback and requested further information regarding:
		• Mining Design
		  ○ Depth of E8 deposit
		  ○ Final design of C3 land bridge
		• Water Management
		  ○ Importance of water to Banjima People
		  ○ Distance of E8 pit to Marillana Creek
		  ○ Flat Rock Spring mitigation actions
		  ○ Mining below water table
		  ○ E7 discharge point
		• Biodiversity / Land
		  ○ Importance of biodiversity values in C3 areas
		  ○ Spatial data capture for additional hectares
			BHP committed to providing the information requested by Banjima People.
			
			BHP committed to working with Banjima to provide further information and investigate and mitigate impacts at Flat Rocks.
			BHP committed to co-developing the SCHEMP with Banjima People.

Stakeholder	Date	Topics/issues raised	BHP response / outcome
		○ Cumulative impacts to Pebble Mound Mouse population • Closure ○ Encouraged by Yandi rehabilitation nursery ○ Strong preference for not having pit lakes	
Banjima representatives, BNTAC	22 March 2023, Perth	Banjima HAC meeting in Perth, BHP provided a project overview of the Yandi Proposal including identification of existing environmental values, potential impacts and proposed environmental management to the committee members.	Banjima representatives requested a site visit with Senior Elders, BHP General Managers and relevant Subject Matter Experts to discuss management of impacts to water on country. BHP committed to an on-country consultation as requested.
Banjima representatives, BNTAC	22 November 2022, Perth	Banjima HAC meeting. BHP provided a project overview on identification of existing environmental values, potential impacts and proposed environmental management to the committee members. Banjima representatives identified water as a significant cultural value for BHP to draw focus to.	BHP committed to inviting water experts to the next consultation and providing further information on current modelling.

5 Object and principles of the EP Act

The Object of the EP Act (s4A) is to protect the environment of the State, having regard to the principles in s4A of the EP Act. Table 5-1 outlines BHP's consideration of the Object and principles of the EP Act in relation to the Proposal.

Table 5-1: Object and principles of the EP Act

Principle	Consideration
1. The precautionary principle *Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.* *In application of this precautionary principle, decisions should be guided by:* *(a) careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and* (b) *an assessment of the risk-weighted consequences of various options.*	BHP has undertaken hydrological studies and biodiversity surveys (Appendix 4, Appendix 8, Appendix 12, Appendix 15) to provide sufficient scientific information to inform the assessment of risks and potential impacts on the environment from the Proposal (Sections 7 to 13). In designing the Proposal, BHP has considered this information by considering different alternatives (Section 2.4) and applying the mitigation hierarchy (Sections 7.5, 8.5, 9.5, 10.5, 11.5 and 0) to avoid and minimise impacts on the environment to ensure that the EPA objective for each key environmental factor will be met.
2. The principle of intergenerational equity *The present generation should ensure that the health, diversity and productivity of the environment is maintained and enhanced for the benefit of future generations.*	BHP has demonstrated how it has applied the mitigation hierarchy (Sections 7.5, 8.5, 0, 10.5, 0 and 0) to avoid, minimise and rehabilitate environmental impacts, to maintain the health, diversity and productivity of the environment into the future. BHP has undertaken social surroundings engagement with Banjima representatives (through BNTAC) to understand the aspects of the environment that are important to the Banjima Traditional Owners. BHP and BNTAC co-developed a SCHEMP which was endorsed by the Banjima Heritage Advisory Council. The SCHEMP includes commitments for ongoing engagement throughout life of the Proposal including in relation to rehabilitation. BHP has also updated the Marillana Creek (Yandi) Mine Closure Plan (Yandi MCP; Appendix 5) which has an overarching closure objective to develop a safe, stable, non-polluting and sustainable landscape that is consistent with social and environmental values agreed by key stakeholders. This includes considering closure issues of interest to the Banjima and returning the site to a post-mining land use that is consistent with the pre-mining environment and is viable for future generations.
3. The principle of the conservation of biological diversity and ecological integrity *Conservation of biological diversity and ecological integrity should be a fundamental consideration.*	BHP has considered biodiversity and hydrological information from recent surveys and studies completed for this Proposal and from extensive knowledge gained from numerous surveys and studies completed for Yandi since the early 1990s, when BHP acquired the Yandi operations. The principle of conservation of biological diversity and ecological integrity is a key consideration for the Proposal as it is also part of the EPA's objectives for the land biodiversity factors of Flora and Vegetation, Terrestrial Fauna and Subterranean Fauna. BHP has considered this principle through the assessment of these factors (Sections 8 to 10). Through the Proposal design and application of the mitigation hierarchy,

Principle	Consideration
	BHP considers that biological diversity and ecological integrity will be conserved.
4. Principles relating to improved valuation, pricing and incentive mechanisms *(1) Environmental factors should be included in the valuation of assets and services.* *(2) The polluter pays principles – those who generate pollution and waste should bear the cost of containment, avoidance and abatement.* *(3) The users of goods and services should pay prices based on the full life-cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste.* *(4) Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, which enable those best placed to maximise benefits and/or minimise costs to develop their own solutions and responses to environmental problems.*	BHP accepts that it is responsible for the costs relating to the management of waste and any pollution, including avoidance, containment, decommissioning, rehabilitation and closure. BHP recognises that cumulative GHG emissions are a contributor to climate change and that the cumulative emissions from the Proposal will contribute to WA's GHG emissions. BHP will bear the cost of emission reduction and offset strategies to minimise BHP's contribution to greenhouse gas emissions over the life of the Proposal. The storage, treatment, movement and disposal of waste is a key consideration for the Proposal, as the minimisation of waste provides an environmental and financial benefit. BHP's Life of Mine waste strategy is informed by the Yandi MCP.
5. The principle of waste minimisation *All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment.*	Standard waste management measures are a key element for the implementation of this Proposal. It is standard practice for BHP to apply the waste management hierarchy to all sites and this will be the case in relation to this Proposal (i.e. avoidance, reuse, recycling, recovery of energy, treatment, containment and disposal). BHP has outlined the measures to minimise greenhouse gas emissions in Section 12.5. BHP's closure philosophy for Yandi is to minimise ex-pit waste through the backfill of waste into mined-out pit voids, as outlined in the Yandi MCP.
Description of how the object of the EP Act has been considered: The Object of the EP Act is 'to protect the environment of the State', having regard to the five principles outlined above. BHP has considered this Object by addressing each of the principles above, in terms of the potential impacts the Combined Proposal could have on the environment of the State.	

6 Environmental factors

BHP considered the various matters that the EPA may have regard to in considering the significance of potential impacts, as outlined in the EPA's Procedures Manual (EPA 2021a) and Statement of environmental principles, factors, objectives and aims of environmental impact assessment (EPA 2023a). Table 6-1 summarises whether BHP has identified that an environmental factor is a preliminary key environmental factor (i.e. those factors that may be significantly impacted by the Proposal) for the assessment of the Proposal.

Table 6-1: Identification of preliminary key environmental factors for the Proposal

Environmental factor	Potential environmental impacts	Preliminary key environmental factor for the Proposal
Land		
Flora and Vegetation	• loss of vegetation and flora from clearing (direct) • loss of and changes to vegetation from changes to groundwater regimes (indirect) • changes to vegetation from changes to surface water regimes (indirect) • changes to vegetation and flora from dust, fire and weeds (indirect)	**Yes** (Section 8)
Terrestrial Fauna	• loss of fauna habitat and individuals/species records due to clearing (direct) • mortality or injury from vehicle strike and/or interactions with machinery/infrastructure (indirect) • changes to and loss of fauna habitats from changes to groundwater regimes (indirect) • changes to fauna habitats from changes to surface water regimes (indirect) • disturbances to fauna from increased light, noise, vibration and dust (indirect) • disturbances to fauna from invasive or introduced species (indirect) •	**Yes** (Section 9)
Subterranean Fauna	• changes to stygofauna habitat and species assemblages from groundwater drawdown (direct) • degradation of stygofauna habitat (indirect) • loss or modification of troglofauna habitat and species assemblages from mine pit excavation (direct) • degradation of troglofauna habitat (indirect) •	**Yes** (Section 10)
Landforms	• erosion of natural landforms • modification of natural landforms	**No** (Section 13)
Terrestrial Environmental Quality	• increased erosion, including waste structures • contamination of land	**No** (Section 13)

Environmental factor	Potential environmental impacts	Preliminary key environmental factor for the Proposal
Water		
Inland Waters	• changes to groundwater regimes • changes to surface water regimes • changes to water quality	**Yes** (Section 7)
Air		
Air Quality	• particulate emissions (dust)	**No** (Section 13)
Greenhouse Gas Emissions	• cumulative greenhouse gas emissions are a contributor to climate change. The cumulative emissions from the Combined Proposal will contribute to WA's greenhouse gas emissions	**Yes** (Section 12)
People		
Social Surroundings	• disturbance of cultural heritage sites and values (direct) • impacts to access, landscape, and amenity (direct) • degradation of social, cultural and heritage values (indirect)	**Yes** (Section 11)

BHP's assessment of the preliminary key environmental factors is detailed in Sections 7 to 12.

As discussed in Section 2.3, the Development Envelope for the Proposal is the same as the Development Envelope of the Approved Proposal (Figure 2-2) where impacts have already been assessed and approved. BHP has provided information on the Approved Proposal so that the EPA can consider the environmental effects of the Proposal in the context of the Approved Proposal. BHP has also outlined the combined effects which the implementation of the Combined Proposal might have on the environment.

BHP's evaluation of 'other environmental factors' is summarised in Section 13. This includes justification as to why BHP considers that they are not preliminary key environmental factors.

7 Inland Waters

7.1 EPA environmental factor and objective

The EPA's objective for the Inland Waters factor is:

> *To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected.*

7.2 Relevant policy and guidance

BHP assessed this environmental factor considering the following EPA policies and guidance, as outlined in Table 7-1.

Table 7-1: Inland Waters - policy and guidance

EPA (and other State and Commonwealth) policy and guidance	Consideration of EPA policy and guidance
Environmental Factor Guideline – Inland Waters (EPA 2018a)	• Considered the links with other environmental factors • Applied the relevant considerations for environmental impact assessment • Considered the environmental values supported by or dependent on Inland Waters, and their significance • Undertook investigations and studies consistent with the Information required for environmental impact assessment
Use of mine dewatering surplus (DWER 2020)	• Determined the mine dewatering surplus • Considered regulatory requirements • Considered use of surplus water, including cumulative impacts and water quality
Western Australian Water in Mining Guideline (DoW 2013)	Undertook the following consistent with the guideline: • considered options for surplus water from mine dewatering and potential impacts, including cumulative impacts
DWER Operational Policy 5.12- Hydrogeological reporting associated with a groundwater well licence (DoW 2009)	Considered during the development of this document and the impact assessment of Inland Waters.

7.3 Receiving environment

7.3.1 Studies and surveys

Table 7-2 summarises the specific studies undertaken by BHP to support the assessment of Inland Waters for the Proposal, in the context of the Combined Proposal. Other supporting information is referenced in these documents, where relevant.

BHP considers that the studies meet the relevant EPA guidance to support the assessment of Inland Waters for the Proposal.

Table 7-2: Inland Waters – studies and management plans

Title	Date	Summary	Appendix
Surface water			
Marillana Creek Water Resource Management Plan v2 (BHP 2025c)	2025	Proposed to supersede the Marillana Creek (Yandi) Mine Surface Water and Groundwater Management Plan (BHP Billiton 2014). This plan was prepared to align with the EPA's revised March 2024 *Instructions on how to prepare Environmental Protection Act 1986 Part IV Environmental Management Plans.*	Appendix 6
Marillana Creek Baseline Hydrology Study: Yandi Closure Landform SPS (Advisian 2023)	2023	Baseline hydrology and flood study of Marillana Creek.	Appendix 4
Groundwater			
Yandi Conceptual Hydrogeological Model (BHP 2024c)	2024	Hydrogeological analysis of collected data and main processes to develop a numerical model.	Appendix 4
Ministers North Aquifer: Numerical groundwater modelling (BHP 2024d)	2024	Analysis of impact of rainfall on Ministers North Aquifer groundwater levels	Appendix 4
BHP Yandi E8 Groundwater Model: Yandi Western Australia (INTERA 2023)	2023	Numerical modelling report outlining the predicted impacts of groundwater abstraction required for mine operations.	Appendix 4
Yandi Borefields Triannual Aquifer Review (BHP 2022b)	2022	Compliance reporting for GWL8950.	Appendix 4
Yandi Borefields Annual Aquifer Review (BHP 2024b)	2024	Compliance reporting for GWL8950.	Appendix 4
Memorandum Flat Rocks Pool Hydrological Conceptualisation (BHP 2019)	2019	Hydrogeologic conceptualisation of the Flat Rocks Area	Appendix 4

7.3.2 Existing environment

7.3.2.1 Climate

The Development Envelope is in the Pilbara region which has a semi-arid to arid climate with hot summers and mild winters. Rainfall in the Pilbara throughout the year is variable, most rainfall occurs from December to March ('wet season') through tropical lows and cyclones, with reduced rainfall occurring during the remainder of the year ('dry season').

DWER has operated the Marillana Creek Flat Rocks rainfall station (505011) immediately upstream of the Development Envelope since 1972. Average annual rainfall at the station between 1972 and 2022 was 390 mm (DWER 2023a).

The annual potential evaporation for the Marillana Creek region is estimated to be 1,800 mm (Golder Associates 2015). Annual average evaporation potential is in excess of the annual average rainfall in the Marillana Creek region which creates a moisture deficit in the environment.

7.3.2.2 Surface water catchments and features

Surface water catchments

At the regional scale, the Development Envelope is located within the Marillana Creek Catchment which is located within the Fortescue River Basin (Figure 7-1). The Marillana Creek catchment is 2,050 km^2 within the much larger Fortescue Marsh catchment which is 30,279 km^2. Surface water features in the Development Envelope are ephemeral and flow in response to direct rainfall events, as such flows are highly seasonal and variable coincident with the December to March wet season.

The surface water hydrology of the Development Envelope is predominantly characterised by Marillana Creek and its tributaries. Marillana Creek traverses the Development Envelope in a generally eastward direction towards its confluence with Weeli Wolli Creek which then travels in a northern direction to ultimately discharge to Fortescue Marsh.

Marillana Creek diversion

An element of the Approved Proposal included diversion of sections of Marillana Creek to maximise resource use and access to orebodies. The alignment of Marillana Creek has changed considerably throughout the Development Envelope to avoid impacting mining operations. The Proposal does not require further diversion of the Creek. The approved diversion is managed through the Marillana Creek Diversion Management Plan which was a condition of approval in MS 679 and MS 1039 (BHP Billiton 2016).

Marillana Creek pools

A series of semi-permanent to permanent pools occur along Marillana Creek, upstream of the Development Envelope (Figure 7-2; Table 7-3). A study conducted by Biologic (2024b, 2023e, 2022a) investigated the following pools:

- Tributary of Marillana Creek (MarC1): One semi- permanent unnamed pool located on a tributary which flows into Marillana Creek approximately 3 km upstream of the Development Envelope.
- Marillana Creek: Three semi-permanent unnamed pools (MarC2, MarC4, MarC5) and one ephemeral pool (MarC3) located downstream of the confluence with the un-named tributary.
- Marillana Creek: One semi-permanent named pool (MarC6; Flat Rocks), partially within the Development Envelope on the western side.

A summary of the pools is provided in Table 7-3.

Table 7-3: Summary of Marillana Creek Pools

Site	Pool Type	Description
MarC1 (tributary)	Semi-permanent pools	Series of semi- permanent, shallow pools and riffles located on an un-named tributary of Marillana Creek. Mineral substrate dominated by pebbles and gravel, with small amounts of bedrock, cobbles, silt and clay. Maximum water depth of 0.2 m in both seasons.
MarC2	Semi-permanent pools	Series of semi-permanent, shallow pools located on the main channel of Marillana Creek, downstream of the confluence with the un-named tributary. Mineral substrate predominately comprised of pebbles and gravel, with some cobbles and silt also present. The maximum water depth was 0.3 m in the dry and 0.4 m in the wet.

Site	Pool Type	Description
MarC3	Ephemeral pool	Long open pool over bedrock. Substrate dominated by bedrock. Maximum water depth of 0.6 m in both seasons.
MarC4	Small semi- permanent pool	A small (15 m long, 11 m wide) semi-permanent pool. Mineral substrate was heterogenous, comprising bedrock, pebbles, gravel, sand and silt. Maximum water depth of 0.7 m recorded in the dry and 0.4 m in the wet.
MarC5	Semi-permanent pool	Series of permanent, shallow pools. Mineral substrate dominated by gravel and pebbles, with low amounts of bedrock, cobbles, sand and silt. The maximum water depth recorded was 0.3 m in the dry and 1.8 m in the wet.
MarC6 (Flat Rocks)	Semi-permanent pool	Semi-permanent pool part of the area colloquially referred to as Flat Rocks (Streamtec 2004). Likely was permanent historically. Most downstream site on Marillana Creek within the Study Area. Though located upstream of current mining operations, this site is thought to be impacted by drawdown (WRM 2018). Substrate comprising bedrock and clay, with small amounts of boulders, cobbles, pebbles, gravel and silt. Maximum water depth was 0.15 m in the dry and 1.5 m in the wet.

Source: Biologic 2024b, 2023e, 2022a

Flat Rocks

Flat Rocks is an area that occurs along a 2.5 km stretch of the Marillana Creek river bed, 1 km upstream of the Development Envelope from downstream of Flat Rocks Road and the western side of the Development Envelope (Figure 7-2; Plate 7-1). Flat Rocks consists of several permanent, semi-permanent and ephemeral pools with associated riparian vegetation and groundwater dependent vegetation. DWER operate a gauging station (No. 708001) at Flat Rocks, approximately 300 m west of the Development Envelope. See Plate 7-1, for locations described above.

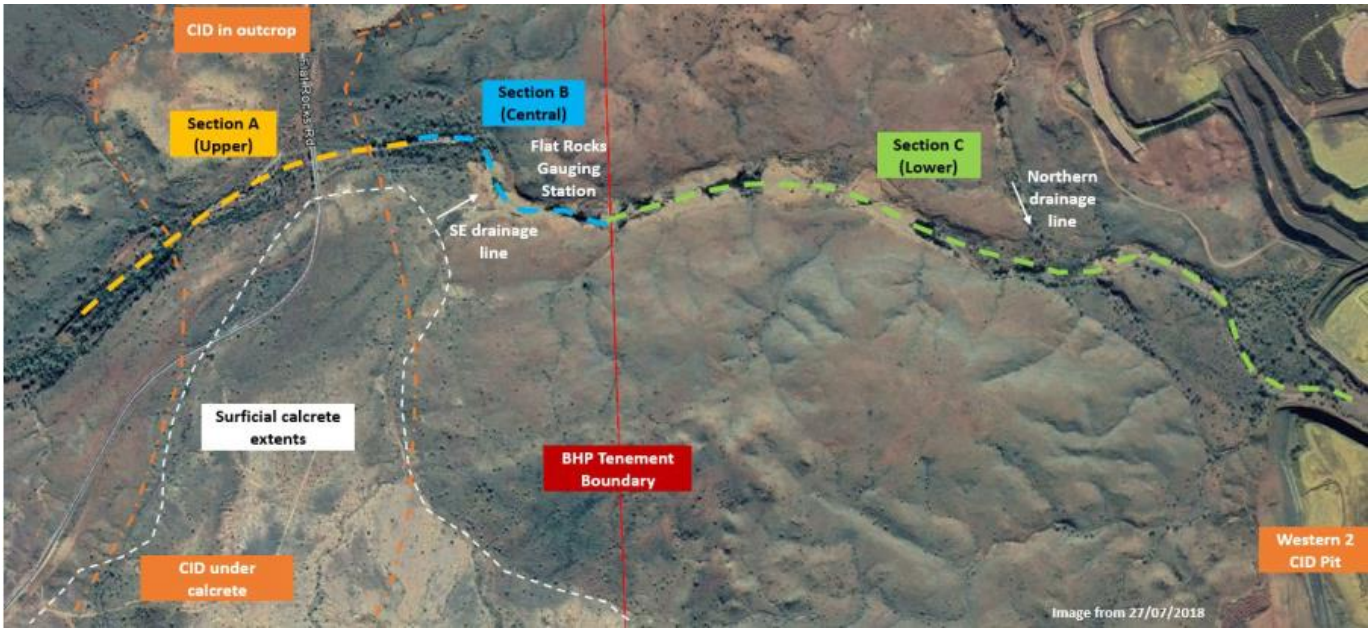


Plate 7-1: Full Extent of "Flat Rocks" reach of Marillana Creek

A summary of the surface water and groundwater interactions in Flat Rocks is described below, for further information refer to the Flat Rocks Pool Hydrological Conceptualisation (BHP 2019a) in Appendix 4.

Historically, the creek, alluvial and CID aquifers interacted to maintain a healthy groundwater dependent ecosystem at the Flat Rocks road crossing. The upper portion of the reach is where the CID aquifer outcrops in the creek bed creating a direct connection between the creek flows and alluvial aquifer (shown as Section A in Plate 7-1). Downstream of the CID intersection is the central reach (Section B in Plate 7-1) which is an area of Flat Rocks that contains a series of semi-permanent pools.

The central reach contains relatively thick alluvium and is underlain by the Weeli Wolli Formation as either Shaley Banded Iron Formation (BIF) or dolerite, both relatively impermeable units. The alluvial aquifer in the Central reach fills during creek flow events, via seepage from surficial calcrete to the south and historically supported by the CID aquifer. A dolerite bar, located in the central reach, dams water in the alluvium providing slow seepage and often allowing pools to be sustained throughout the dry season. The presence and extent of water in pools is influenced by several factors, to differing degrees, depending on location including:

- rainfall and associated creek flow
- geomorphology and grade of the creek bed
- interactions with underlying aquifers.

Generally, the upper reaches are driven by the geology and discharge from the underlying aquifer and the lower reaches by the presence of water in flat sections of the creek bed. Management and mitigation of impacts to the hydrological regime and associated riparian vegetation has been undertaken through the Surface Water and Groundwater Management Plan (BHP 2014) and is reported on annually for compliance with Condition 8 of MS 1039.

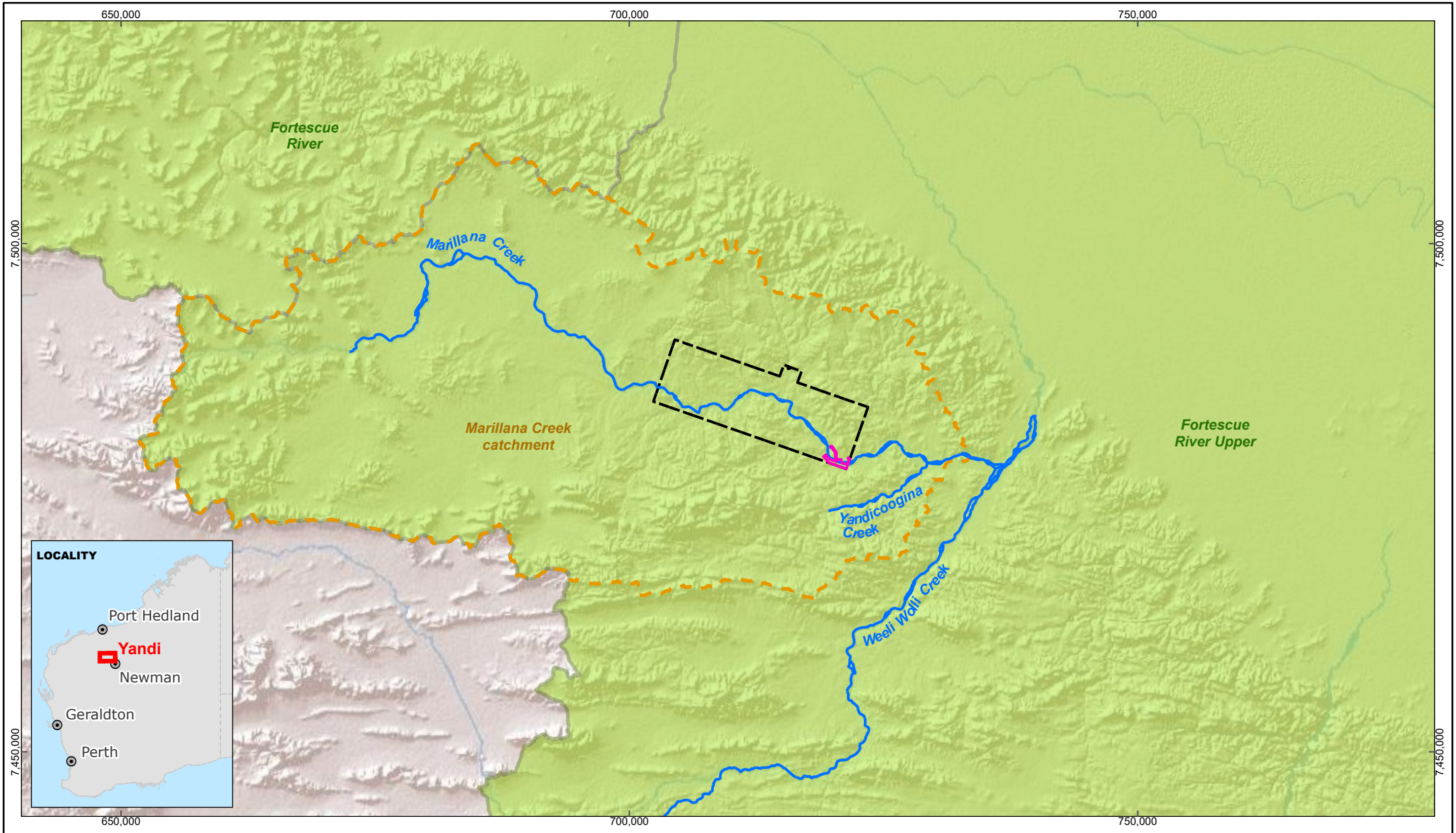
There are no natural pools present in the stretch of Marillana Creek to the north side of the Indicative Footprint or downstream of the Development Envelope. An artificial pool is located immediately north of the Indicative Footprint, as a result of continuous surplus water discharge from that location. The artificial pool is shown on Figure 7-2.

Creek discharge

The DWER License to Operate L6168/1991/10 for the Approved Proposal includes approval to discharge up to 15,000,000 tpa of mine dewater (41.1 mega litres per day (ML/day)). Since 2018, dewatering volumes have declined as the dewatering objective moves from drawing down water levels to maintaining water levels resulting in less surplus water being discharged.

In FY2024, total surplus water generated from mine dewatering discharged into Marillana from the Development Envelope was approximately 1,267,318 tpa, well within the allowable licensed rate. The discharge of this water is continuous throughout the year and has created a permanent pool. The associated wetting front extends downstream from the discharge point to beyond the boundary of the Development Envelope.

The wetting front was analysed in 2013 and defined by aerial imagery. It was estimated that the wetting front from an average discharge of 22.5 ML/day produced a wetting front length of approximately 6.5 km.



Watercourse
Indicative Footprint
Development Envelope
Marillana Creek Catchment
Fortescue River Basins

N
0 2 4 6 8 10
kilometres
GDA 1994 MGA ZONE 50

BHP

PUBLIC

MARILLANA CREEK (YANDI) SIGNIFICANT AMENDMENT

SURFACE WATER CATCHMENTS

WAIO PLANNING, TECHNICAL & ENVIRONMENT

SCALE @ A4:	1:500,000	PREPARED:	GEOMATICS	FIGURE:	7-1
DATE:	1/04/2025	REQUESTOR:	ENV APPROVALS		

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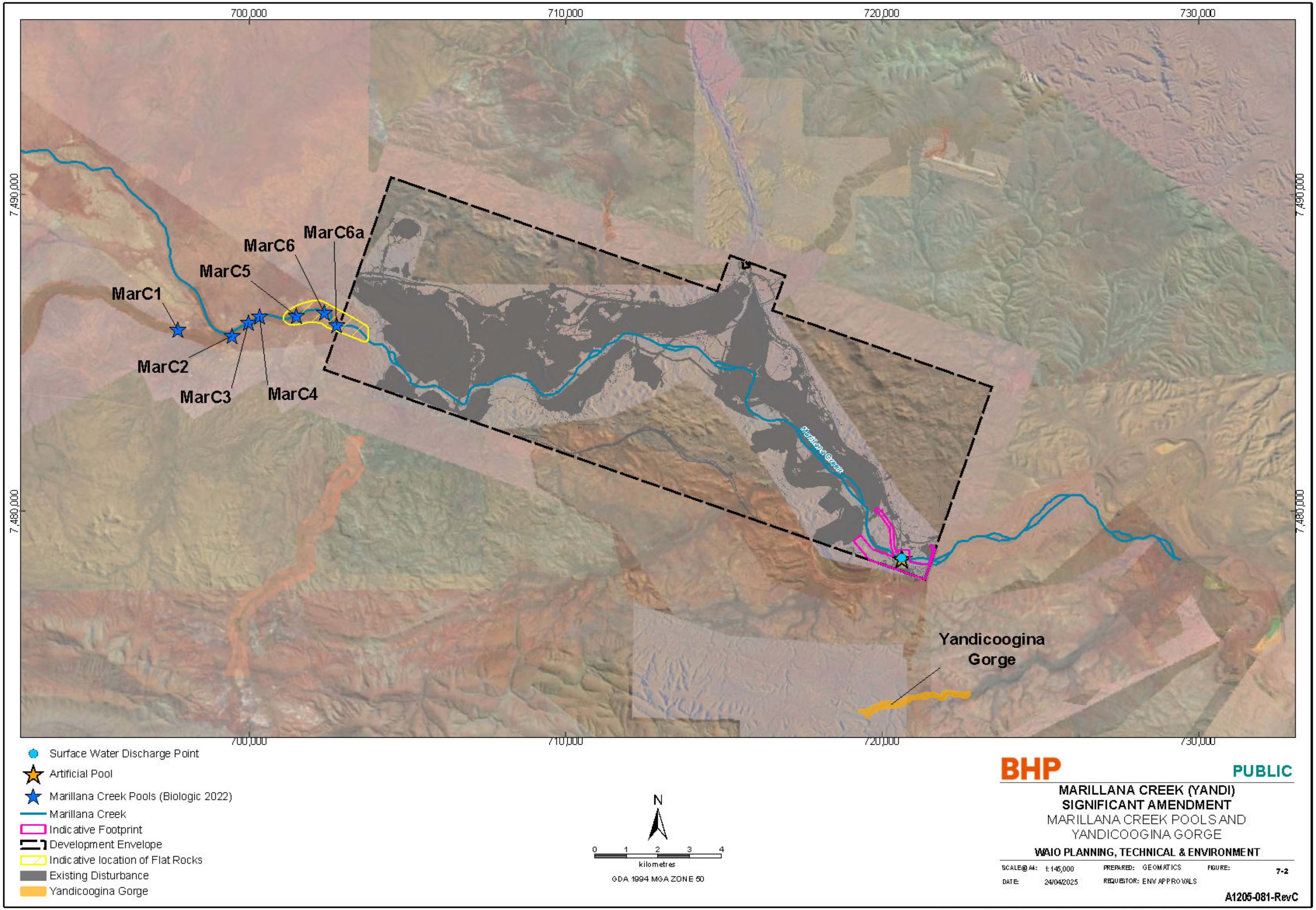


700,000
710,000
720,000
730,000
7,490,000
7,480,000
MarC1
MarC2
MarC3
MarC4
MarC5
MarC6
MarC6a
Marillana Creek
Yandicoogina Gorge
Surface Water Discharge Point
Artificial Pool
Marillana Creek Pools (Biologic 2022)
Marillana Creek
Indicative Footprint
Development Envelope
Indicative location of Flat Rocks
Existing Disturbance
Yandicoogina Gorge
N
0 1 2 3 4
kilometres
GDA 1994 MGA ZONE 50
BHP
PUBLIC
MARILLANA CREEK (YANDI)
SIGNIFICANT AMENDMENT
MARILLANA CREEK POOLS AND
YANDICOOGINA GORGE
WAIO PLANNING, TECHNICAL & ENVIRONMENT
SCALE@A4: 1:145,000
PREPARED: GEOMATICS
FIGURE: 7-2
DATE: 24/04/2025
REQUESTOR: ENV APPROVALS
A1205-081-RevC

7.3.2.3 Surface water quality

Surface water quality is monitored according to the Yandi Surface Water and Groundwater Management Plan (BHP 2014) and reported in the BHP AER. Two surface water monitoring sites are located along Marillana Creek and monitored following rain events for physical parameters, nutrients, metals and total recoverable hydrocarbons.

In FY2024 and FY2023 annual reporting there were no significant rain events to generate enough volume for sampling to be undertaken, as a result no samples were analysed in 2023 and 2024 (BHP 2024a). In FY 2022, three samples were collected, the results show that surface water generated in Marillana Creek was slightly alkaline with pH between 7.5 and 7.8 and samples were fresh with an average TDS of 206 mg/L (BHP 2022a). There were no exceedances for trigger levels in FY2022. No exceedances were recorded in FY2023 and FY2024 as no samples were able to be collected.

Surplus water discharge is authorised at two locations along Marillana Creek MCSW040 (main discharge, located north of the proposed E8 pit) and MCSW031(supplementary). Quarterly testing of water quality is reported in the BHP AER at both locations consistent with the requirements of Yandi Operating License L6168/1991/11 (BHP 2024a).

In FY2024, the discharge at MCSW040 reported the following water quality results:

- Neutral pH with an average of 7.6
- Fresh water with an average TDS of 537 milligrams per litre (mg/L)
- Most reported heavy metals and total recoverable hydrocarbons were reported as below the laboratory's detectable limit
- Concentrations for Boron ranged between 0.34 mg/L and 0.45 mg/L which are below the BHP internal trigger level and within the Australia and New Zealand Guidelines for Fresh and Marine Water Quality trigger value for freshwater 90%-95% protection of species (ANZECC & ARMCANZ 2000)
- Concentrations for Total Nitrogen ranged from 0.69 mg/L to 4 mg/L which are below BHP internal trigger values of 5 mg/L but slightly above the Australia and New Zealand Guidelines for Fresh and Marine Water Quality Tropical Australia default trigger value for total nitrogen of 0.2 mg/L-0.3 mg/L (ANZECC & ARMCANZ 2000).

Surplus water quality was generally within accepted guideline values with the exception of Total Nitrogen. Nitrate and nitrogen detections in surplus water discharge are likely derived from explosive use within the Development Envelope and are also present in groundwater (discussed below).

7.3.2.4 Surface water flooding and flow regime

Streamflow data from the Marillana Creek gauging station (No. 708001) indicates that flow in Marillana Creek is driven by cyclonic rainfall events with little to no flow outside these events (DWER 2023a).

The available flow data from the Flat Rocks gauging station covers the period from 1967 to present and indicates that total annual discharge from the stream varies widely from a maximum of 144,500 mega litres per annum (ML/a) in 1975 to a minimum of 5.8 mega litres per annum (ML/a) in 2023. The historic maximum flow was recorded in 1976 with a recorded flow of 1,328 metres cubed per second (m^3/s), the last major flood event at Flat Rocks was recorded in 2003 with a corresponding flow of 727 m^3/s (Advisian 2023).

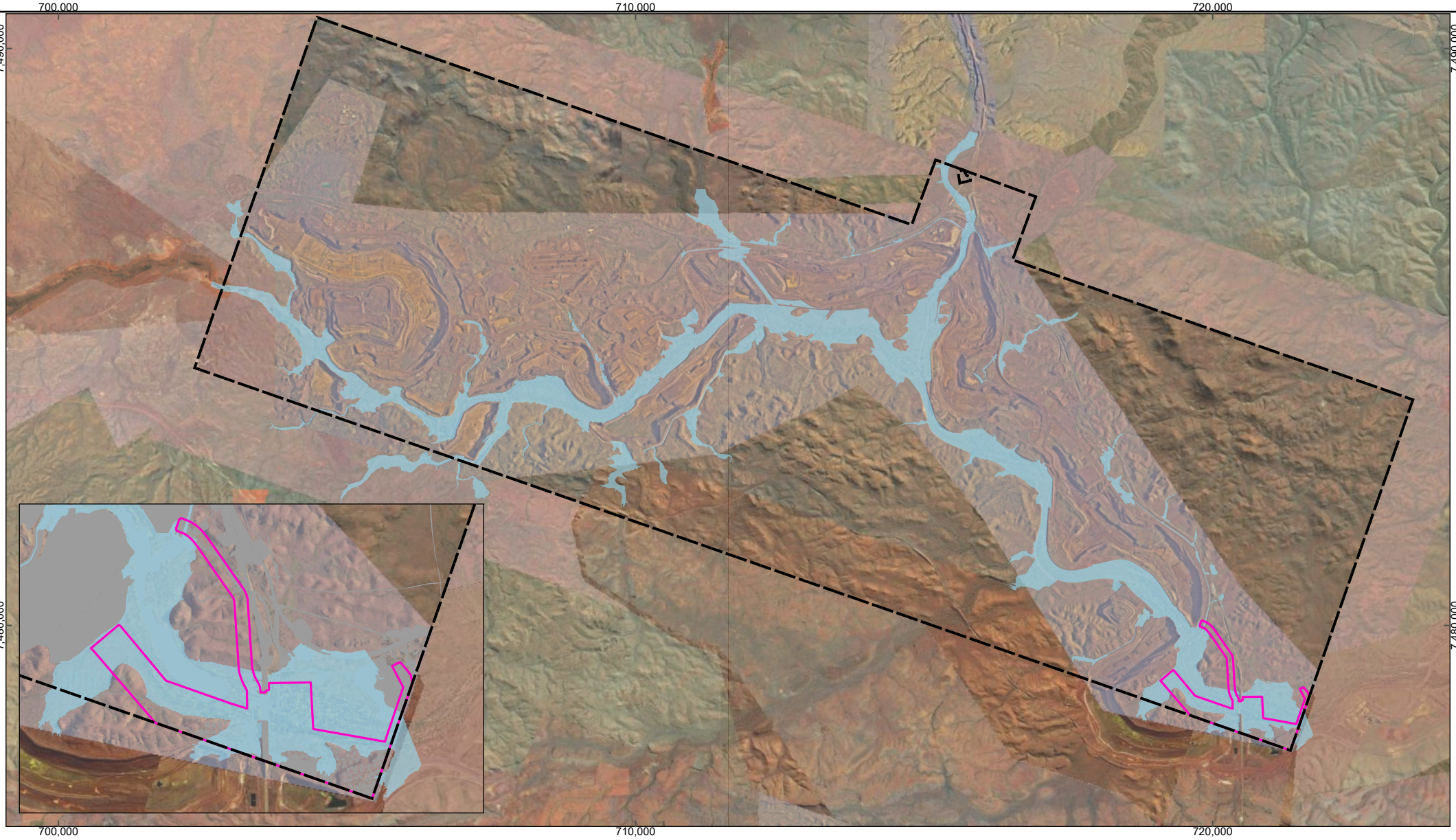
The Marillana Creek Flood Study was undertaken by Advisian in 2023 to update the hydrologic and hydraulic model of the Marillana Creek System to assist in informing the review of the Yandi MCP. This Flood Study updated the 2012 and 2014 flood study reporting by incorporating an additional eight years of data from Flat Rocks gauging station and adopted the updated standards for hydrological modelling in Australian Rainfall & Runoff (Ball et al 2019).

Flows in Marillana Creek were estimated for a range of annual exceedance probability events (AEPs) from 10% through to 1 in 10,000 at a range of locations within the Development Envelope (Advisian 2023). Table 7-4 provides a summary of the design flows across the Development Envelope and vicinity, with Flat Rocks representing the upstream western boundary and BHP Rail representing the downstream eastern boundary.

Table 7-4: Adopted Design Flows (Advisian 2023)

Location	Average Exceedance Probability (AEP)		
	10% m^3/s	2% m^3/s	1% m^3/s
Flat Rocks	493	1,398	1,898
BHP Rail (Downstream)	532	1,895	2,553

Advisian compiled a hydraulic model to determine the flood extent of Marillana Creek in the 1% AEP peak flow event. Flood depths were determined between 0.5 m to 3 m and extend into the Indicative Footprint as shown in Figure 7-3 below.



1% AEP flood extent
Indicative Footprint
Development Envelope

N

0 1 2 3 4
kilometres

GDA 1994 MGA ZONE 50

BHP

PUBLIC

MARILLANA CREEK (YANDI)
SIGNIFICANT AMENDMENT
MARILLANA CREEK 1%
AEP FLOOD DEPTH

WAIO PLANNING, TECHNICAL & ENVIRONMENT

SCALE @ A4:	1:90,000	PREPARED:	GEOMATICS	FIGURE:	7-3
DATE:	1/04/2025	REQUESTOR:	ENV APPROVALS		

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7.3.2.5 Surface water dependent ecosystems

Ephemeral surface water flows in Marillana Creek support riparian vegetation characterised by *Eucalyptus camaldulensis*, *Eucalyptus victrix* and *Melaleuca argentea*. *Eucalyptus camaldulensis* and *Eucalyptus victrix* are facultative phreatophytes and *Melaleuca argentea* is an obligate phreatophyte (Onshore 2015). Details on vegetation survey and potential impacts to riparian vegetation are presented in Section 8.

A diverse range of aquatic fauna has been recorded within the Marillana Creek Pools including 488 native aquatic invertebrate taxa (across zooplankton, hyporheic, rehydrate and macroinvertebrate lists), two freshwater fish species (Spangled Perch and Pilbara Tandan) and two frog species (Biologic 2024b). Details on aquatic fauna survey and potential impacts to fauna habitat are presented in Section 9.

7.3.2.6 Hydrogeology

The aquifer system of the Development Envelope can be broadly classified into three hydrogeological units:

1. The shallow alluvial aquifer associated with Marillana Creek. A hydraulic connection exists between the Marillana alluvium and the CID aquifer where the two units interface and cross. Elsewhere, the hydraulic connectivity is limited (BHP 2022b)

2. The Marillana Formation, which incorporates the CID paleochannel orebody, is a strip aquifer extending approximately 85 km in length and is the main aquifer in the local area, of which 39 km are within the Development Envelope. The aquifer is heterogeneous, and its permeability varies due to anisotropy, both vertically and laterally. Zones of higher permeability are associated with secondary porosity feature, such as cavities (millimetres to metres in dimension). Marginal sediments have low permeability but can still transmit groundwater where cavities exist. Permeability is lowest within the Lower CID and Basal Clay/Conglomerate, although there are also zones of cavernous permeability within the Lower CID (BHP 2022b)

3. The Weeli Wolli Formation surrounds the CID and presents highly variable characteristics. Immediately beneath and adjacent to the CID it is likely that the Weeli Wolli Formation presents an elevated hydraulic conductivity due to weathering. However, beyond this zone the hydraulic conductivity may range from very low to moderate and storage is low (BHP 2024c).

Extensive groundwater studies, testing and monitoring have been undertaken prior to and since the commencement of mining. The Yandi Conceptual Hydrogeological Model (BHP 2024c) describes the hydrogeology and conceptualisation of the Development Envelope (Appendix 4).

7.3.2.7 Groundwater levels

Groundwater levels generally fall in an easterly direction consistent with the flowpath of Marillana Creek. Pre-mining groundwater elevations are estimated as 601 mAHD on the western side of the Development Envelope falling to 520 mAHD on the eastern side (BHP 2024c; Figure 7-4).

Groundwater abstraction for dewatering activities commenced in the Development Envelope in the Eastern part of the CID in 1991 and peaked between 2012 and 2015.

Since dewatering commenced, long-term groundwater monitoring has been carried out, as part of the requirements under existing groundwater licences issued under the RiWI Act (see Section 7.3.2.8). There are over 20 groundwater monitoring bores throughout the Development Envelope, measured for groundwater levels and water chemistry for license compliance.

Detailed analysis of groundwater levels across the Development Envelope is provided in the Yandi Conceptual Hydrogeological Model (BHP 2024c) in Appendix 4 and summarised below.

Alluvial aquifer

Groundwater levels in the Marillana Creek alluvium aquifer system fluctuate with seasonal rainfall and streamflow. During creek flow events the alluvium can become fully saturated with increases in water levels ranging from 3 m-12 m (subsurface) (BHP 2024c). Once wet season rains subside groundwater levels in the alluvium also subside and monitoring has shown that most bores will dry out completely or retain a few meters of water (BHP 2024c). The only exception to this is groundwater bore HYM0011M in the alluvium near the Indicative Footprint which maintains an almost fully saturated profile year-round regardless of rainfall due to its proximity to the surplus water discharge outlet.

CID aquifer

Drawdown from dewatering the CID has been migrating both west (upstream) and east (downstream) along the CID. At the eastern end of the Development Envelope cumulative drawdown is occurring due to the presence of third-party dewatering.

The timing of when drawdown reaches its maximum varies depending on location, but the maximum observed groundwater drawdown (within the Development Envelope) has reached approximately 50 m to 60 m in the CID in the Eastern / Central and Western pits.

In the west of the Development Envelope, groundwater levels:

- were roughly stable until 2011,
- declined between 2011 and 2022 (in response to dewatering), and then
- recovered slightly between 2022 and early 2025 (in response to a reduction in local dewatering).

For example, at bore HYW0005M, on the western boundary of the Development Envelope, the CID groundwater level fell from 599 mAHD in 2009 to 546 mAHD in 2022 but then rebounded to 563.5 mAHD in January 2025.

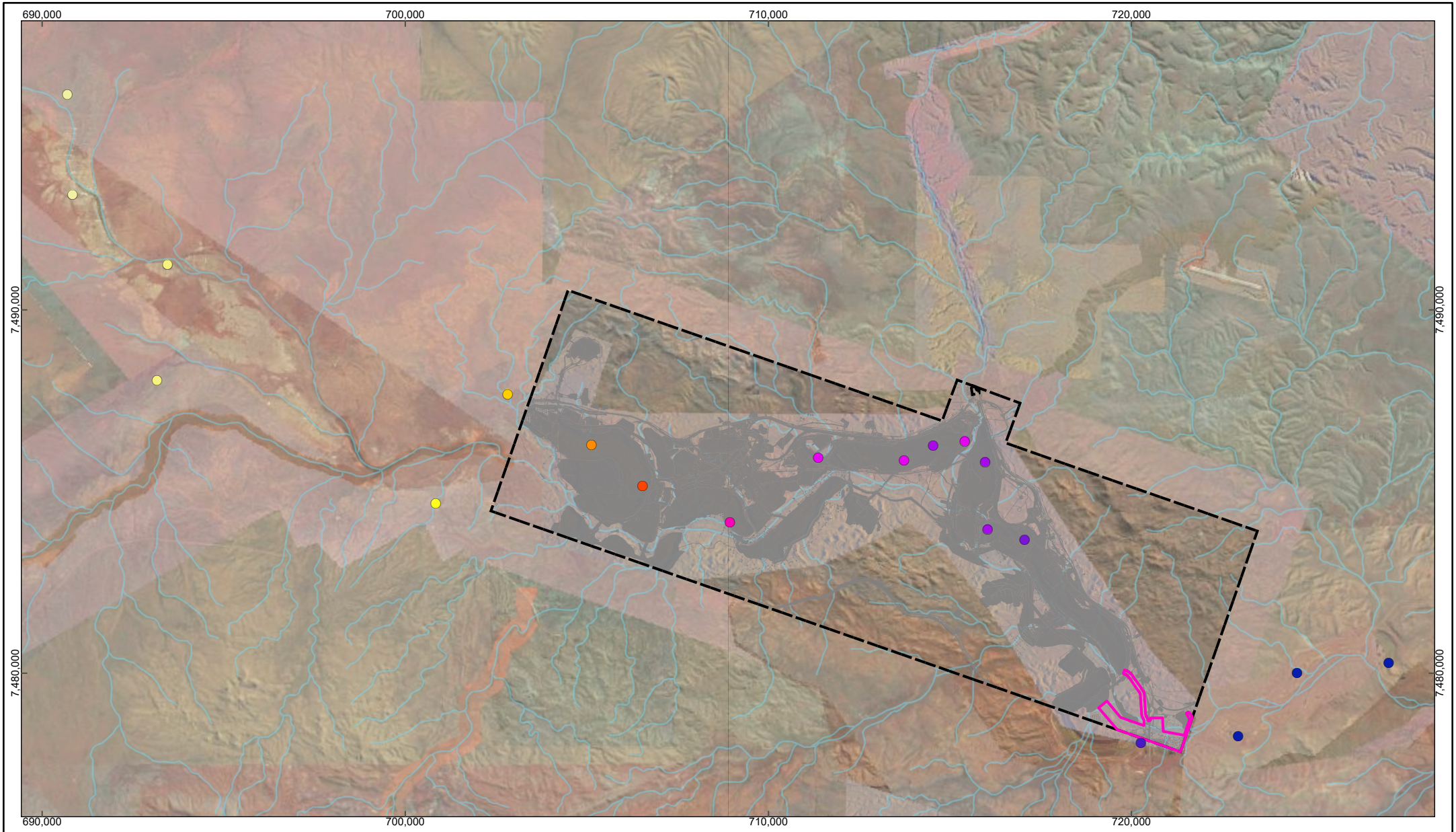
Further west, outside of the Development Envelope and 600 m directly to the west of the Flat Rocks (bore MB16YSN0003M), there is limited monitoring prior to 2016. From 2016 to 2024 groundwater levels have fallen here from approximately 602 mAHD to 596 mAHD (a 6 m decline). There is some uncertainty regarding the pre-mining groundwater level at this location, but it is assumed at approximately 609 mAHD. This suggests that the total drawdown in this location is in the order of 12 m. This has resulted in tree health decline at Flat Rocks, which has been reported in the AER and is further discussed in Section 8.

Drawdown is observed further west along the CID and upstream of Flat Rocks at HYM0002M. The CID groundwater level has varied here by approximately 5 m prior to being impacted by dewatering (naturally ranging between 613 and 618 mAHD between 1994 and 2003). However, since 2012 the water level at this bore has fallen by 5 m (from 614 to 609 mAHD). The abstraction reduction in W0 has resulted in groundwater level recovery to 610 mAHD at HYM0002M. Monitoring of HYW0002M is a current requirement of the SGWMP and has been updated with the provision of the MCWRMP (Appendix 6) with associated trigger and threshold values.

In the east of the Development Envelope, groundwater levels were not impacted directly by dewatering until approximately 2013. Prior to this, water levels may have increased due to the infiltration of surplus water discharge into the Marillana Creek in the eastern part of the Development Envelope (e.g. water levels at YM121M vary between approximately 520 and 527 mAHD between 1991 and 2010). Observed groundwater levels at HYE1513M, which is in the Indicative Footprint, show that water levels have declined to approximately 500 mAHD in this area since dewatering began.

Basement

Monitoring of groundwater levels in the basement (i.e. the Weeli Wolli Formation) is restricted to within a few kilometres of the CID. Generally, basement groundwater levels are thought to increase roughly perpendicular away from the CID (i.e. the basement drains into the CID). The response to dewatering in basement monitoring bores varies considerably from nothing to several metres. Interpretation is made difficult by limited time series data, however. Further analysis of groundwater levels across the Development Envelope is provided in the Yandi Conceptual Hydrogeological Model (BHP 2024c) in Appendix 4.



Indicative Footprint
Development Envelope
Existing Disturbance

Groundwater Level, Pre-Development (mAHD)

- 507 - 520
- 521 - 530
- 531 - 540
- 541 - 550
- 551 - 560
- 561 - 570
- 581 - 590
- 591 - 600
- 601 - 610
- 611 - 620
- 631 - 640
- 641 - 650

N

0 1 2 3 4
kilometres

GDA 1994 MGA ZONE 50

BHP

PUBLIC

MARILLANA CREEK (YANDI) SIGNIFICANT AMENDMENT

PRE-DEVELOPMENT GROUNDWATER LEVELS

WAIO PLANNING, TECHNICAL & ENVIRONMENT

SCALE @ A4:	1:140,000	PREPARED:	GEOMATICS	FIGURE:	7-4
DATE:	1/04/2025	REQUESTOR:	ENV APPROVALS		

A1205-041-RevB

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7.3.2.8 Groundwater quality

The Yandi Borefields Annual Aquifer Review 2024 (BHP 2024b) reports groundwater quality data from groundwater bores as required under 5C License to Take Water issued under the RiWI Act.

Based on the AAR, groundwater quality within the Development Envelope can be summarised as:

- pH ranges from slightly acidic to slightly alkaline (6.1 to 8.8)
- Salinity ranges from fresh to brackish (695 μS/cm to 1437 μS/cm)
- Exceedances of the site-specific trigger value (0.37 mg/L) for Boron have been recorded with concentrations measured between 0.26 mg/L and 1.4 mg/L. All concentrations in the Development Envelope were within the Australia and New Zealand Guidelines for Fresh and Marine Water Quality trigger value for freshwater 80% protection of species (ANZECC & ARMCANZ 2000).
- Exceedances of the site-specific trigger value (4.0 mg/L) for Nitrate (NO_3) have been recorded with concentrations measured between 0.36 mg/L and 34.0 mg/L. Nitrate exceedances in the mining environment are often attributed to mine explosive sources.

Per- and polyfluoroalkyl substances (PFAS) fire-fighting foams were phased out at Yandi in 2021 as part of BHP's WAIO PFAS Phase Out Program. Separately, PFAS investigations have been undertaken at Yandi since 2020, with a Targeted Site Investigation (TSI) completed at Yandi in January 2024. The investigations targeted known and potential sources, migration pathways and known receptors. Over 500 samples were collected from a combination of soil, sediment, surface water, production bores, monitoring bores, ponds/sumps and surface water.

The investigations identified:

- Trace concentrations of PFAS are present across the Development Envelope, consistent with "mixed-ambient" concentration ranges as presented for Victoria and Queensland in the PFAS National Environmental Management Plan (NEMP) 3.0 – Draft 2023 (DCCEEW 2023a).
- Perfluorooctanoic acid was not identified above any regulatory guideline, with Perfluorooctane Sulfonate & Perfluorohexanesulfonic acid representing the primary compounds of concern.
- No exceedances of human health guidelines have been recorded in the Development Envelope.
- No exceedances of the ecological 95% Species Protection Limit (0.48 µg/L) were recorded (DCCEEW 2023b)
- The highest groundwater concentration of PFAS recorded was 0.016 µg/L, located adjacent to workshop facilities which undertook maintenance of fire-fighting systems.
- No exceedances of any human health or environmental guidelines were recorded in surplus groundwater discharged from site, or within Marillana Creek.

7.3.2.9 Existing water use and management

The Development Envelope is located within the East Pilbara sub area of the Pilbara groundwater area (DWER 2023b). Groundwater in proclaimed groundwater areas is subject to compliance with RiWI Act including licensing for abstraction. Groundwater abstraction in proximity to the Development Envelope occurs predominantly to enable below water table mining and other mining related water uses.

Currently, groundwater abstraction is licensed under GWL 89501 with a total allocation of 20,650,520 kilolitres (kL) per annum. The licence provides authorisation for the following purposes; to meet site and aerodrome water demands, dewatering, dust suppression, mineral ore processing, exploration activities, earthworks, construction,

mining camp and potable water supply. All groundwater abstraction activities are carried out in accordance with the GWL Operating Strategy for Yandi (BHP 2024e).

The Yandi 2024 AAR (BHP 2024b) reported groundwater abstraction as 4,493,488 kL over the FY2023 period with groundwater being used as potable water in Spinifex Camp and Barimunya Aerodrome, dust suppression and mine processing with remainder discharged to Marillana Creek.

7.3.3 Regional environmental values

7.3.3.1 Flat Rocks and Marillana Creek pools

Flat Rocks is a cultural and archaeological heritage site which is significant to the Banjima Traditional Owners.

Flat Rocks is located where Marillana Creek crosses a broad exposure of bedrock which is the transition from the upper and lower parts of the catchment (Figure 7-2). The pools at Flat Rocks are dependent on surface water from Marillana Creek and in its upper portion on groundwater discharge from the CID. Shallow groundwater discharging into Flat Rocks has resulted in near permanent baseflow at low rates to supply water to the pools, in recent years a reduction in this permanent baseflow has been observed. The interaction between surface water and groundwater of Flat Rocks is detailed above in Section 7.3.2.2. Vegetation in Marillana Creek and Flat Rocks is generally characterised by the presence of *Melaleuca argentea, Eucalyptus camaldulensis* and *Eucalyptus victrix.* The presence of *Melaleuca argentea*, signifies that vegetation is dependent on groundwater (also known as an obligate phreatophyte). Further discussion regarding vegetation is provided in Section 8. BHP has been monitoring the tree health of the above listed species and groundwater levels in accordance with MS 679 through the SWGWMP to determine changes to the ecosystem.

Upstream of Flat Rocks are a series of semi-permanent, permanent and ephemeral pools referred to as the Marillana Creek pools (Figure 7-2). The pools are given unique identifiers (MarC1-MarC6) on Figure 7-2 noting that MarC5 and MarC6 are within area known as Flat Rocks. The pools support groundwater dependant ecosystems (GDE) of varying levels of significance including groundwater dependant vegetation (GDV; described in Section 8.4.2), a high diversity of aquatic fauna (described in Section 9.3.2.6), subterranean fauna values including stygofauna (described in Section 10.3.2.2) and likely provide critical and supporting habitat for a number of listed significant fauna species (described in detail in Section 9.3.2.1; Astron 2019; Biologic 2023e, 2024b; Biota 2022). Three of the pools in particular have high ecological values for GDEs:

- MarC2 which recorded a high diversity of GDV species, a relatively high richness of groundwater dependent invertebrate taxa (stygobites and permanent hyporheos stygophiles), significant stygobitic species, taxa restricted to springs and permanent pools of high ecological condition, and overall high macroinvertebrate taxa richness refer to Section 9.3.2.6*)*.
- MarC4 which recorded a high diversity of GDV species, high richness of wetland flora (submerged and emergent macrophytes) in comparison to other creeks in the region, a relatively high richness of groundwater dependent invertebrate taxa, restricted species and International Union for Conservation of Nature (IUCN) listed species (refer to Section 9.3.2.6*)*.
- MarC5 which recorded high overall macroinvertebrate richness, high richness of odonate species, including IUCN listed species, and a high richness of Pilbara endemic taxa (refer to Section 9.3.2.6*)*.

The ecohydrological conceptualisation of the Marillana Creek pools is as follows:

- The part of Marillana Creek where the pools are located is dominated by BIF, Shaley BIF and hills of Dolerite. Locally, the old valley infill caps Shaly BIF and forms low, standalone table hills. Here, Marillana Creek and its tributaries cross the dolerite units exposing rock along and within the channels, resulting in damming to form near permanent water pools. The river channel is dominated by high hydraulic conductivity cobbly gravels, shallow BIF and dolerite with patchy gravels and silty clay deposits, frequent

to dense gum trees and paper barks (including *Eucalyptus victrix*, *Eucalyptus camaldulensis, Melaleuca argentea* and *Acacia citrinoviridis)*.

- Several water quality characteristics indicated pools were maintained by both groundwater input and contribution by rainfall, with most sites being dominated by sodium (Na) cations and bicarbonate (HCO_3) anions. The ionic composition is dominated by carbonate anions, similar to other spring systems of the Pilbara (Biologic 2024b)
- Surface waters within the pools were slightly basic to circum-neutral, with pH ranging from 7.37 (at MarC2 in the dry) to 9.24 (at MarC6 also in the dry). Despite this, no pH values were considered to be of ecological concern or out of the ordinary for Pilbara waters. Slightly basic pH is often recorded from Pilbara pools, especially those with some connection to groundwaters.
- MarC1, MarC2, MarC4 and MarC5 recorded marginally higher EC values in the wet season. This illustrates the permanence of the water in these areas, with limited evapoconcentration occurring during the dry season. MarC6 showed signs of evapoconcentration effects, with considerably higher EC recorded in the dry season.
- Only one site within the Study Area (MarC6 in the dry 2020) recorded total nitrogen notably in excess of the Default Guideline Value (DGV). At this site, total nitrogen was more than six times the DGV. Concentrations at MarC6 were notably high in the dry 2020, with total phosphorus being more than 16 times the DGV.

7.3.3.2 Ministers North aquifer and Yandicoogina Gorge

The Minsters North aquifer is approximately 3 km south of the Proposal and RTIO Mungadoo Operations and is assumed to support groundwater levels and associated groundwater dependent ecosystems in Yandicoogina Gorge (Figure 7-2). Yandicoogina Gorge is located approximately 4 km south of the Development Envelope and is an important feature of the Pilbara ecohydrological system, located at the convergence of surface and groundwater flows from the upstream catchment. The gorge is characterised by riparian and/or groundwater dependent vegetation as well as a series of permanent and semi-permanent pools that are likely supported by groundwater at (or close to) surface. The gorge is culturally significant to the Banjima Traditional Owners (see Section 11.3.3), has affinities with the Priority 2 Ecological Community '*Riparian flora and plant communities of springs and river pools with high water permanence of the Pilbara*' (DBCA 2023), supports a high diversity of aquatic fauna (see Section 9.3.2.6), contains significant subterranean fauna values (see Section 10.3.2.4) and supports significant fauna species such as the Pilbara Olive Python and Ghost Bat (see Section 9.3.2.2).

The Ministers North aquifer has been investigated through hydrogeological drilling programs since 2017/2018 as part of future BHP mine planning with the installation and subsequent monitoring of up to 35 bores installed with continuous groundwater level loggers. Data prior to 2018 is limited with intermittent groundwater levels collected in two groundwater bores from 2002.

Groundwater monitoring over the 2018 to 2023 period has identified groundwater levels across the Minister's North aquifer have a flat gradient with groundwater levels ranging from 562 mAHD to 564 mAHD. Since 2018, groundwater levels in the Minister's North Aquifer have demonstrated a consistent decline in most bores. In the period from March 2018 to February 2023, groundwater levels in all bores demonstrated a consistent decline of almost 3.5 m. Groundwater levels in the Ministers North aquifer are in a constant state of flux reacting to both short-term and long-term changes in rainfall.

Water levels in the permanent pool of Yandicoogina Gorge have been recorded since 2020 and water levels in this permanent pool have declined approximately 1 m during that period. Periodic monitoring of tree health within the Gorge has also recorded tree deaths and decline of groundwater dependent vegetation health, which may be attributed to declining groundwater levels.

The connection between the Ministers North aquifer, the Weeli Wolli Formation (present in the Development Envelope) and regional units is complex. The conventional view of the hydrogeology of the region does not support a connection between the Gorge and regional below water table mining in the CID. Based on observed groundwater decline in the Minsters North aquifer, BHP in collaboration with RTIO have commenced investigations with the aim of refining a joint conceptualisation and determine if there is a potential for a hydraulic connection between the Weeli Wolli Formation and Ministers North aquifer.

Given there is not a definitive conceptualisation of the hydrogeology in the region, the following possible causes for declining groundwater levels in the gorge have been considered:

- climate variability (below average rainfall), or
- a combination of both climate variability and regional dewatering activities.

BHP have further explored the above considerations through the development of two groundwater numerical models:

1. The Ministers North aquifer numerical model (BHP 2024d and Appendix 4). This model includes only the Ministers North aquifer and the material immediately surrounding it. Water enters the system via rainfall recharge and leaves the system via discharge at the Gorge. There is no hydraulic connection to the Yandi CID and therefore no influence from dewatering drawdown in this model. The model was calibrated to transient conditions between 2000 and 2024 and replicates the observed decline in groundwater levels over this period, including the decline in groundwater levels between 2018 and 2024. The modelling results present a sound basis that climate variability could be the key driver for the observed groundwater decline.

2. The BHP Yandi E8 Groundwater Model is a regional model provided in Appendix 4 (INTERA 2023). This model includes the entire Yandi groundwater catchment, which incorporates the Ministers North aquifer. The simulated water balance at Ministers North is much the same as the smaller model described above, but in this case the model incorporates the precautionary assumption of a diffuse hydraulic connection to the Yandi CID allowing drawdown to migrate from there to the Ministers North aquifer. This model was calibrated to transient conditions between 1991 and 2023 and incorporates BHP and third-party dewatering of the CID. The model is able to replicate the observed decline in Ministers North groundwater levels between 2018 and 2023. The decline in this model is derived from a combination of climate variability and cumulative drawdown from dewatering the CID. The model therefore shows that cumulative drawdown from the Yandi CID directly to the north of the Ministers North aquifer could contribute to the observed declines.

To summarise the two modelling exercises above, a successful match to the observed Ministers North groundwater levels was achievable using the model with rainfall variations only and using the model with rainfall variations combined with drawdown from the Yandi CID.

The Yandi E8 Groundwater Model (as described above) was undertaken to assess the potential impacts on groundwater regimes as a result of the Proposal (dewatering at E8 pit). The model was subsequently used to estimate potential drawdown in the alluvium, the CID, the Weeli Wolli and Ministers North aquifer (collectively referred to as the Basement aquifer) based on existing and proposed dewatering rates associated with the Approved Proposal, the Proposal and assumed third-party dewatering. To achieve this, the model was based on the precautionary assumption that a connection exists between the CID and the Ministers North aquifer. Predicted drawdown and modelling results for the Combined Proposal alone are unable to be generated due to the proximity of third-party operators and the influence of their dewatering on existing and proposed operations. Modelling of the present-day scenario produced drawdown contours which show drawdown at the gorge consistent with the 3.5 m decline observed through groundwater monitoring.

The End of Mine 2029 (EOM) scenario predicts dewatering drawdown for the Combined Proposal and third-party operators combined with below average rainfall until 2029. Groundwater levels in the Ministers North aquifer in the Yandicoogina Gorge area are predicted to further decline over time by an additional 1.5 m to 2.5 m by 2029 (an approximate total decline of 5 m to 6 m).

Although the present day and EOM modelling scenarios predict that drawdown at the gorge will increase after the introduction of the Proposal, dewatering of the E8 orebody is not predicted to cause further drawdown in the Minister's North aquifer (discussed in Section 7.6.1 below). Examination of the drawdown impact of the Proposal in isolation is provided and shows a maximum of 10 m of drawdown in the Weeli Wolli Formation that does not extend into the Ministers North aquifer. The predicted drawdown (2029) are the predicted impacts of climate variability, the Approved Proposal and dewatering undertaken by third party operators.

Although the causation for regional groundwater decline is still unclear nor can be attributed to regional or a single mining operation or climate process, BHP are currently working with Traditional Owners, RTIO, EPA and DWER to mitigate further groundwater decline to the gorge through initiating a groundwater supplementation trial.

The trial commenced late 2024 and ran for a short period prior to the onset of the wet season. It is proposed to run as a short-term mitigation trial with a potential extension pending results and stakeholder feedback. The trial's objectives are to:

1. Stabilise groundwater levels within the Ministers North aquifer at the head of the gorge, specifically to abate further groundwater decline. The infrastructure to support the trial has been designed to provide flexibility with supplementation rates while maintaining practicability.
2. Improve understanding of the interactions between Ministers North aquifer and Yandicoogina Gorge GDV, specifically how regional groundwater is supporting the GDV and to test hydraulic properties.

The scope of the trial includes:

1. Construction of 8 km of a 200-250 mm high-density polyethylene pipeline from BHP's Yandi mine.
2. Conveyance of up to 2.7 ML/day of surplus dewatered groundwater to a break tank within Ministers North Tenure. The pipeline route has been designed to minimise clearing by utilising existing cleared tracks where feasible.
3. Construction of reinjection head works with a solar and/or diesel-powered pump to enable reinjection into one of four existing groundwater bores located near the head of the gorge.
4. Installation of six additional groundwater monitoring bores at two locations within 200m of the head of the gorge to monitor reinjection levels and water quality.
5. Installation of four additional shallow groundwater monitoring bores in two locations within Yandicoogina Creek, upstream from the gorge and Ministers North to assess recharge of rainfall events.
6. Establishment of remote supervisory control and data acquisition systems to provide real time monitoring and control during the trial.
7. Development of a Trigger Action Response Plan, with trigger and threshold criteria values to support the trial, the actual supplementation rate will be determined via monitoring and adherence to thresholds and triggers to achieve the objectives of the scheme.
8. Trial approved under Part V licence for the Approved Proposal.

Results of the trial and hydrogeological field studies are communicated regularly with all relevant stakeholders.

A longer-term supplementation program was referred to the EPA in February 2025 as part of the Mining Area C-Southern Flank Significant Amendment (BHP 2025f) that includes a pipeline from BHP Mining Area C and a water supply of up to 10 ML/day.

7.4 Potential environmental impacts

BHP has considered the development activities that have the potential to impact on Inland Waters outlined in the EPA's *Environmental Factor Guideline – Inland waters* (EPA 2018a) and considers that those relevant to the Proposal are:

- changes to surface water regimes from discharge of surplus water to Marillana Creek and installation of infrastructure (direct)
- changes to groundwater regimes from groundwater abstraction for mine pit dewatering (direct)
- changes to water quality from pit excavation, installation of infrastructure, pit closure and discharge of surplus water to Marillana Creek (indirect).

The EIA for Inland Waters include a discussion of impacts associated with the Proposal and includes consideration of impacts extending beyond the boundaries of the Development Envelope. BHP has provided information on the Approved Proposal so that the EPA can consider the environmental effects of the Proposal in the context of the Approved Proposal, including consideration of impacts off-tenure where relevant. BHP has also outlined the combined effects which the implementation of the Combined Proposal might have on the environment. Unless specified otherwise, the potential impacts discussed in this section are unmitigated (i.e. potential impacts before mitigation measures are applied, if required).

7.4.1 Changes to surface water regimes

7.4.1.1 Discharge of surplus water to Marillana Creek

In accordance with *Use of mine dewatering surplus* (DWER 2020), use of mine dewater will be prioritised for processing operations, dust suppression and other fit-for-purpose uses across the Development Envelope. The AAR reports that approximately 62% of the mine dewater is used for beneficial use across the Development Envelope (BHP 2024b).

Surplus mine dewatering from the Proposal will also be discharged into Marillana Creek at the existing discharge point shown in Figure 7-2, with a maximum proposed discharge rate of 26 ML/day. Impacts associated with discharge of surplus water at the discharge point were previously assessed for the Approved Proposal.

As discussed in Section 7.3.2.2, the discharge of surplus water to Marillana Creek is regulated by surplus discharge conditions licence L6168/1991/10 which authorises discharge of up to 15,000,000 tonnes (41.1 ML/day) of mine dewater per year. The maximum proposed surplus discharge is expected to be less than 10,000,000 tonnes of mine dewater per year (26 ML/day) and is within the existing licence requirements.

7.4.1.2 Changes to surface water catchments from installation of infrastructure

Changes to Marillana Creek Catchment

The excavation of pits and construction of infrastructure has the potential to change surface water regimes by disrupting natural surface flows and reducing the availability of surface water (runoff) downstream. Mining creates internally draining mine pits and can impact the quantity of rainfall runoff that reaches the waterways.

The Indicative Footprint lies immediately south of Marillana Creek and is close to the eastern and southern boundary of the tenement. In this location the existing (pre-mining) topography slopes towards Marillana Creek and flow is contributed predominantly through diffuse overland flow within this part of the Marillana Creek catchment.

The Approved Proposal includes 1,286 ha (12.86 km2) of mine pit area which corresponds to 0.63% of the Marillana Creek catchment. The loss of catchment area contributing surface water runoff to Marillana Creek from the Proposal is estimated to be approximately 24 ha (0.24 km2) corresponding to approximately 0.01% of the Marillana Creek catchment (2,050 km2). The Combined Proposal would reduce the Marillana Creek catchment by 1,310 ha (13.1 km2) or 0.64%. Table 7-5 below provides a summary of impacts to the Marillana Creek catchment area.

Table 7-5: Marillana Creek Catchment Reduction

Scenario	Mine Pit Area (ha)	% reduction to Marillana Creek Catchment
Proposal	24	0.01
Approved Proposal	1286	0.63
Combined Proposal	1310	0.64

There are no contributing flows into the proposed location of the eastern E8 pit from outside the Development Envelope. This is due to the Mungadoo Mine immediately to the south having altered the catchment to not contribute any flow across the Development Envelope towards Marillana Creek at this location.

At the proposed location of the western E8 pit, there is currently a drainage line and contributing catchment from RTIO Operations to the south that has been directed towards the Development Envelope via the eastern edge of the RTIO Mungadoo pit. The location of this diversion has been a subject of discussion with RTIO with their intention to redirect the flows appropriately through their tenure. The Indicative Footprint includes the use of a bund on the southern side of the proposed eastern E8 pit to prevent any surface water discharge from entering the excavated pit.

Changes to surface water regimes from the use of flood bunds

A flood bund is used to create a barrier to protect infrastructure from damage and ingress of flood waters. The Proposal includes the construction of flood bunds on the downstream side of the proposed E8 pits adjacent to Marillana Creek. The Proposal includes the use of flood bunds to prevent the ingress of infrequently occurring flood events into pits during mining operations. The bunding proposed is designed to keep floodwater within the natural channel of Marillana Creek and simulate the natural catchment flow and prevent creek capture into the E8 pits. There is no diversion of the creek required for the Proposal.

Changes to surface water regimes from road creek crossings

The creation of road infrastructure can result in changing waterway channel morphology and the clearing of riparian vegetation. Haul roads and light vehicle tracks across Marillana Creek will be designed to convey flows and not prevent or restrict the movement of water in the creek. The eastern creek crossing will be constructed level will the current flow channel with a number of gaps included to reduce any obstruction to flow. The western creek crossing has been designed with culverts to convey flows up to 20% annual exceedance probability flows and bigger events

designed to flow over the top of the road. The clearing of riparian vegetation associated with creek crossings are discussed in Section 8.

7.4.2 Changes to groundwater regimes

7.4.2.1 Groundwater abstraction (dewatering)

The Proposal includes the development of the E8 pit, with the pit base at approximately 480 mAHD, which is approximately 60 m below the existing natural surface (530 mAHD to 542 mAHD). Groundwater levels at E8 are currently influenced by nearby dewatering with groundwater levels approximately 25 m below pre-development levels. Dewatering is planned to reduce the existing groundwater level to 12 m below the pit base (468 mAHD). This will result in groundwater being reduced 20 m from the existing groundwater level of 488 mAHD to 468 mAHD. Table 7-6 provides a summary of groundwater levels within the Indicative Footprint.

Table 7-6: Summary of Groundwater Levels

Groundwater Levels	Elevation (mAHD)	Depth below ground surface* (m)
Pre-mining	513	27
Current (Approved Proposal)	488	52
Proposal (End of 2029)	468	72

* approximate

The Yandi regional numerical groundwater model (INTERA 2023 and Appendix 4) was used to quantify impacts to groundwater levels from dewatering to support the Combined Proposal. Two elements of the modelling are pertinent to this discussion:

- As detailed in Section 7.3.3, the regional model is based on the precautionary assumption that there is a diffuse hydraulic connection between the Yandi CID and the Ministers North aquifers. Without this assumption it would be impossible to assess the potential for dewatering at E8 to impact the Ministers North aquifer.
- It is not possible to numerically separate the historic or future dewatering from BHP and third parties in the east of the Development Envelope. The presence of third-party dewatering in this area impacts (reduces) the dewatering requirements of BHP. If the third-party dewatering was not included, BHP dewatering requirements and drawdown would be overstated. As such, this modelling is more representative of the cumulative impacts of dewatering in the region rather than the Combined Proposal in isolation.

The Proposal: Changes to groundwater regimes from abstraction

The Proposal includes groundwater abstraction (dewatering) to facilitate the mining of below water table ore bodies. Dewatering in the E8 pit will not increase the total volume of dewatering across the Development Envelope and no increase to the existing license to take groundwater (GWL89501) is proposed. Dewatering to facilitate the Proposal will result in a peak flow of up to 12.5 ML/day stabilising at up to 10 ML/day and a maximum proposed groundwater abstraction of approximately 4.6 GL/annum. provides an estimate of annual dewatering volumes for E8 (INTERA 2023). As noted in Table 7-7 below, the first three years of E8 operation will require no dewatering, largely due to the influence of existing dewatering drawdown from mining operations.

The Proposal does not seek an increase in the abstraction or modification of the existing groundwater licence for the Development Envelope.

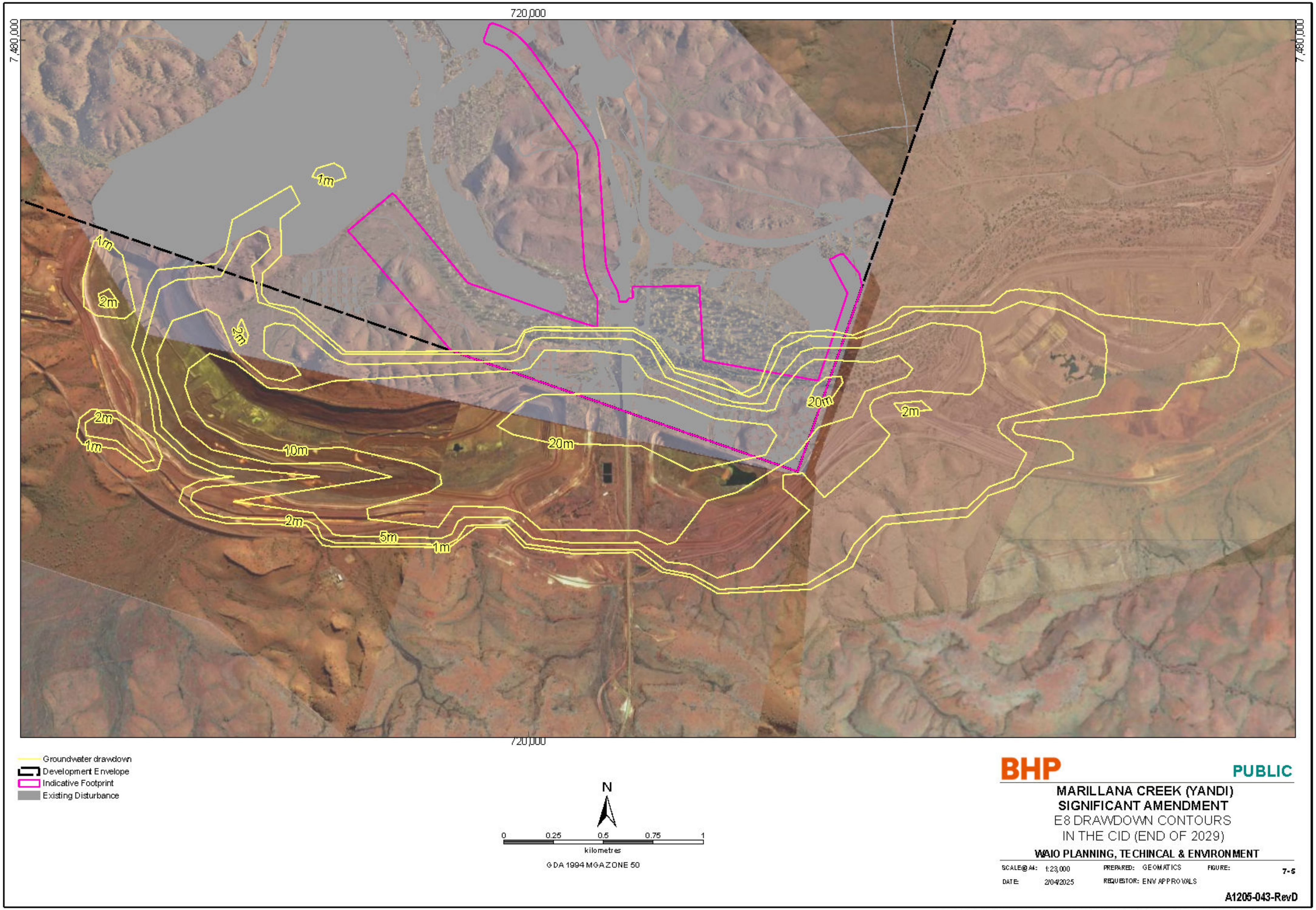
Table 7-7: Proposed Annual Dewatering Volumes for E8

Year	E8 annual dewatering volumes GL/a
2024	0
2025	0
2026	0
2027	3.285
2028	4.563
2029	3.212

The model was unable to reproduce historical groundwater levels in the alluvium due to the alluvium being heterogeneous, discontinuous from west to east and having limited monitoring. However, the model was able to reproduce historical groundwater levels in the CID and Basement. At the end of mining (2029) the predicted drawdown as a result of the Proposal in these two units is:

- CID – approximately 20 m in the E8 orebody. The drawdown migrates approximately the same distance east and west along the CID from E8 to outside the Development Envelope (up to 2.5 km in both directions). To the west however, the magnitude is greater. The predicted drawdown extends approximately 200 m to 250 m in a northerly direction towards Marillana Creek (Figure 7-5)
- Basement – just over 10 m beneath the E8 orebody. Drawdown of up to 1 m is predicted to extend between 2.5 km (north south) and 4.5 km (east west) from the dewatering (Figure 7-6).

The predicted drawdown of the Proposal does not intersect with sensitive environmental receptors in the region including Flat Rocks, Marillana Creek pools or Yandicoogina Gorge (Figure 7-5 and Figure 7-6). Impacts of drawdown on riparian vegetation of Marillana Creek and groundwater dependent vegetation is discussed in Chapter 8.


720,000
7,480,000
1m
2m
5m
10m
20m
Groundwater drawdown
Development Envelope
Indicative Footprint
Existing Disturbance
N
0 0.25 0.5 0.75 1
kilometres
GDA 1994 MGA ZONE 50
BHP
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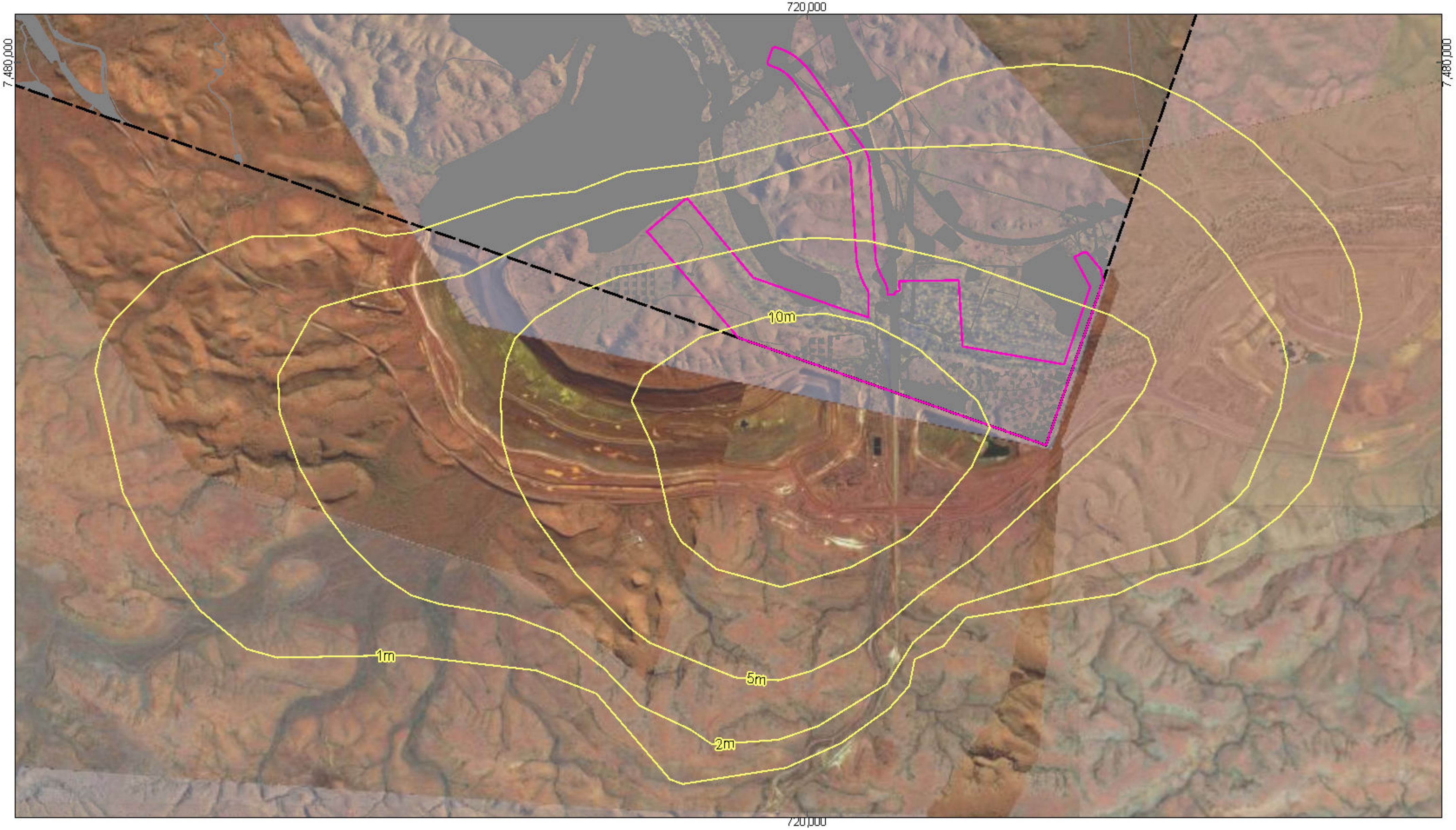
MARILLANA CREEK (YANDI)
SIGNIFICANT AMENDMENT
E8 DRAWDOWN CONTOURS
IN THE CID (END OF 2029)
WAIO PLANNING, TECHINCAL & ENVIRONMENT
SCALE@ A4: 1:23,000
PREPARED: GEOMATICS
FIGURE: 7-5
DATE: 2/04/2025
REQUESTOR: ENV APPROVALS
A1205-043-RevD



Groundwater drawdown
Development Envelope
Indicative Footprint
Existing Disturbance

N

0 0.25 0.5 0.75 1
kilometres
GDA 1994 MGA ZONE 50

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MARILLANA CREEK (YANDI) SIGNIFICANT AMENDMENT

E8 DRAWDOWN CONTOURS IN THE BASEMENT (END OF 2029)

WAIO PLANNING, TECHNICAL & ENVIRONMENT

SCALE@A4: 1:29,000 PREPARED: GEOMATICS FIGURE: 7-6
DATE: 24/04/2025 REQUESTOR: ENV APPROVALS

A1205-045-RevD

Combined Proposal: Changes to groundwater regimes from abstraction

Dewatering to facilitate the Combined Proposal will result in a peak flow of up to 35 ML/day and a maximum proposed groundwater abstraction of approximately 12.1 GL/a provides an estimate of annual dewatering volumes for the Combined Proposal (INTERA 2023).

Groundwater abstraction across the Development Envelope has reduced in recent years as several pits have reached their target depth. This overall reduction in dewatering for the Approved Proposal has meant that dewatering for the Combined Proposal is within the existing licence allocation (GWL 89501), as predicted total annual dewatering volumes in the Development Envelope are less than the licence allocation of 20,650,520 kL/a (20.65 GL/a) (Table 7-8:). Therefore, the Proposal does not seek to increase the authorised abstraction rate or modify the existing groundwater licence for the Development Envelope.

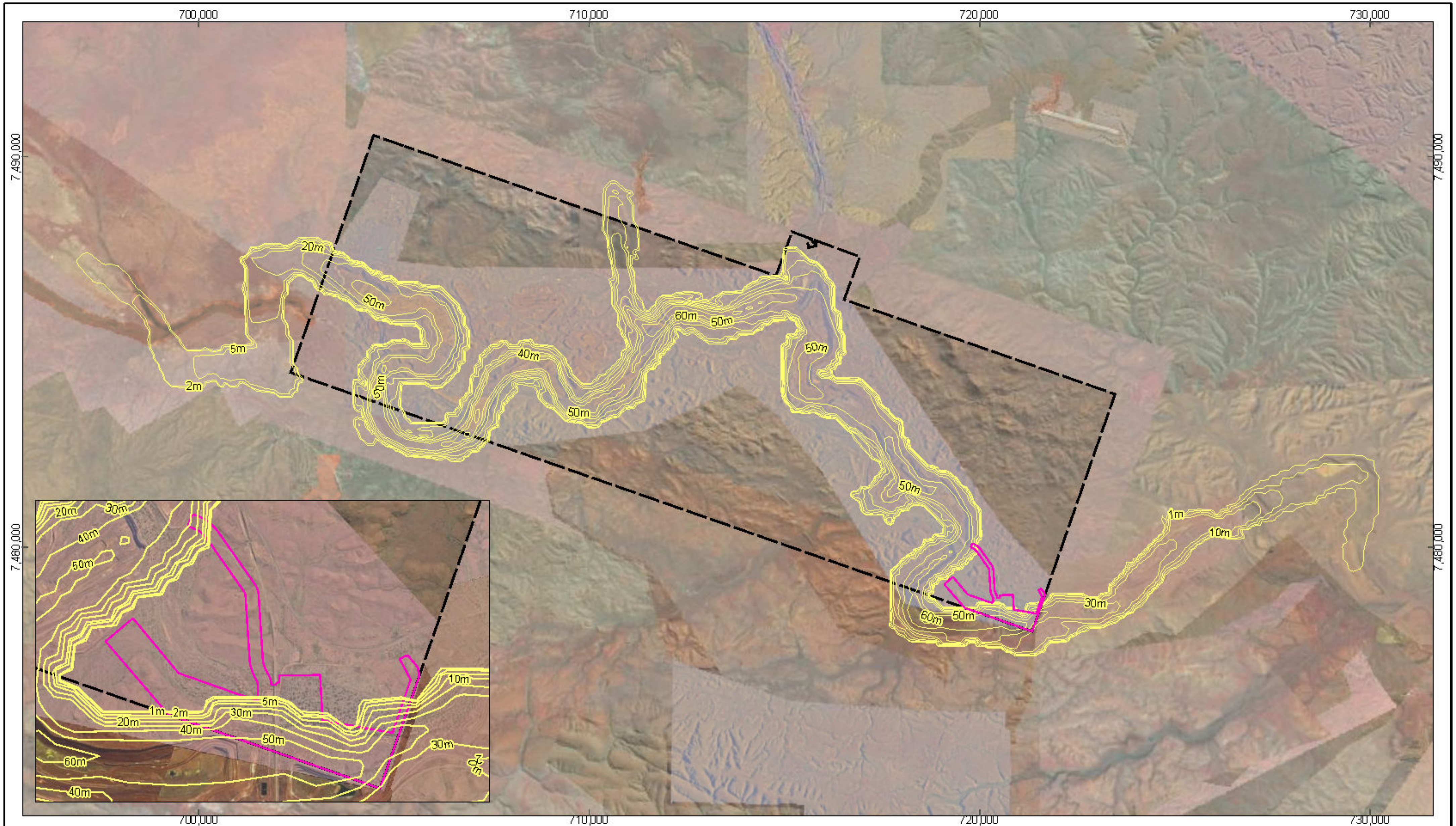
As described above, the numerical model for the Combined Proposal includes third party dewatering which is more representative of cumulative impacts of dewatering in the region. Numerical model development of the Combined Proposal only could not be undertaken because dewatering impacts from nearby third-party operations influence the results of existing and proposed dewatering.

The predicted drawdown as a result of the cumulative proposal (Combined Proposal and third-party operation) in each aquifer is discussed below:

- The drawdown within the CID is shown in Figure 7-7.
- Drawdown of up to 1 m is predicted to migrate up to 10 km along the CID west of the Development Envelope. Drawdown to the east is also predicted to migrate beyond the eastern boundary of the Development Envelope, but this is complicated by the presence of third-party dewatering in this area.
- The results for drawdown in the Basement (Figure 7-8) indicate that drawdown extends various distances laterally away from the CID, with the maximum lateral extent (defined by the 1 m drawdown contour) approximately 6 km south of the Development Envelope.

The predicted unmitigated impacts to environmental receptors by 2029 are as follows:

- Drawdown in the CID adjacent to Flat Rocks (MarC5 and MarC6 pools) is estimated to be approximately 15 m. Measured groundwater levels at Flat Rocks estimate current drawdown is approximately 12 m, this therefore represents an increase of 3 m.
- Drawdown in the CID is estimated to propagate 10 km west of the Development Envelope and potentially impact groundwater levels in MARC2 where the CID discharges directly into the pool. For pools, MARC3-MARC4 drawdown in the Basement is predicted to be approximately 1-2 m, the CID does not underly these pools.
- Assuming a hydraulic connection between the CID and Ministers North aquifers (i.e. a precautionary approach), the current measured drawdown in the Ministers North aquifer in the vicinity of Yandicoogina Gorge is approximately 3.5 m. This drawdown is predicted to increase to approximately 6.1 m (Figure 7-8).



Groundwater drawdown

Development Envelope

Indicative Footprint

N

0 1 2 3 4

kilometres

GDA 1994 MGA ZONE 50

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CUMULATIVE IMPACTS DRAWDOWN
IN THE CID (END OF 2029)

WAIO PLANNING, TECHINICAL & ENVIRONMENT

SCALE@A4:	1:130,000	PREPARED:	GEOMATICS	FIGURE:	7-7
DATE:	24/04/2025	REQUESTOR:	ENV APPROVALS		

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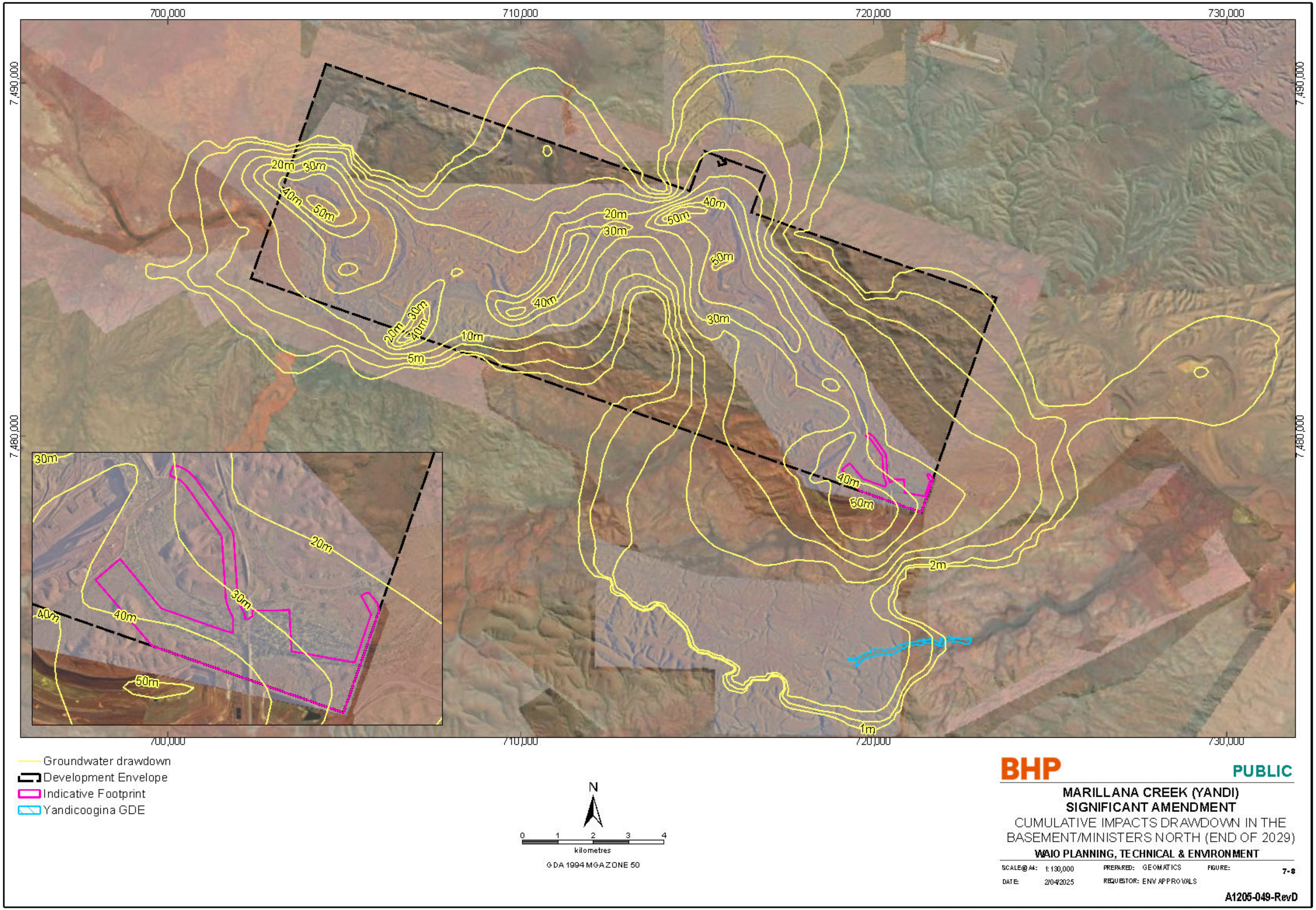

700,000
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730,000
7,490,000
7,480,000
20m
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Groundwater drawdown
Development Envelope
Indicative Footprint
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SIGNIFICANT AMENDMENT
CUMULATIVE IMPACTS DRAWDOWN IN THE BASEMENT/MINISTERS NORTH (END OF 2029)
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SCALE@ A4: 1:130,000
PREPARED: GEOMATICS
FIGURE: 7-8
DATE: 2/04/2025
REQUESTOR: ENV APPROVALS
A1205-049-RevD

Table 7-8: Proposed Annual Dewatering Volumes for Development Envelope

Year	C1	C45	C3	E1	E356	E4	E7	E8	W0	W1	W2	W3	W4	W5	W6	Total
	GL/annum															
2023	1.314	0.000	0.000	0.986	1.132	0.073	0.876	0.000	0.694	0.949	0.986	0.000	1.497	0.365	0.292	9.162
2024	1.205	0.000	0.000	0.913	1.095	0.073	0.840	0.000	0.657	0.913	0.949	0.000	1.314	0.329	0.256	8.541
2025	1.205	0.000	0.000	0.840	1.022	0.073	0.840	0.000	0.621	0.876	0.876	0.000	1.168	0.329	0.256	8.103
2026	1.168	0.000	0.000	0.803	0.949	0.146	0.767	3.285	0.621	0.840	0.913	0.000	1.022	0.329	0.256	11.096
2027	1.132	0.219	0.000	0.767	0.876	0.183	0.657	4.563	0.584	0.803	1.022	0.000	0.876	0.292	0.256	12.118
2028	1.132	0.183	0.000	0.730	0.876	0.183	0.584	3.212	0.584	0.803	0.913	0.000	0.876	0.329	0.256	10.658
2029	1.314	0.000	0.000	0.986	1.132	0.073	0.876	0.000	0.694	0.949	0.986	0.000	1.497	0.365	0.292	9.162

Differences from the Approved Proposal

The impact on groundwater levels in the Approved Proposal included determination of the dewatering requirements for the Yandi Life of Mine Proposal which included mining from W1, W2, W3, W4, W5/6, C1, C5, E1, E2, E3/5/6, and E7. The Approved Proposal pits were typically 60 m deep (ranging from 55 m-80 m).

The dewatering drawdown contours provided in the Approved Proposal (2008) represent combined CID and Basement predictions at the end of mining (2025) (Figure 7-9). Drawdown in the alluvium is not included. Numerical modelling undertaken for the Approved Proposal did not include the Proposal or dewatering from RTIO Operations. The results of the 2008 modelling can be summarised as follows:

- Drawdown would migrate approximately 6.5 km to the west of the Development Envelope.
- Drawdown would migrate into the Basement (predominantly Weeli Wolli Formation) in all directions up to approximately 5 km from the CID.
- Drawdown between approximately 0 and 2.5 m would occur in the Ministers North aquifer.

A key difference between the Approved Proposal and current groundwater levels is the extent of drawdown west of the Development Envelope. The Approved Proposal estimated that drawdown would be between 0 m and 5 m west of the Development Envelope; however, observations in regional bores have estimated that drawdown in the same area is currently between approximately 3 m and 12 m. These observations are commensurate with tree health decline in the Flat Rocks area as described in 8.4.2.

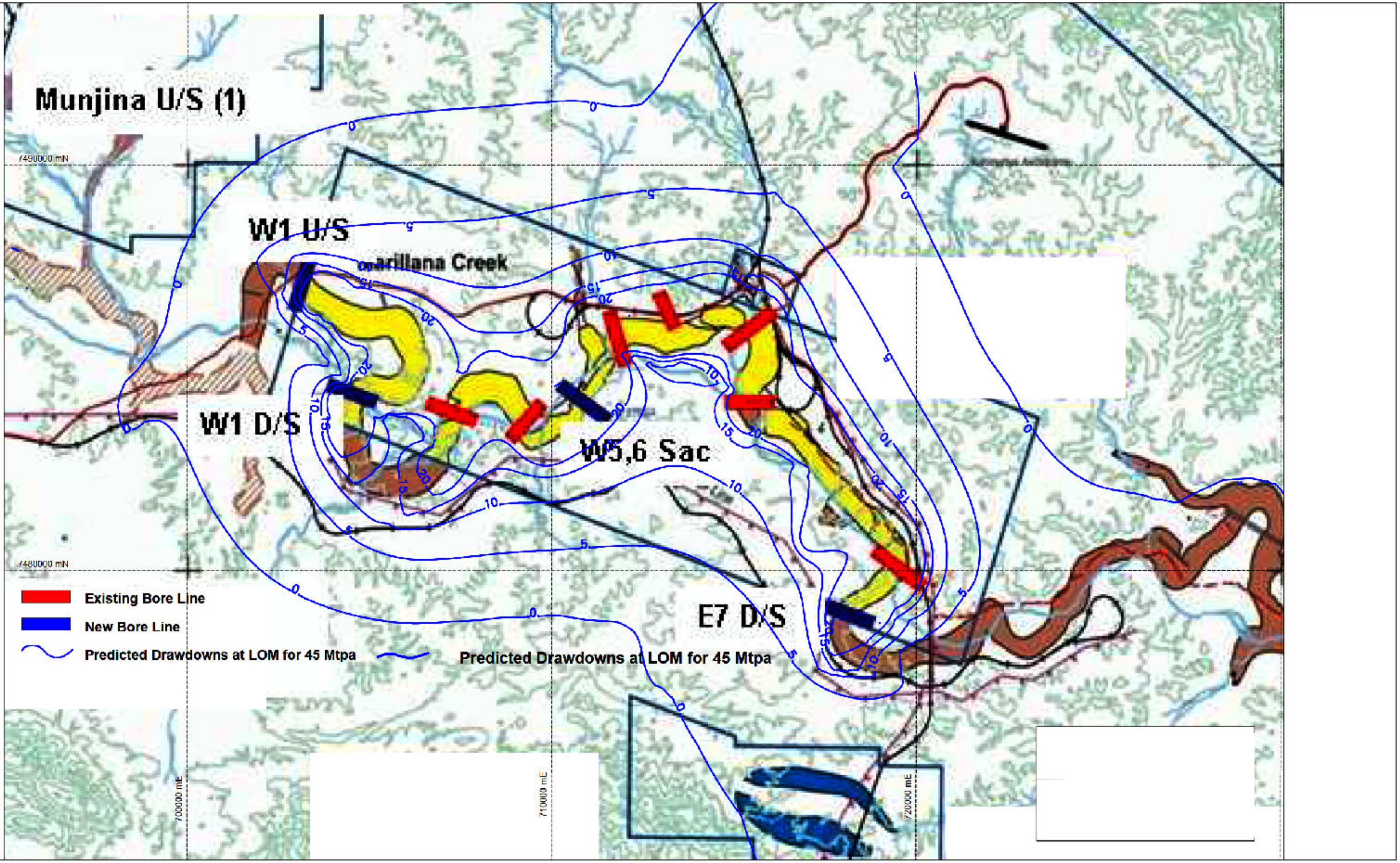
Key differences in dewatering drawdown in the Combined Proposal compared to the Approved Proposal are as follows:

- Increased drawdown to the west of the Development Envelope along the CID (consistent with above).
- Increased drawdown of 20 m in the Indicative Footprint to facilitate the Proposal (below water table mining at E8 pits).
- Increased lateral extent of dewatering drawdown to the south and east to which due to the incorporation of dewatering from third party mining operations.
- Further refinement of numerical modelling of the Combined Proposal to estimate drawdown in mine pits and CID.

Post-Mining impact to groundwater levels

Mine pit voids are created during mining operations. Depending on the material movement strategy, one of several scenarios may eventuate for any particular void; there may be no backfill of material, partial backfill, or complete backfill, where the void is backfilled to the void crest. Residual voids remain where the resultant surface is below the crest. To date, the Proposal has not been incorporated into the GoldSim model, but current plans are to backfill the E8 pit to prevent the formation of pit lakes and to prevent creek capture and this would be expected to result in a minimal net impact to groundwater levels in this location (i.e. post-closure groundwater levels would be influenced by the Approved Proposal and third-party operations).

The Yandi MCP is attached as Appendix 5 and includes an assessment of mine void backfill options and evaluations as Section 7.5.3.



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SIGNIFICANT AMENDMENT

APPROVED PROPOSAL GROUNDWATER MODELLING TO 2025 (AQUATERRA 2008)

WAIO PLANNING, TECHNICAL & ENVIRONMENT

SCALE@ A4:	Not to scale	PREPARED:	GEOMATICS	FIGURE:	7-9
DATE:	24/04/2025	REQUESTOR:	ENV APPROVALS		

A1205-103-RevA

7.4.3 Changes to water quality

7.4.3.1 Pit excavation and infrastructure

The existing infrastructure in the Development Envelope (including rail, processing facilities, accommodation camps, etc.) has been assessed as part of the Approved Proposal. Any additional infrastructure such as heavy vehicle haul roads or light vehicle tracks within the Proposal will be designed to limit any potential for sediment movement. Every effort has been made to maximise the use of existing cleared areas to minimise vegetation clearing and potential changes to surface water runoff characteristics of the site.

Mine Waste Management (2022) conducted an assessment of pit wall exposure of each stratigraphic unit at closure across the Development Envelope. The assessment concluded that there was a low risk of acid mine drainage (AMD) for the Development Envelope.

7.4.3.2 Pit closure

The current closure strategy for the Proposal is yet to be finalised, however BHP intend to backfill the pit with the objective of preventing formation of a pit lake, and the capture of Marillana Creek.

7.4.3.3 Changes to water quality from discharge of surplus water to Marillana Creek

As discussed in 7.4.1.1 the forecast surplus water discharge to Marillana Creek from the Combined Proposal will be less than the EP Act (Part IV and Part V) authorised limit of 15,000,000 tpa. Groundwater monitoring across the CID within the Development Envelope has relatively consistent water quality results it is considered unlikely that discharge from the Proposal will cause any change to the water quality of the surplus water discharge.

7.5 Mitigation

7.5.1 Avoid

The Proposal avoids impacts by using existing infrastructure within the BHP Yandi Operations where possible to reduce additional impacts. The Proposal will be operated within the existing groundwater license limits and surplus water discharge to avoid increased impacts.

BHP will continue to implement the avoidance measures for the Approved Proposal (summarised in Appendix 2) as part of the Combined Proposal if approved (see Appendix 6).

7.5.2 Minimise

7.5.2.1 Marillana Creek Water Resource Management Plan

The Surface Water and Groundwater Management Plan (SWGWMP) was prepared and implemented as Condition 8 from MS 679 and was approved on 1 April 2015 (Ref A427483:OEPA2001/000759). The intent is to implement the revised Marillana Creek Water Resource Management Plan (MCWRMP) in place of the SWGWMP which has been attached as Appendix 6.

The revised management plan has been updated to include the following monitoring and management actions:

- monitor the impact of the Combined Proposal on key water parameters relevant to the proposed activities.
- maintain the quantity and quality of water so that existing and potential environmental values, including ecosystem maintenance, are protected.

- management and mitigation actions to limit groundwater drawdown impacts including mitigation measures suggested below in Section 7.5.2.2.

Table 7-9: Summary of MCWRMP Approach

Environmental Receptor	Approach
Groundwater levels	Outcome based approach • triggers and thresholds to control groundwater level drawdown from dewatering • threshold criteria associated with groundwater quality
Marillana Creek Riparian vegetation	Outcome based approach • triggers and thresholds associated with riparian vegetation
Marillana Creek Pools	Management based approach • develop baseline dataset of water levels in the pool • continued sampling of aquatic fauna

7.5.2.2 Groundwater abstraction (dewatering) Flat Rocks

Groundwater decline upstream of the Development Area has been managed to date through the implementation of SWGWMP (2014). Consistent with the SWGWMP groundwater levels are regularly monitored throughout the Development Envelope and at upstream locations off tenure. Monitoring of riparian tree health has been undertaken concurrently with groundwater level monitoring and riparian tree health decline/death has been observed and reported in AER, in response BHP has commenced mitigation actions to recover groundwater levels in the area to minimise further riparian tree health decline (Riparian tree health discussed further in Section 8).

To prevent the further decline of water levels BHP has undertaken the following actions at W0 (the westernmost pit):

- August 2022: commenced a dewatering reduction trial by ceasing dewatering in one out of four bores
- January 2023: increased the reduction by ceasing dewatering in two out of four bores
- April 2023: ceased dewatering in all bores.

A rapid improvement in water level was observed in the nearest groundwater monitoring bore (HYW0005M) to W0 which has recorded 18 m of groundwater level rise as a result of the dewatering reduction trial. An increase in water levels of 10 m has been observed further upgradient at MB16YSN0001 and an increase of 1.5 m has been observed at MB16YSN0003 located at Flat Rocks Road crossing. Water levels at HYW0002M bore have risen 1 m to 610 m in January 2025. It should be noted that estimates of mitigation measures use bore HYW0002M to describe water level changes which is upstream of Flat Rocks, and not MB16YSN003 at Flat Rocks because of the following:

- MB16YSN003 data is received under a data sharing agreement with RTIO and is provided on an inconsistent basis. There is a limited dataset associated with this location and no pre-mining data available.
- BHP have 33 years of historical data associated with HYW0002M which assists in the accuracy of predictions.

- HYW0002M is located between the reference tree health site and Flat Rocks which provides an indication of how groundwater levels in both systems may be changing.

BHP is intending on carrying out other mitigation measures to minimise groundwater and tree health decline at Flat Rocks including the following proposed works:

1. Off-tenure injection in the CID at one location upstream of Flat Rocks is currently being investigated. The aim of this reinjection is to provide groundwater supplementation at source for groundwater dependent vegetation. This option would allow water levels at HYW0002M to increase to near long-term average of 613 mAHD (pre-mining water levels) with injection in two years from commencement. Approvals under EP Act and RiWI Act will be required prior to proceeding.

2. Investigation into possible low permeability barriers to slow groundwater flow into W1 Pit and force water to mound within the CID channel upstream. The objective being to allow groundwater levels to stabilise at long term average upstream of the low permeability barrier, without ongoing active mitigations. Approvals under EP Act and RiWI Act will be required prior to proceed.

7.5.2.3 Groundwater abstraction (dewatering) Yandicoogina Gorge

Although the causation for regional groundwater decline is still unclear nor can be attributed to regional or a single mining operation or climate process, BHP are currently working with Traditional Owners, RTIO, EPA and DWER to mitigate further groundwater decline to the Gorge through initiating a groundwater supplementation trial.

The trial is proposed to run as a short-term mitigation trial for 6 months with potential extension pending results and stakeholder feedback. The trial's objectives are to:

- Stabilise groundwater levels within the Ministers North aquifer at the head of the Gorge, specifically to abate further groundwater decline. The infrastructure to support the trial has been to provide flexibility with supplementation rates, while maintaining practicability.
- Improve understanding of the interactions between Ministers North Aquifer and the Gorge (Gorge GDV), specifically how regional groundwater is supporting the GDV and to test hydraulic properties.

The scope of the trial includes:

1. Construction of 8 km of a 200-250 mm high-density polyethylene pipeline from BHP's Yandi mine.
2. Conveyance of up to 2.7 ML/day of surplus dewatered groundwater to a break tank within Ministers North Tenure. The pipeline route has been designed to minimise clearing by utilising existing cleared tracks where feasible.
3. Construction of reinjection head works with a solar and/or diesel-powered pump to enable reinjection into one of four existing groundwater bores located near the head of the Gorge.
4. Installation of six additional groundwater monitoring bores at two locations within 200m of the head of the Gorge to monitor reinjection levels and water quality.
5. Installation of three additional shallow groundwater monitoring bores in one location within Yandicoogina Creek, upstream from the Gorge and Ministers North to assess recharge of rainfall events.
6. Establishment of remote supervisory control and data acquisition systems to provide real time monitoring and control during the trial.
7. Development of a Trigger Action Response Plan, with trigger and threshold criteria values to support the trial.

Results of the trial and hydrogeological field studies are communicated regularly with all relevant stakeholders. A long-term option for groundwater supplementation in the gorge was referred to the EPA in February 2025 as part of the Mining Area C-Southern Flank Significant Amendment (BHP 2025f).

7.5.2.4 Pit excavation and infrastructure - mine site drainage

BHP will design and construct mine infrastructure according to applicable Australian Standards and standard internal management practices, to minimise potential impacts to surface water regimes from changes to surface water availability.

As discussed in Section 7.4.1.2, no further drainage diversions are planned as part of the Proposal. Disturbance to sections of Marillana Creek will be required for the construction of the haul road and light vehicle road. The final design will ensure there will be no detrimental changes to the flow of Marillana Creek.

7.5.2.5 Pit excavation and infrastructure – water quality

As discussed in Section 0, there is a very low hazard of generating AMD/saline drainage generation within the Development Envelope because of the Proposal. BHP will quantify any remaining risk of AMD during operations in the review of the Yandi MCP.

Impacts to water quality from emissions and discharges to surface and groundwater can be adequately assessed, managed and regulated under Part V of the EP Act. BHP considers that Part V of the EP Act is the most appropriate statutory decision-making process to manage any potential impacts on water quality from the Proposal.

7.5.3 Rehabilitate

Rehabilitation within the Development Envelope is addressed in the Yandi MCP. The MCP covers the Approved Proposal and has been updated in 2025 to include the Proposal (BHP 2025c).

The Yandi MCP addresses how pits and constructed landforms (principally OSAs) will be designed, constructed and rehabilitated, to ensure they are safe, stable and non-polluting. This includes potential management strategies and processes for monitoring the risk indicators for surface water and groundwater quality.

Management approaches in the Yandi MCP relating to Inland Waters for the Proposal include:

- Continue monitoring and management of materials with the potential for AMD (if encountered)
- Progressively review and refine the closure designs for the short-term
- Utilise updated flood modelling (Advisian 2023), to inform the closure designs for surface water management infrastructure
- Complete detailed closure designs for flood bunds and diversions
- Review (and if appropriate revise) the surface water monitoring program, to inform closure and assess achievement of completion criteria
- Refine conceptual and numerical groundwater modelling as new data becomes available and the backfill strategy evolves, to further analyse post-mining groundwater levels and water quality
- Backfill the E8 BWT voids to prevent formation of a pit lake and creek capture with appropriate material
- Review the backfill strategy for other BWT voids, to minimise the formation of pit lakes and the potential impacts of pit lakes, in consultation with key stakeholders including Traditional Owners.

7.5.4 Other statutory decision-making processes

Table 7-10 summarises whether another statutory decision-making process can mitigate the potential environmental impacts of the Proposal on Inland Waters, considering the EPA's Taking decision making processes into account in EIA: Interim Guidance (EPA 2021b). Table 7-10 also provides reasons, including how, in relation to the specific potential impacts of the Proposal, the decision-making process takes the EP Act object and principles, and the EPA's objective for Inland Waters, into account.

Table 7-10: Inland Waters - other statutory decision -making processes

Potential impact from the Proposal	Statutory decision-making process can mitigate impacts on the environment?	Reasons (if Yes)
Changes to groundwater regimes (drawdown) from groundwater abstraction (dewatering)	Yes	**RiWI Act section 5C licence to take water** • Licence specifies approved location of groundwater abstraction, authorised abstraction volume and compliance requirements • Operating Strategy (licence condition) specifies abstraction, monitoring and reporting details • Licence contains outcome-based conditions (including operating strategy) that can maintain the hydrological regimes of surface water to protect environmental values, to meet the EPA's objective for Inland Waters
Changes to groundwater and surface water regimes from discharge of surplus water to Marillana Creek	Yes	**EP Act Part V licence** • Provides for granular regulation of emissions and discharges • Licence specifies authorised location of surplus discharge, discharge rate limit, monitoring locations and parameters, triggers, reporting and compliance requirements • Licence contains outcome-based conditions that can maintain the hydrological regimes of groundwater and surface water to protect environmental values to meet the EPA's objective for Inland Waters
Changes to water quality from groundwater abstraction (dewatering)	No	• Water quality monitoring is undertaken as a requirement of the RiWI Act section 5C licence Operating Strategy, but the Operating Strategy does not contain water quality triggers or thresholds to mitigate potential impacts
Changes to water quality from discharge of surplus water	Yes	**EP Act Part V licence** • Provides for the granular regulation of emissions and discharges • Licence specifies authorised location of surplus discharge, discharge rate limit, monitoring locations and parameters, triggers, reporting and compliance requirements

Potential impact from the Proposal	Statutory decision-making process can mitigate impacts on the environment?	Reasons (if Yes)
		• Licence contains outcome-based conditions that can maintain the hydrological regimes of groundwater and surface water to protect environmental values to meet the EPA's objective for Inland Waters
Changes to surface water catchments from installation of infrastructure	Yes	**RiWi Act Bed and Banks Permit** • Permit ensures health and wellbeing of a watercourses ecology • Licence contains outcome-based conditions (including operating strategy) that can maintain the hydrological regimes of surface water to protect environmental values, to meet the EPA's objective for Inland Waters

7.6 Assessment and significance of residual impacts

An assessment of the significance of residual impacts to Inland Waters as a result of the Proposal and Combined Proposal are addressed in this section.

7.6.1 Changes to surface water regimes

7.6.1.1 Changes to surface water catchment runoff quantity

As discussed in Section 7.4.1, there are unlikely to be direct or indirect impacts to surface water flows in Marillana Creek. The potential reduction in surface water availability from loss of catchment due to the Proposal is predicted to be up to 0.5%, for the Marillana Creek catchment. A reduction in catchment area of less than 5% is within the natural variation of seasonal rainfall runoff. This is not considered a significant reduction in catchment area on a local or regional scale, particularly given the highly seasonal nature of streamflow in the Pilbara, as well as the annual variability of rainfall. Therefore, there is unlikely to be any significant impacts on surface water catchments from the effects of from the Proposal.

7.6.1.2 Changes to surface water flow paths from mine pit excavation and construction of infrastructure

As discussed in Section 7.4.1.2, there will be no residual impact on current surface water flow paths from the Proposal through the use of flood bunds for redirected flood waters and haul road creek crossings designed to convey flows.

7.6.2 Changes to groundwater regimes

7.6.2.1 Changes to groundwater levels and flow from groundwater abstraction (dewatering)

Residual impacts of the Proposal

As discussed in Section 7.4.2 the Proposal will not result in an increase in the peak dewatering rate or annual groundwater abstraction limit. The Proposal will not result in an increase in drawdown at Flat Rocks and is not predicted to result in drawdown in the Ministers North aquifer (and therefore impacts the Yandicoogina Gorge GDE).

Numerical modelling simulating the drawdown from the Proposal alone predicts that by end of 2029:

- CID – approximately 20 m in the E8 orebody. The drawdown migrates approximately the same distance east and west along the CID from E8 (up to 2.5 km in both directions). To the west however, the magnitude is greater (Figure 7-5).
- Basement – approximately 10 m beneath the E8 orebody. Drawdown of up to 1 m is predicted to extend between 2.5 km (north south) and 4.5 km (east west) from the dewatering (Figure 7-6)
- No impact to the Ministers North Aquifer and Yandicoogina Gorge as a result of the Proposal.

Long term impacts from open pit mining are proposed to be limited through backfilling of the pits in the Indicative Footprint at closure to above groundwater levels.

The only licensed groundwater users that could potentially be impacted by groundwater drawdown for the Proposal (adjacent proponents), are also using their licensed allocations for dewatering and will not be impacted by the Proposal.

Residual impacts of the Combined Proposal at Flat Rocks and Marillana Creek Pools

The predicted drawdown in end of 2029 at Flat Rocks and the Marillana Creek Pools as a result of the Combined Proposal is estimated to be an additional 3 m (INTERA, 2024). Mitigation of the drawdown extent began in 2022 through initial reduction and subsequent ceasing of dewatering at W0 pit when groundwater level trigger values at upstream bores were exceeded.

Current drawdown at Flat Rocks is estimated as 12 m in MB16YSN0003. Ceasing dewatering at W0 has resulted in a water level recovery of over 18 m at the tenure boundary and has been effective in stopping the decline of groundwater off tenure at Flat Rocks. Water levels at the HYW0002M monitoring bore have begun to recover and are above 610 mAHD (3 m below pre-development groundwater levels). Through these mitigation actions further drawdown upstream of W0 is considered unlikely.

Groundwater level change associated with the Combined Proposal can be described as follows:

- Groundwater levels at Flat Rocks and MarC5 Pool currently at 12 m below ground level. No further drawdown due to dewatering at the Combined Proposal at Flat Rocks and MARC5 Pool. Groundwater levels near MarC1, MarC2, MarC3, and MarC4 pools to be maintained within 3-4 m of pre-mining groundwater levels consistent with trigger and threshold values in MCWRMP.

Results on the implementation of other mitigation strategies (off-tenure injection and the feasibility of a possible flow barrier) are currently being investigated by BHP with the long-term aim of restoring hydrological function to support GDV at Flat Rocks. These works are subject to future studies and associated approval.

Potential Residual impacts of the Combined Proposal at Yandicoogina Gorge

As described in Section 7.3.3, the cause of the observed decline in groundwater levels in the Ministers North aquifer (which is thought to support the Yandicoogina Gorge) is not conclusively known. Data analysis and numerical groundwater modelling has shown that it may be due to climate variability, or a combination of climate variability and drawdown from dewatering by both BHP and third-party operators in the CID (BHP 2024c; INTERA 2023).

Groundwater modelling to inform the impact assessment for the Combined Proposal is based on the precautionary assumption that regional dewatering is connected to groundwater decline in Yandicoogina Gorge. Potential impacts of the Combined Proposal are unable to be reviewed in isolation from other factors potentially influencing Yandicoogina Gorge including lower than average rainfall and third-party dewatering operations. The objective of the groundwater supplementation trial is to abate further groundwater decline in the Ministers North aquifer at the head of the Gorge. A prediction on the residual impact in the absence of the definitive causation of groundwater decline or

initial results from the supplementation trial is challenging in this case. Further investigation and outcomes of the supplementation is required by BHP and other stakeholders to assess the residual impact.

The indirect impacts to flora, vegetation, terrestrial fauna and subterranean fauna associated with cumulative groundwater drawdown in the Ministers North aquifer are discussed in Section 16 Cumulative Impacts as the results of this modelling are consistent with cumulative dewatering in the region.

7.6.3 Changes to water quality

7.6.3.1 Pit excavation and infrastructure

As discussed in Section 0, the risk of generating AMD from waste rock and pit wall exposure from the Proposal is considered to be low.

Therefore, impacts on water quality from pit excavation and infrastructure for the Combined Proposal are not predicted to be significantly different to those assessed for the Approved Proposal. The combined effect of potential impacts from pit excavation and infrastructure is therefore not significant and can be managed under Part V (works approval and licence) and Part IV (MCP) of the EP Act, to be consistent with the EPA's objective for Inland Waters.

7.6.3.2 Changes to water quality from discharge of surplus water to Marillana Creek

It is unlikely that there will be exceedances of analyte concentrations (including TDS) in any surplus water discharged to Marillana Creek based on existing water quality data (Section 7.3.2.3). Monitoring of surplus water discharge will be undertaken consistent with existing licence requirements to detect any potential change and will be reported in the BHP AER.

7.6.4 Significant residual impacts

Following the application of the mitigation hierarchy (Section 7.5) and applying the Residual Impact Significance Model in the WA Offsets Guidelines (Government of Western Australia 2014), BHP considers that there is no significant residual impact to Inland Waters from the Proposal. Whilst this impact is not considered significant to the Inland Water factor it has the potential to result in significant indirect impacts to other factors which is considered in Sections 8, 9, 10 and 11. BHP considers that the residual impact to Flat Rocks is subject to further investigation and analysis. Residual impacts to Yandicoogina Gorge are due to cumulative dewatering and/or climate variability and also subject to further investigation and analysis (refer to Section 16.1). See Section 7.7 for the discussion on the outcomes relating to the identified residual impacts of the Combined Proposal and BHP's proposed assurance (regulation) and monitoring, where required.

7.7 Environmental outcomes

Table 7-11 summarises the environmental outcomes, proposed assurance (regulation) and proposed monitoring (if required) for each residual impact for Inland Waters. Detail of the proposed monitoring is set out in the Part IV environmental management plans and other relevant statutory decision-making documents discussed in Section 7.5. Table 7-11 demonstrates how the proposed environmental outcomes for the Proposal, together with the proposed regulation and monitoring, are consistent with the EPA's objective for Inland Waters (Section 7.1).

As required by the EPA's ERD Instructions, for Significant Amendments, BHP has included information about the existing implementation conditions for the Approved Proposal (Appendix 2). BHP considers that the EPA should inquire into the Approved Proposal implementation conditions (relating to Inland Waters), as provided for under s40AA(3), as part of the assessment of the Proposal under s40 and in the EPA's assessment report required under s44, for the following reasons:

- to contemporise the conditions to reflect the contemporary condition setting approach (in recommended conditions in EPA Reports and Ministerial Statement since early 2023).

Table 7-11: Inland Waters - environmental outcomes, proposed regulation and monitoring for the Proposal

Residual impact	Environmental outcome	Proposed regulation (Condition[1] or other statutory decision-making process)	Proposed monitoring	Consistency with EPA objective
Decrease in groundwater levels (drawdown) from dewatering	Decrease in groundwater levels in the CID and the Basement Potential decrease in groundwater levels in Ministers North aquifer (cumulative)	**Condition B1: Inland Waters** • Implement the Marillana Creek Water Resource Management Plan (BHP 2025c; Rev 2) **RiWI Act section 5C licence to take water** Compliance with existing licence GWL89501: • limit on rate of annual groundwater abstraction • condition - Groundwater Operating Strategy • conditions - groundwater monitoring reviews	**Condition B1: Inland Waters** • Implement the Marillana Creek Water Resource Management Plan (BHP 2025c; Rev 2 May 2025) **RiWI Act section 5C licence to take water** Continue monitoring in Groundwater Operating Strategy	Subject to regulation (EP Act Part IV Condition, RiWI Act Licence), the environmental outcome is likely to be consistent with the EPA's objective
Decrease in surface water catchment runoff	Decrease in Marillana Creek catchment by 0.64%	None	None	The environmental outcome is likely to be consistent with the EPA's objective
Changes to water quality	Changes to water quality from pit excavation	**EP Act Part V licence** No change to existing surplus water discharge licence (L6168/1991/10): • limit on surplus discharge (15,000,000 tpa) • monitoring conditions related to surplus discharge from existing license	**EP Act Part V licence** Continue monitoring for Licence (see Table 7-10: Inland Waters - other statutory decision - making processes)	Subject to regulation (EP Act Part V), the environmental outcome is likely to be consistent with the EPA objective

Residual impact	Environmental outcome	Proposed regulation (Condition[1] or other statutory decision-making process)	Proposed monitoring	Consistency with EPA objective
Decrease in groundwater levels at Flat Rocks[2]	Groundwater drawdown at Flat Rocks at 12m below ground level. No further drawdown due to dewatering at the Combined Proposal at Flat Rocks and MARC5 Pool.	**Condition B1: Inland Waters** • Implement the Marillana Creek Water Resource Management Plan (BHP 2025c) **Condition B6: Rehabilitation and Decommissioning** • Implement the MCP (BHP 2025b)	**Condition B1: Inland Waters** • Implement the Marillana Creek Water Resource Management Plan (BHP 2025c) **Condition B6**: The proponent must implement monitoring outlined in the MCP (BHP 2025b).	Subject to regulation (EP Act Part V), the environmental outcome is likely to be consistent with the EPA objective

[1] See Appendix 3 for proposed implementation conditions for the Combined Proposal

[2] This is a residual impact of the Combined Proposal

8 Flora and Vegetation

8.1 EPA environmental factor and objective

The EPA's objective for the Flora and Vegetation factor is:

> *To protect flora and vegetation so that biological diversity and ecological integrity are maintained.*

8.2 Relevant policy and guidance

BHP assessed this environmental factor considering the following relevant EPA policies and guidance, as outlined in Table 8-1.

Table 8-1: Flora and Vegetation - policy and guidance

EPA, other State and Commonwealth policy and guidance	Consideration of EPA policy and guidance
Environmental Factor Guideline - Flora and Vegetation (EPA 2016a)	• Applied the relevant considerations for environmental impact assessment • Identified the values of flora and vegetation, and their significance • Identified activities that can impact on flora and vegetation • Considered the links with other environmental factors
Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016b)	Surveys described in Section 8.3.1 were undertaken in accordance with the guidance
WA Environmental Offsets Policy (Government of Western Australia 2011) *WA Environmental Offsets Guidelines* (Government of Western Australia 2014)	• Applied avoidance and mitigation measures to the Proposal • Considered cumulative impacts in the regional context in determining significant residual impact • Quantified the significant residual impact

8.3 Receiving environment

8.3.1 Studies and surveys

A total of 34 flora and vegetation surveys have been undertaken wholly or partially within the area of the Development Envelope. These surveys comprise 20 detailed surveys, 13 targeted surveys and one desktop assessment. A complete list and summary of these surveys is provided in Appendix 7. All surveys were completed in accordance with the EPA guidance (relevant at the time of surveying). Surveys undertaken post-2009 have also been completed in accordance with BHP's Vegetation and Flora Survey Procedure (BHP 2018) that was developed to ensure a consistent approach for all surveys undertaken for BHP.

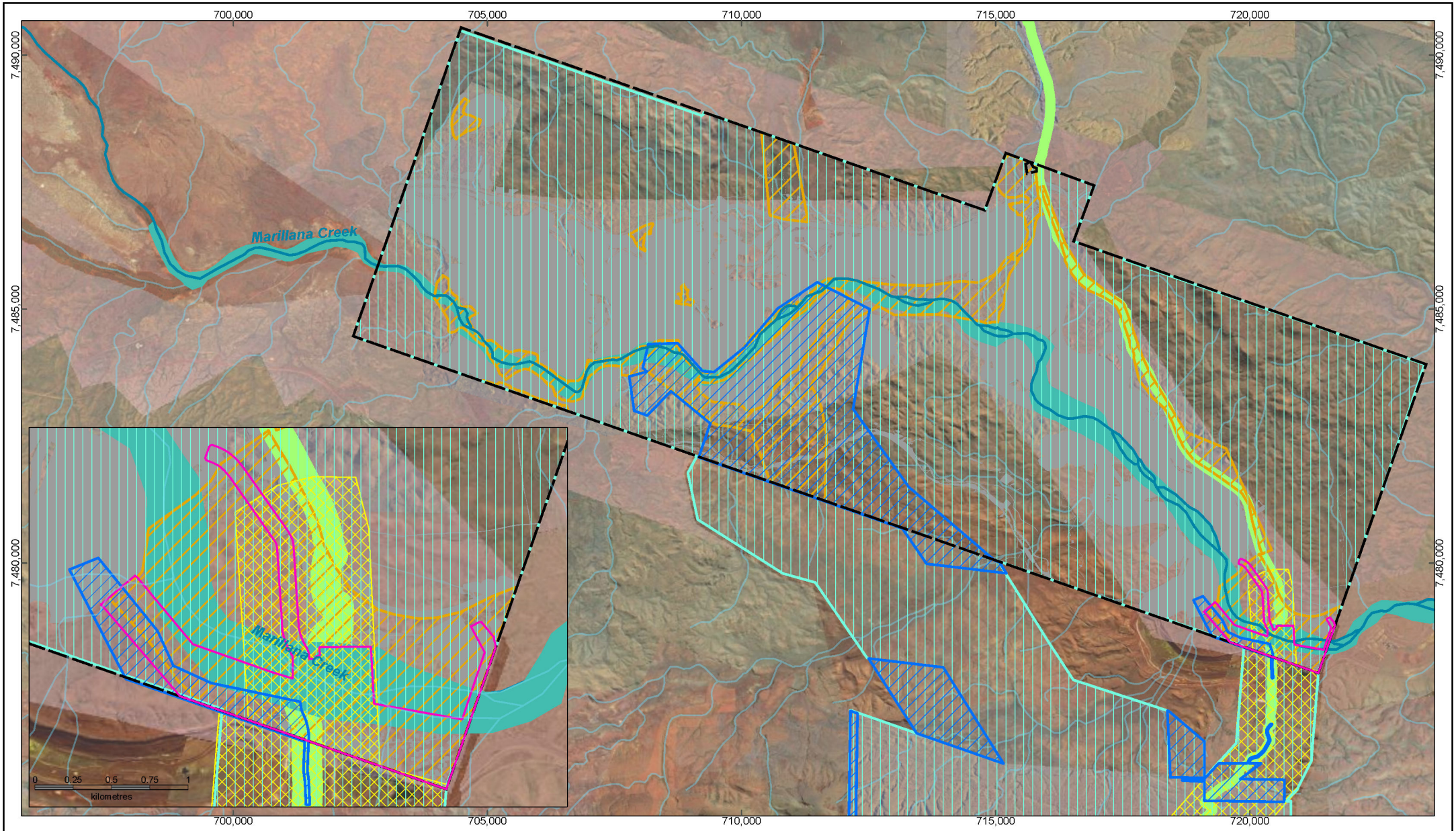
Table 8-2 summarises recent surveys undertaken across the Development Envelope to support the assessment of Flora and Vegetation for the Proposal, and Figure 8-1 shows the location of these surveys. The associated survey reports are provided in Appendix 8 and IBSA data package as Appendix 9.

One small area comprising the northernmost edge of the Indicative Footprint has been subject to historic baseline surveys; however, this area has not been recently surveyed for significant flora species. This area is highly disturbed

as it lies over an existing road and therefore contains minimal remnant vegetation so is considered unlikely to support any significant flora species. One additional small area along the south-western boundary of the Indicative Footprint also falls outside recent targeted survey areas; however, this area is immediately adjacent to cleared areas and therefore is also not considered likely to contain significant flora species.

Table 8-2: Flora and Vegetation - recent studies and surveys

Title	Date	Summary	Appendix
Central Pilbara Hub Detailed and Targeted Flora Survey (Biologic 2024a)	Nov 2021 Mar 2022 Apr 2022 May 2022 June 2022	A multiple season detailed and targeted flora survey, including targeted GDV survey, to map the vegetation and assess the flora taxa present, or likely to be present, within a study area which included part of the Indicative Footprint. The survey covered a total area of 60,000 ha.	Appendix 8
Yandi E8 Targeted Flora Survey (Biologic 2023a)	May 2022	Single season targeted flora survey of several areas within the Development Envelope including the Indicative Footprint. Targeted searches were conducted through the survey area for significant flora species.	Appendix 8
Targeted Flora Surveys of Pipeline Corridors (GHD 2022)	April-May 2021	Single season targeted flora survey of a pipeline corridor; a portion of which traverses the western side of the Development Envelope. Targeted searches were conducted through the survey area for significant flora species.	Appendix 8
Ministers North and Yandi Vegetation Association and Condition Mapping (Onshore 2020)	June 2020	Detailed desktop review of all existing vegetation associations and condition mapping across BHP's Ministers North and the Approved Proposal tenements and associated infrastructure corridors. The majority of the Development Envelope was included in this study. The review consolidated mapping across the tenements, aligning the vegetation association mapping with BHP's regional consolidated database, and aligning vegetation condition mapping with the condition rating scale for the Eremaean Botanical Province detailed in the EPA's *Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016b).	Appendix 8
Ministers North Miscellaneous Licence Area Amendment Surveys and Yandicoogina Creek Detailed Flora and Vegetation Assessment (Biologic 2020a)	March-April 2020	Two season detailed flora and vegetation survey of Yandicoogina Creek, and a single season detailed flora and vegetation survey plus targeted flora and vegetation survey of additional areas in the Ministers North miscellaneous licence area. Portions of the Development Envelope in the centre and south-eastern corner were included in the Ministers north detailed and targeted survey areas. Vegetation was sampled from three quadrats and four relevés, supplemented with targeted searches.	Appendix 8
Marillana Creek Riparian Flora and Vegetation Survey (Onshore 2015)	June 2015	Detailed riparian flora and vegetation survey and riparian vegetation monitoring conducted along a 32 km section of Marillana Creek, covering the entire extent of Marillana Creek within the Development Envelope. Vegetation was sampled from 40 quadrats and 237 relevés across the study area. A total of five permanent monitoring points were established along the length of Marillana Creek.	Appendix 8



- Indicative Footprint
- Development Envelope
- Existing Disturbance
- Marillana Creek Riparian Flora and Vegetation Survey (Onshore 2015)
- Ministers North Miscellaneous Licence Area Amendment Surveys and Yandicoogina Creek Detailed Flora and Vegetation Assessment (Biologic 2020)
- Ministers North and Yandi Vegetation Association and Condition Mapping (Onshore 2020)
- Targeted Flora Surveys of Pipeline Corridors (GHD 2022)
- Central Pilbara Hub Targeted and Detailed Flora Survey (Biologic 2022)
- Yandi E8 Targeted Flora Survey (Biologic 2023)

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kilometres

GDA 1994 MGA ZONE 50

BHP

PUBLIC

MARILLANA CREEK (YANDI) SIGNIFICANT AMENDMENT

FLORA AND VEGETATION SURVEYS

WAIO PLANNING, TECHNICAL & ENVIRONMENT

SCALE @A4:	1:100,000	PREPARED:	GEOMATICS	FIGURE:	8-1
DATE:	30/04/2025	REQUESTOR:	ENV APPROVALS		

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8.3.2 Environmental values

8.3.2.1 Vegetation

Regional vegetation

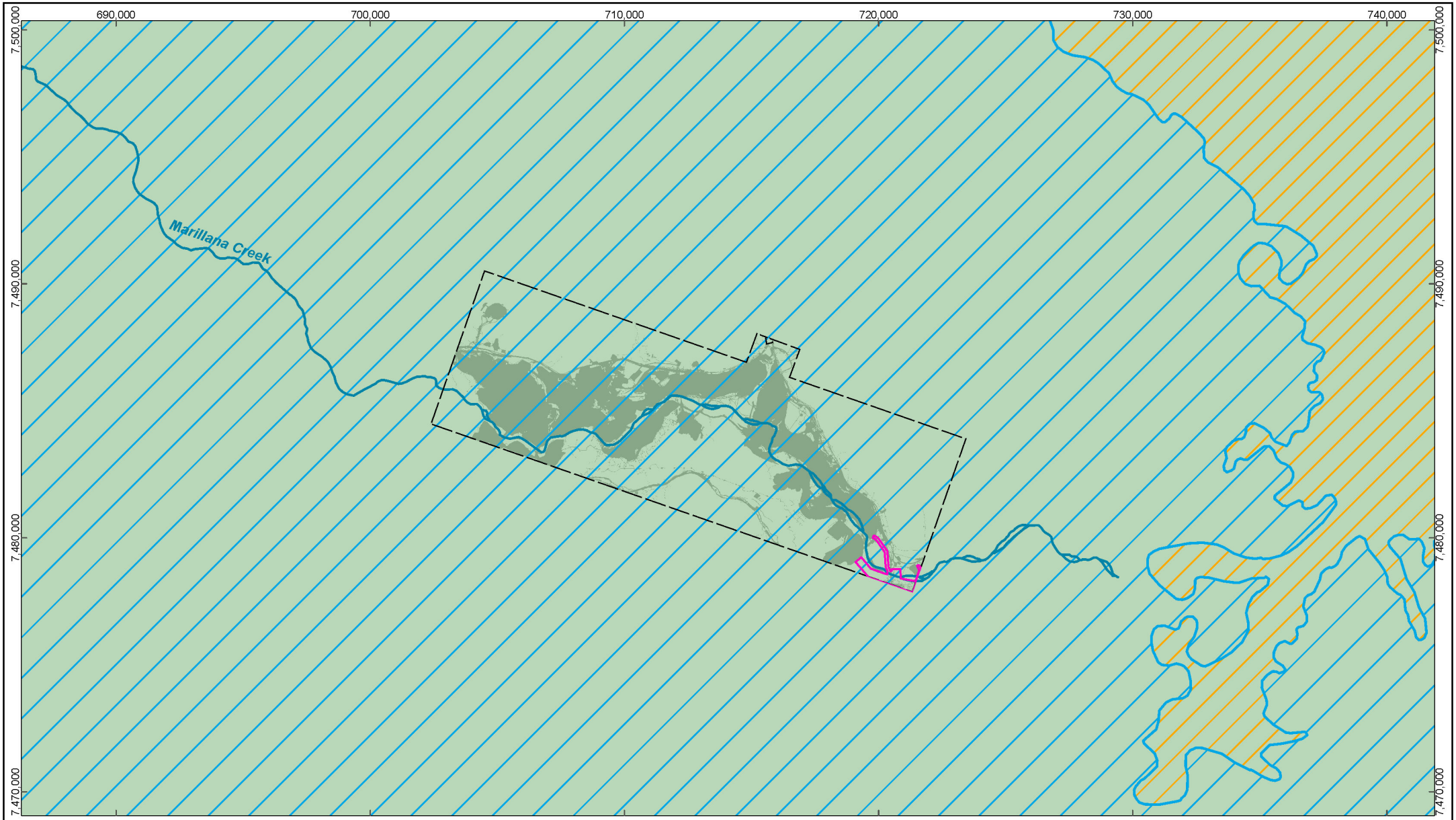
The Development Envelope is located within the IBRA Pilbara bioregion, and wholly within the Hamersley subregion (PIL3) (DCCEEW 2020) (Figure 8-2). The Hamersley subregion is characterised by mountainous areas of Proterozoic sedimentary ranges (ironstone ranges) and plateaux dissected by gullies and gorges (Kendrick 2001). Mulga low woodland over bunch grasses on fine-textured soils dominates in valley floors, while skeletal soils of the ranges are dominated by snappy gum over *Triodia brizoides*. Drainage is typically into the Fortescue River to the north, the Ashburton River to the south, or the Robe River to the west (Kendrick 2001).

The vegetation of the Development Envelope, as mapped by Beard (1975) and refined by Shepherd et al. (2002), is classified as the following two associations (Figure 8-3):

- Association 18 – low mulga woodland dominated by *Acacia aneura*
- Association 82 – hummock grasslands, low tree steppe and snappy gums over *Triodia wiseana*.

The dominant association in the Development Envelope is association 18, occurring across 89% of the Development Envelope (Figure 8-3).

The regional vegetation associations that occur within the Development Envelope all have over 99% of their pre-European extent remaining and are not considered regionally significant. The associations are well represented within Western Australia occurring broadly within, or extending beyond, the Pilbara bioregion.



Indicative Footprint
Development Envelope
Existing Disturbance
Marillana Creek

Interim Biogeographic Regionalisation for Australia (IBRA) V6.1 - Regions

Pilbara

Interim Biogeographic Regionalisation for Australia (IBRA) V6.1 - Sub Regions

Fortescue
Hamersley

N

0 2 4 6 8 10
kilometres

GDA 1994 MGA ZONE 50

BHP

PUBLIC

MARILLANA CREEK (YANDI) SIGNIFICANT AMENDMENT

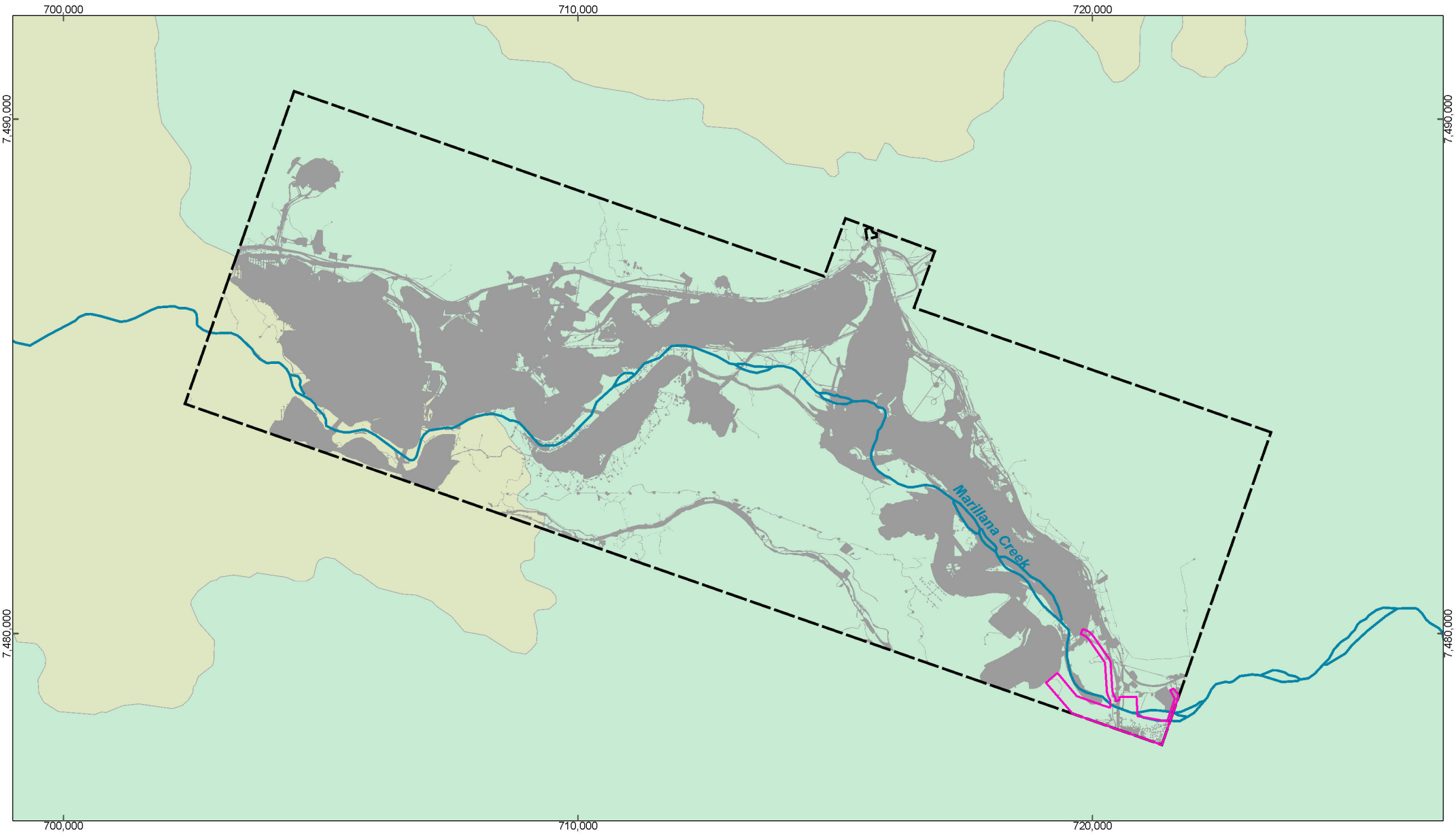
IBRA BIOREGIONS AND SUBREGIONS

WAIO PLANNING, TECHNICAL & ENVIRONMENT

SCALE @A4:	1:200,000	PREPARED:	GEOMATICS	FIGURE:	8-2
DATE:	30/04/2025	REQUESTOR:	ENV APPROVALS		

A1205-013-RevD

Document Path: \\ogisfileprdwaio\premiumafs\Depts\Heritage_Data\Jobs\A1001_A1500\A1205\3Project\A1205_013_E_Yandi_S38_IBRAbioregions_RevC.aprx



Indicative Footprint
Development Envelope
Existing Disturbance
Marillana Creek
Beard's Pre-European Vegetation Classification
Association 82 – hummock grasslands, low tree steppe and snappy gums over *Triodia wiseana*
Association 18 – low mulga woodland dominated by *Acacia aneura*

N
0 1 2 3 4
kilometres
GDA 1994 MGA ZONE 50

BHP
PUBLIC

MARILLANA CREEK (YANDI) SIGNIFICANT AMENDMENT
BEARD VEGETATION ASSOCIATIONS

WAIO PLANNING, TECHNICAL & ENVIRONMENT

SCALE @A4:	1:100,000	PREPARED:	GEOMATICS	FIGURE:	8-3
DATE:	30/04/2025	REQUESTOR:	ENV APPROVALS		

A1205-007-RevD

Document Path: \\iogisfileprdwaio\premiumafs\2depts\Heritage_Data\Jobs\A1001_A1500\A1205\3Project\A1205_007_E_Yandi_S38_BeardVeg_RevC.aprx

Local vegetation

BHP reviewed and consolidated vegetation mapping across its tenements in 2014 with vegetation association descriptions (and codes) aligned between surveys undertaken across the Pilbara (Onshore 2014a). The mapping has been regularly revised and updated as new survey data became available. More recently, detailed vegetation mapping across the Development Envelope was consolidated by Onshore Environmental in 2020 and aligned vegetation condition mapping with the condition rating scale for the Eremaean Botanical Province detailed in the EPA *Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016b).

A total of 43 vegetation associations, classified under 18 broad floristic formations, have been described and mapped within the Development Envelope (Table 8-3, Figure 8-4). The majority of the Development Envelope was included in the vegetation association mapping undertaken by Onshore (2020). Therefore, this mapping has been used to define the vegetation associations of approximately 99% of the Development Envelope as presented in Figure 8-4 and Table 8-3. Some areas of the Development Envelope have been mapped by more recent surveys (e.g. Biologic 2024a).

In addition, due to survey area misalignment with ML 270SA, some of the vegetation association mapping around the edges of the Development Envelope has been sourced from previous surveys (Onshore 2014a, Onshore 2011, Onshore 2014b, Biologic 2020a and Astron 2019). Some of these periphery areas also have minimal or no survey information available in BHPs database due to survey boundary misalignment and survey age, noting that mining was approved to commence at the Yandi mine in 1988. Collectively, these areas account for <1% of the Development Envelope and are listed under 'Other' in Table 8-3.

The dominant vegetation association of the Development Envelope is *Triodia* hummock grassland on hill crests (HC Tw AiAb InrSeao), which makes up 43% of the current extent of vegetation in the Development Envelope. A total of 20 riparian[1] vegetation associations are mapped within the Development Envelope (Table 8-3). Eleven of these are aligned with 'ecosystems at risk' by the DBCA, as they represent vegetation associated with a major ephemeral water course (Marillana Creek) in the Hamersley subregion which is subject to grazing and weed invasion (Kendrick 2001) (Table 8-3; Figure 8-5). One additional vegetation association (SA Aa TpTwTb CcChf) is potentially aligned with an ecosystem at risk; 'Valley Floor Mulga' (Kendrick 2001). The importance of the 'Valley Floor Mulga' ecosystem, within the northern extent of the Hamersley subregion, is in relation to large occurrences of vegetation dominated by Mulga occurring on valley floors or broad plains. The vegetation association SA Aa TpTwTb CcChf occurs sparsely in the Development Envelope and not over large areas and is therefore not considered to represent the 'Valley Floor Mulga' ecosystem at risk. No other vegetation association is considered to represent an ecosystem at risk as recognised by the DBCA.

[1] Riparian vegetation means the distinctive vegetation associated with a wetland or watercourse, as defined in DWER's *A guide to the exemptions and regulations for clearing native vegetation* (DWER 2019a).

Table 8-3: Vegetation associations in the Development Envelope

Broad floristic formation	Vegetation code	Vegetation association description	Local significance	Current extent within DE (ha)	% of DE
Acacia low open forest	MA AaAciApr CcTtChf EvEcr	Low Open Forest of *Acacia aptaneura, Acacia citrinoviridis* and *Acacia pruinocarpa* very Open Tussock Grassland of **Cenchrus ciliaris*, *Themeda triandra* and *Chrysopogon fallax* with Open Woodland of *Eucalyptus victrix* and *Eucalyptus camaldulensis subsp*. *refulgens* on brown loamy sand on major drainage lines with broad and deeply incised drainage channels.	Riparian vegetation	0.02	<1
	SA Aa TpTwTb CcChf	Low Open Forest of *Acacia aptaneura* over Open Hummock Grassland of *Triodia pungens*, *Triodia wiseana* and *Triodia basedowii* over Open Tussock Grassland of **Cenchrus ciliaris* and *Chrysopogon fallax* on red brown sandy loam on sandy plains and undulating low hills.		30.6	<1
	SP AaApr TmTwTp TtChfAri	Low Open Forest of *Acacia aptaneura* and *Acacia pruinocarpa* over Open Hummock Grassland of *Triodia melvillei*, *Triodia wiseana* and *Triodia pungens* over Tussock Grassland of *Themeda triandra*, *Chrysopogon fallax* and *Aristida inaequiglumis* on red brown loam on stony plains.		3.3	<1
Acacia low woodland	FP AcaoAaEx Erff Tp	Low Woodland of *Acacia catenulata* subsp. *occidentalis*, *Acacia aptaneura* and *Eucalyptus xerothermica* over Open Shrubland of *Eremophila forrestii* subsp. *forrestii* over Open Hummock Grassland of *Triodia pungens* on red sandy loam on floodplains.		12.2	<1
	MA AciAcpAthe Tp EteEnl	Low Woodland of *Acacia citrinoviridis*, *Acacia coriacea* subsp. *pendens* and *Atalaya hemiglauca* with Open Hummock Grassland of *Triodia pungens* and Open Tussock Grassland of *Eriachne tenuiculmis* and *Enneapogon lindleyanus* on brown loam on raised levee banks of major drainage line.	Riparian vegetation	11.4	<1
Acacia open scrub	MI AtpPlAm TpTs ChEll	Open Scrub of *Acacia tumida* var. *pilbarensis*, *Petalostylis labicheoides* and *Acacia monticola* over Open Hummock Grassland of *Triodia pungens* and *Triodia* sp. Shovelanna Hill (S.van Leeuwen 3835) with Low Open Woodland of *Corymbia hamerselyana* and *Eucalyptus leucophloia* subsp. *leucophloia* on red brown sandy loam on minor drainage lines.	Riparian vegetation	23.0	<1
Acacia shrubland	MI AbAdAma Tp TtPamuEua	Shrubland of *Acacia bivenosa*, *Acacia dictyophleba* and *Acacia maitlandii* over Open Hummock Grassland of *Triodia pungens* over Open Tussock Grassland of *Themeda triandra*, *Paraneurachne muelleri* and *Eulalia aurea* on brown sandy loam on minor drainage lines.	Riparian vegetation	46.0	<1

Broad floristic formation	Vegetation code	Vegetation association description	Local significance	Current extent within DE (ha)	% of DE
Cenchrus closed tussock grassland	MA CcCs Aci EcrEv	Closed Tussock Grassland of **Cenchrus ciliaris* and **Cenchrus setiger* with Low Open Forest of *Acacia citrinoviridis* and Scattered Low Trees of *Eucalyptus camaldulensis* and *Eucalyptus victrix* on banks and floodplains of major drainage line with brown sandy loam.	Riparian vegetation Represents major ephemeral water course in the Hamersley subregion	23.4	<1
Corchorus low open heath	MA CocrTerfc EcrEv EteCcEpd	Low Open Heath of *Corchorus crozophorifolius* and *Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186) with Scattered Trees of *Eucalyptus camaldulensis* and *Eucalyptus victrix* and Scattered Tussock Grasses of *Eriachne tenuiculmis*, **Cenchrus ciliaris* and *Eriachne pulchella* subsp. *dominii* on creekbed of major drainage line with brown clay loam.	Riparian vegetation Represents major ephemeral water course in the Hamersley subregion	10.9	<1
Dysphania herbs	SP DyrTrhPta	Herbs of *Dysphania rhadinostachya*, *Tribulus hirsutus* and *Ptilotus aervoides* on brown clay on undulating stony plains.		0.7	<1
Eucalyptus low open forest	MA EcrEvEx ApypAtpGoro TtEuaCyp	Low Open Forest of *Eucalyptus camaldulensis* subsp. *refulgens*, *Eucalyptus victrix* and *Eucalyptus xerothemica* over High Shrubland of *Acacia pyrifolia* var. *pyrifolia*, *Acacia tumida* var. *pilbarensis* and *Gossypium robinsonii* over Open Tussock Grassland of *Themeda triandra*, *Eulalia aurea* and *Cymbopogon procerus* on red brown clay loam on major drainage lines.	Riparian vegetation Represents major ephemeral water course in the Hamersley subregion	38.9	<1
Eucalyptus low woodland	MA Ev TefcCocrApy TtSoplCya	Low Woodland of Eucalyptus victrix over Low Shrubland of *Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186), *Corchorus crozophorifolius* and *Acacia pyrifolia* over Open Tussock Grassland of *Themeda triandra*, *Sorghum plumosum* and *Cymbopogon ambiguus* on brown sand on major drainage lines.	Riparian vegetation	0.01	<1
Eucalyptus open forest	MA EcrEvMa AcpAamAthe TydCyv	Open Forest of *Eucalyptus camaldulensis* var. *refulgens*, *Eucalyptus victrix* and *Melaleuca argentea* over Low Open Forest of *Acacia coriacea* subsp. *pendens*, *Acacia ampliceps* and *Atalaya hemiglauca* over Open Sedges of *Typha domingensis* and *Cyperus vaginatus* on brown sandy clay loam along major rivers with permanent water.	Riparian vegetation Represents major ephemeral water course in the Hamersley subregion	11.2	<1

Broad floristic formation	Vegetation code	Vegetation association description	Local significance	Current extent within DE (ha)	% of DE
Eucalyptus open woodland	MA EcrEv AciAcp Mg	Open Woodland of *Eucalyptus camaldulensis* and *Eucalyptus victrix* over Low Open Woodland of *Acacia citrinoviridis* and *Acacia coriacea* subsp. *pendens* over High Open Shrubland of *Melaleuca glomerata* on river bed with brown sand.	Riparian vegetation Represents major ephemeral water course in the Hamersley subregion	31.8	<1
Eucalyptus woodland	MA EvAciEcr TercCocrApyp CcEuaTt	Woodland of *Eucalyptus victrix*, *Acacia citrinoviridis* and *Eucalyptus camaldulensis* subsp. *refulgens* over Low Open Shrubland of *Tephrosia rosea* var. *clementii*, *Corchorus crozophorifolius* and *Acacia pyrifolia* var. *pyrifolia* over Very Open Tussock Grassland of **Cenchrus ciliaris*, *Eulalia aurea* and *Themeda triandra* on brown loamy sand on channels of major drainage lines.	Riparian vegetation Represents major ephemeral water course in the Hamersley subregion	143.1	1
	MA EcrEv AcpAtheEv TpTl	Woodland to Open Woodland of *Eucalyptus camaldulensis* and *Eucalyptus victrix* over Low Woodland of *Acacia coriacea* subsp. *pendens*, *Atalaya hemiglauca* and *Eucalyptus victrix* over Open Hummock Grassland of *Triodia pungens* and *Triodia longiceps* on brown sandy loam on levees and channel islands of major drainage lines.	Riparian vegetation Represents major ephemeral water course in the Hamersley subregion	56.5	<1
Melaleuca high open forest	MA MaEcrEv MgAcpAtr Cyv	High Open Forest of *Melaleuca argentea*, *Eucalyptus camaldulensis* var. *refulgens* and *Eucalyptus victrix* over High Open Shrubland of *Melaleuca glomerata*, *Acacia coriacea* subsp. *pendens* and *Acacia trachycarpa* over Very Open Sedges of *Cyperus vaginatus* on alluvial gravelly soils on major drainage channels with seasonal pools.	Riparian vegetation Represents major ephemeral water course in the Hamersley subregion	13.7	1
Potamogeton open herbs	MA Pt Ecr TdScsuCyv	Open Herbs of *Potamogeton tricarinatus* with Open Woodland of *Eucalyptus camaldulensis* and Very Open Sedges of *Typha domingensis*, *Schoenoplectus subulatus* and *Cyperus vaginatus* on brown light clay on dolerite platforms of major drainage lines.	Riparian vegetation Represents major ephemeral water course in the Hamersley subregion	16.5	<1

Broad floristic formation	Vegetation code	Vegetation association description	Local significance	Current extent within DE (ha)	% of DE
Themeda tussock grassland	FP TtEuaAri EvCa GoroErloAthe	Tussock Grassland of *Themeda triandra*, *Eulalia aurea* and *Aristida inaequiglumis* with Open Woodland of *Eucalyptus victrix* and *Corymbia aspera* and High Open Shrubland of *Gossypium robinsonii*, *Eremophila longifolia* and *Atalaya hemiglauca* on brown sandy loam on plains.	Riparian vegetation Represents major ephemeral water course in the Hamersley subregion	6.9	<1
	GG TtErmuThmb EllChCf AtpGoroPl	Tussock Grassland of *Themeda triandra*, *Eriachne mucronata* and *Themeda* sp. Mt Barricade with Low Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia*, *Corymbia hamersleyana* and *Corymbia ferriticola* over High Shrubland of *Acacia tumida* var. *pilbarensis*, *Gossypium robinsonii* and *Petalostylis labicheoides* on red brown sandy loam on narrowly incised rocky drainage lines.		4.4	<1
	ME TtChfEua ExEvCh PlApaApyp	Tussock Grassland of Themeda triandra, Chrysopogon fallax and Eulalia aurea with Low Open Woodland of Eucalyptus xerothermica, Eucalyptus victrix and Corymbia hamersleyana and Shrubland of Petalostylis labicheoides, Acacia pachyacra and Acacia pyrifolia var. pyrifolia on red sandy loam on medium drainage lines.	Riparian vegetation	0.01	<1
	ME TtEuaEte ApypAtpPl EvCh	Tussock Grassland of *Themeda triandra*, *Eulalia aurea* and *Eriachne tenuiculmis* with High Shrubland of *Acacia pyrifolia* var. *pyrifolia*, *Acacia tumida* var. *pilbarensis* and *Petalostylis labicheoides* and Open Woodland of *Eucalyptus victrix* and *Corymbia hamersleyana* on red brown silty loam on medium drainage lines and flood plains.	Riparian vegetation Represents major ephemeral water course in the Hamersley subregion	18.2	<1
Triodia closed hummock grassland	HC TbTw Erfr AbAk	Closed Hummock Grassland of *Triodia brizoides* and *Triodia wiseana* with Shrubland of *Eremophila fraseri* and High Open Shrubland of *Acacia bivenosa* and *Acacia kempeana* on brown silty loam on high dolerite hills.		16.0	<1
Triodia hummock grassland	CP TwTa Ese AbPlApyp	Hummock Grassland of *Triodia wiseana* and *Triodia angusta* with Open Mallee of *Eucalyptus socialis* subsp. *eucentrica* and Open Shrubland of *Acacia bivenosa*, *Petalostylis labicheoides* and *Acacia pyrifolia* var. *pyrifolia* on light brown clay loam on calcrete plains and rises.		7.6	<1

Broad floristic formation	Vegetation code	Vegetation association description	Local significance	Current extent within DE (ha)	% of DE
	FP Tp ChApr GrwhApypAb	Hummock Grassland of *Triodia pungens* with Scattered Low Trees of *Corymbia hamersleyana* and *Acacia pruinocarpa* over Open Shrubland of *Grevillea wickhamii* subsp. *hispidula*, *Acacia pyrifolia* var. *pyrifolia* and *Acacia bivenosa* on brown loamy sand on floodplains.		14.6	<1
	FP Tp ChHallEv TefcApy	Open Hummock Grassland of *Triodia pungens* with Low Open Woodland of *Corymbia hamersleyana*, *Hakea lorea* subsp. *lorea* and *Eucalyptus victrix* over Low Open Shrubland of *Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186) and *Acacia pyrifolia* on brown sandy loam on floodplains and drainage lines.	Riparian vegetation	0.00004	<1
	FS Ts CdHc AancAiGrwh	Hummock Grassland of *Triodia* sp. Shovelanna Hill (S. van Leeuwen 3835) with Low Open Woodland of *Corymbia deserticola* subsp. *deserticola* and *Hakea chordophylla* over Open Shrubland of *Acacia ancistrocarpa*, *Acacia inaequilatera* and *Grevillea wickhamii* subsp. *hispidula* on red brown sandy loam on footslopes and stony plains.		38.3	<1
	FS TsTpTw Ell AbApaAanc	Hummock Grassland of *Triodia* sp. Shovelanna Hill (S. van Leeuwen 3835), *Triodia pungens* and *Triodia wiseana* with Low Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* and Open Shrubland of *Acacia bivenosa*, *Acacia pachyacra* and *Acacia ancistrocarpa* on red brown loam on footslopes, low undulating hills and stony plains.		656.8	5
	HC Tw AiAb InrSeao	Hummock Grassland of *Triodia wiseana* with High Open Shrubland of *Acacia inaequilatera* and *Acacia bivenosa* over Low Open Shrubland of *Indigofera rugosa* and *Senna artemisioides* subsp. *oligophylla* on red silty loam on dolerite hill crests.		5,670.6	43
	HC TwTbrTp EllCh AmaGrwhAb	Hummock Grassland of *Triodia wiseana*, *Triodia brizoides* and *Triodia pungens* with Low Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* over High Open Shrubland of *Acacia maitlandii*, *Grevillea wickhamii* subsp. *hispidula* and *Acacia bivenosa* on red brown sandy loam on hill crests and upper hill slopes.		201.4	2
	HS TsTwTp EllCh AhiAaa	Hummock Grassland of *Triodia* sp. Shovelanna Hill (S. van Leeuwen 3835), *Triodia wiseana* and *Triodia pungens* with Low Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* over Low Open Shrubland of *Acacia hilliana* and *Acacia adoxa* var. *adoxa* on red brown sandy loam on hill slopes.		769.7	6

Broad floristic formation	Vegetation code	Vegetation association description	Local significance	Current extent within DE (ha)	% of DE
	HS TwTbrTs EllExCh PtcPtasAhi	Hummock Grassland of *Triodia wiseana*, *Triodia brizoides* and *Triodia* sp. Shovelanna Hill with Low Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia*, *Eucalyptus xerothermica* and *Corymbia hamersleyana* over Low Open Shrubland of *Ptilotus calostachyus*, *Ptilotus astrolasius* and *Acacia hilliana* on brown loam on hill crests and upper hill slopes.		2.8	<1
	HS TwTpTs Ell AprAaAanc	Hummock Grassland of *Triodia wiseana*, *Triodia pungens* and *Triodia* sp. Shovelanna Hill (S. van Leeuwen 3835) with Low Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* over Open Shrubland of *Acacia pruinocarpa*, *Acacia aptaneura* and *Acacia ancistrocarpa* on red brown loam on plains and low hills.		54.1	<1
	ME TpTlo ExAciCh PlApypGoro	Hummock Grassland of *Triodia pungens* and *Triodia longiceps* with Low Woodland of *Eucalyptus xerothermica*, *Acacia citrinoviridis* and *Corymbia hamersleyana* over High Shrubland of *Petalostylis labicheoides*, *Acacia pyrifolia* var. *pyrifolia* and *Gossypium robinsonii* on red brown clay loam on medium drainage lines and surrounding floodplains.	Riparian vegetation	316.6	2
	SP TbTp HlAancAi Ch	Hummock Grassland of *Triodia basedowii* and *Triodia pungens* with High Open Shrubland of *Hakea lorea* subsp. *lorea*, *Acacia ancistrocarpa* and *Acacia inaequilatera* and Scattered Low Trees of *Corymbia hamersleyana* on red brown loamy sand on stony plains.		92.1	1
Mosaic (*Eucalyptus* High Open Forest and *Eucalyptus* Open Forest (to Woodland))	1/3	1: High Open Forest of *Melaleuca argentea*[1], *Eucalyptus camaldulensis* var. obtusa over High Shrubland of *Melaleuca glomerata*, *Acacia bivenosa*, *Acacia sericophylla* over Very Open Sedges of *Cyperus vaginatus* in alluvial gravelly soils along major drainage channels. 3: Open Forest (to Woodland) of *Eucalyptus camaldulensis* var. obtusa, *Eucalyptus victrix* over Open Scrub of *Acacia pyrifolia*, *Acacia tumida*, *Gossypium robinsonii* over Low Shrubland of *Corchorus crozophorifolius*, *Indigofera monophylla*, *Tephrosia rosea* var. *glabrior* Pedley ms in dark red brown loam soils along major drainage lines.	Riparian vegetation	80.9	<1
Other[2]					
	A4/A5	not available		0.7	<1
	B6	Mixed tall shrubs over *Triodia pungens*.		0.05	<1
	C2	Scattered Eucalypt species over mixed shrubs and dense *Triodia pungens.*		0.5	<1

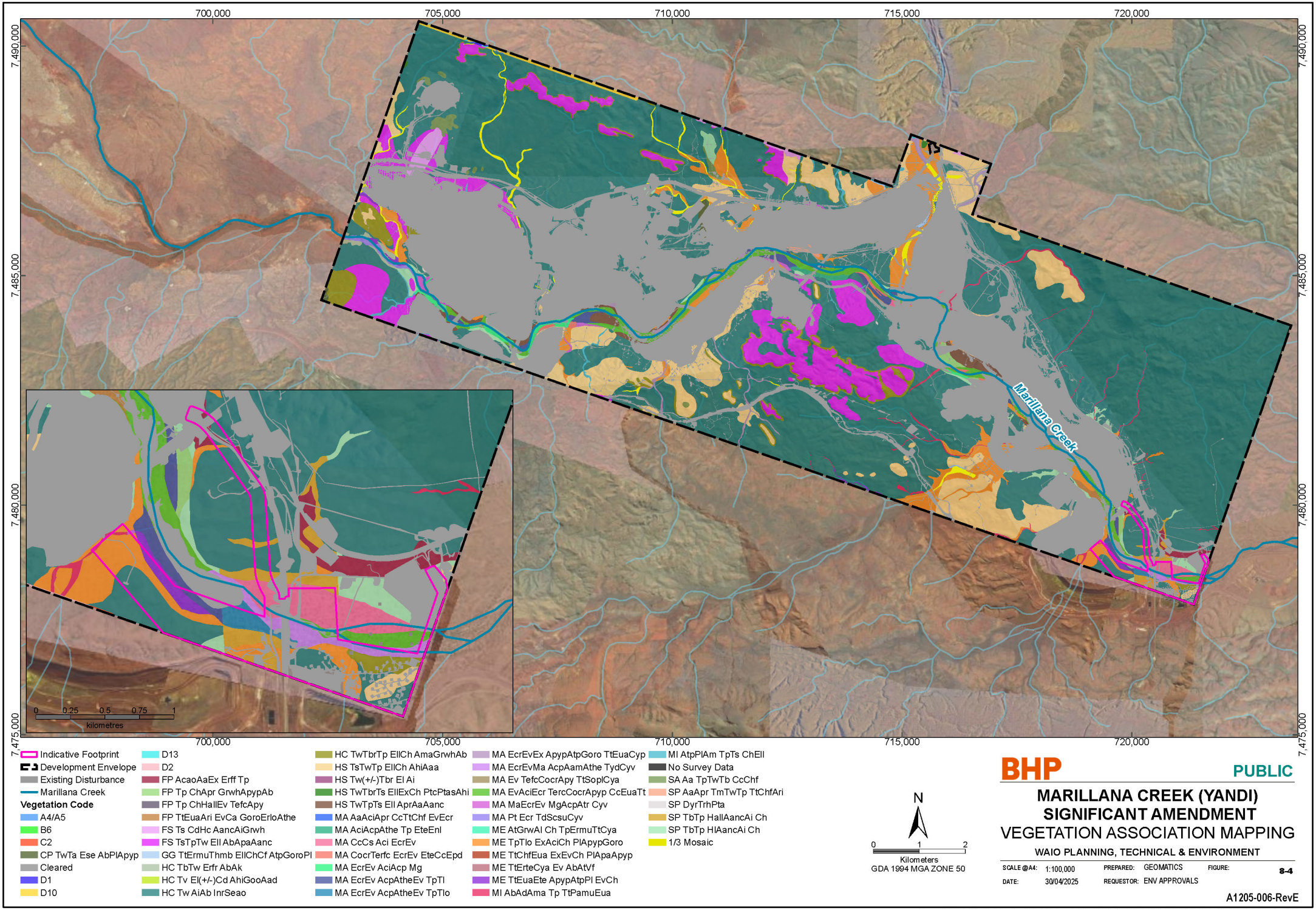
Broad floristic formation	Vegetation code	Vegetation association description	Local significance	Current extent within DE (ha)	% of DE
	D1	*Triodia basedowii* steppe with sparse emergents including *Corymbia deserticola* and *Eucalyptus leucophloia*.		1.5	<1
	D10	*Acacia inaequilatera* over *Triodia wiseana*.		38.9	<1
	D13	*Triodia brizoides* / *T. wiseana* steppes.		0.5	<1
	D2	*Triodia wiseana* steppe with sparse emergents including *Eucalyptus leucophloia*.		0.7	<1
	No survey data	n/a		6.2	<1
	Disturbed[3]	n/a		7.9	<1
Sub-total (area of vegetation remaining in DE)				**8,481**	**64**
Cleared areas					
	Cleared (MS 679)	n/a		4,492	34
	Other clearing[4]	n/a		184.6	1.4
Sub-total (cleared areas in the DE)				**4,677**	**36**
TOTAL				**13,158**	**100**

[1] The tributaries within the Development Envelope where this mosaic vegetation occurs was originally mapped in 2011 as containing Melaleuca argentea. However, this is considered an error as more recent knowledge of the vegetation within the Development Envelope indicates it is unlikely this species occurs at those locations.

[2] These are periphery areas of the Development Envelope that have minimal or no survey information available due to survey boundary misalignment and age of surveys, with mining commencing at the Yandi mine in 1988. Collectively, these areas account for <1% of the Development Envelope.

[3] These areas are classified as 'Completely Degraded' in the vegetation condition mapping or were mapped as 'disturbed' or 'cleared' during flora and vegetation surveys (Table 8-6).

[4] Areas of other disturbance which includes non-BHP Clearing, historic BHP clearing (prior to MS 679), Native Vegetation Clearing Permit (NVCP) clearing (2843, 5826, 5889, 7009 and 8940), exploration, Program of Works (POW) and State Agreement clearing. The majority of this disturbance has occurred to previously mapped vegetation types.



Indicative Footprint
Development Envelope
Existing Disturbance
Marillana Creek

Vegetation Code

A4/A5
B6
C2
CP TwTa Ese AbPlApyp
Cleared
D1
D10
D13
D2
FP AcaoAaEx Erff Tp
FP Tp ChApr GrwhApypAb
FP Tp ChHallEv TefcApy
FP TtEuaAri EvCa GoroErloAthe
FS Ts CdHc AancAiGrwh
FS TsTpTw Ell AbApaAanc
GG TtErmuThmb EllChCf AtpGoroPl
HC TbTw Erfr AbAk
HC Tv El(+/-)Cd AhiGooAad
HC Tw AiAb InrSeao
HC TwTbrTp EllCh AmaGrwhAb
HS TsTwTp EllCh AhiAaa
HS Tw(+/-)Tbr El Ai
HS TwTbrTs EllExCh PtcPtasAhi
HS TwTpTs Ell AprAaAanc
MA AaAciApr CcTtChf EvEcr
MA AciAcpAthe Tp EteEnl
MA CcCs Aci EcrEv
MA CocrTerfc EcrEv EteCcEpd
MA EcrEv AciAcp Mg
MA EcrEv AcpAtheEv TpTl
MA EcrEv AcpAtheEv TpTlo
MA EcrEvEx ApypAtpGoro TtEuaCyp
MA EcrEvMa AcpAamAthe TydCyv
MA Ev TefcCocrApy TtSoplCya
MA EvAciEcr TercCocrApyp CcEuaTt
MA MaEcrEv MgAcpAtr Cyv
MA Pt Ecr TdScsuCyv
ME AtGrwAl Ch TpErmuTtCya
ME TpTlo ExAciCh PlApypGoro
ME TtChfEua ExEvCh PlApaApyp
ME TtErteCya Ev AbAtVf
ME TtEuaEte ApypAtpPl EvCh
MI AbAdAma Tp TtPamuEua
MI AtpPlAm TpTs ChEll
No Survey Data
SA Aa TpTwTb CcChf
SP AaApr TmTwTp TtChfAri
SP DyrTrhPta
SP TbTp HallAancAi Ch
SP TbTp HlAancAi Ch
1/3 Mosaic

N

0 1 2
Kilometers
GDA 1994 MGA ZONE 50

BHP PUBLIC

MARILLANA CREEK (YANDI) SIGNIFICANT AMENDMENT
VEGETATION ASSOCIATION MAPPING

WAIO PLANNING, TECHNICAL & ENVIRONMENT

SCALE @A4:	1:100,000	PREPARED:	GEOMATICS	FIGURE:	8-4
DATE:	30/04/2025	REQUESTOR:	ENV APPROVALS		

A1205-006-RevE

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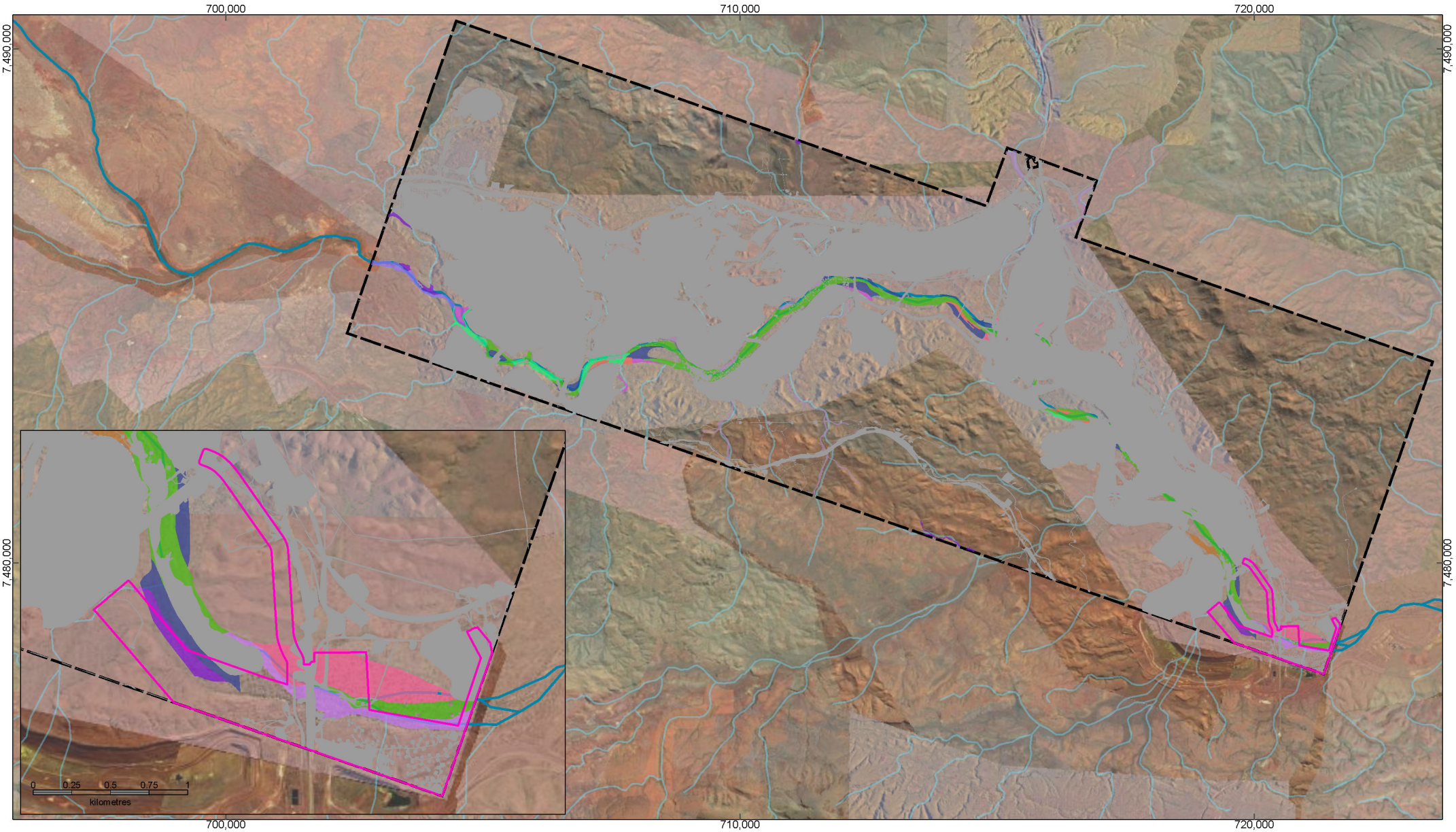

- Indicative Footprint
- Development Envelope
- Existing Disturbance
- Marillana Creek

Major Ephemeral Watercourse Vegetation

- FP TtEuaAri EvCa GoroErloAthe
- MA CcCs Aci EcrEv
- MA CocrTerfc EcrEv EteCcEpd
- MA EcrEv AciAcp Mg
- MA EcrEv AcpAtheEv TpTl
- MA EcrEvEx ApypAtpGoro TtEuaCyp
- MA EcrEvMa AcpAamAthe TydCyv
- MA EvAciEcr TercCocrApyp CcEuaTt
- MA MaEcrEv MgAcpAtr Cyv
- MA Pt Ecr TdScsuCyv
- ME TtEuaEte ApypAtpPl EvCh

N

0 1 2 3 4
kilometres
GDA 1994 MGA ZONE 50

BHP

PUBLIC

MARILLANA CREEK (YANDI) SIGNIFICANT AMENDMENT

DBCA ECOSYSTEMS AT RISK

WAIO PLANNING, TECHNICAL & ENVIRONMENT

SCALE @A4:	1:100,000	PREPARED:	GEOMATICS	FIGURE:	8-5
DATE:	5/05/2025	REQUESTOR:	ENV APPROVALS		

A1205-014-RevF

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Groundwater Dependent Vegetation

Drainage lines within and in the region surrounding the Development Envelope have the potential to support groundwater dependent vegetation (GDV) i.e. vegetation that may be reliant on groundwater for part or all water requirements.

GDV is typically characterised by the presence of flora species that rely on groundwater and are known as phreatophytes. Phreatophytes may be classified as either obligate or facultative phreatophytes depending on their reliance on groundwater (Eamus *et al.* 2016):

- Obligate phreatophytes are flora species confined to habitats with permanent access to groundwater.
- Facultative phreatophytes are flora species that can utilise groundwater to satisfy a proportion of their ecological water requirement (EWR) when it is available. However, some individuals may also satisfy their EWR by relying solely on uptake from upper unsaturated soils layers where groundwater is inaccessible.

Dominant facultative phreatophytes of the riparian zone in the Pilbara are *Eucalyptus camaldulensis*, *Eucalyptus victrix* and the dominant obligate phreatophyte is *Melaleuca argentea* (Onshore 2015).

GDV assessment within and outside of Development Envelope

Assessment of potential GDV within the Development Envelope and surrounding area within the modelled drawdown extent was undertaken by review of baseline vegetation association mapping. Some historical measurements of pre-development baseline groundwater depth are available for the Yandi tenement. However, the data was not used in the analysis of GDV likelihood because it is not consistent across bores (e.g. in many instances two adjacent bores had high differentiation in mbgl readings) and the bores do not intersect many of the areas of potential GDV.

Most of the vegetation associations mapped from numerous flora and vegetation surveys across the Development Envelope and surrounding area are known to have no potential to be GDV. However, a total of 20 riparian vegetation associations occur in the Development Envelope, and an additional 28 occur outside the Development Envelope within approximately 10 km (the extent of the modelled drawdown associated with the Combined Proposal), some of which have potential to be groundwater dependent. These were selected based on DWER's definition 'distinctive vegetation associated with a wetland or watercourse' and includes all vegetation association codes beginning with 'MI', 'ME' and 'MA' as well as some 'FP' associations that contain *Eucalyptus victrix* (Figure 8-6) (DWER 2019a).

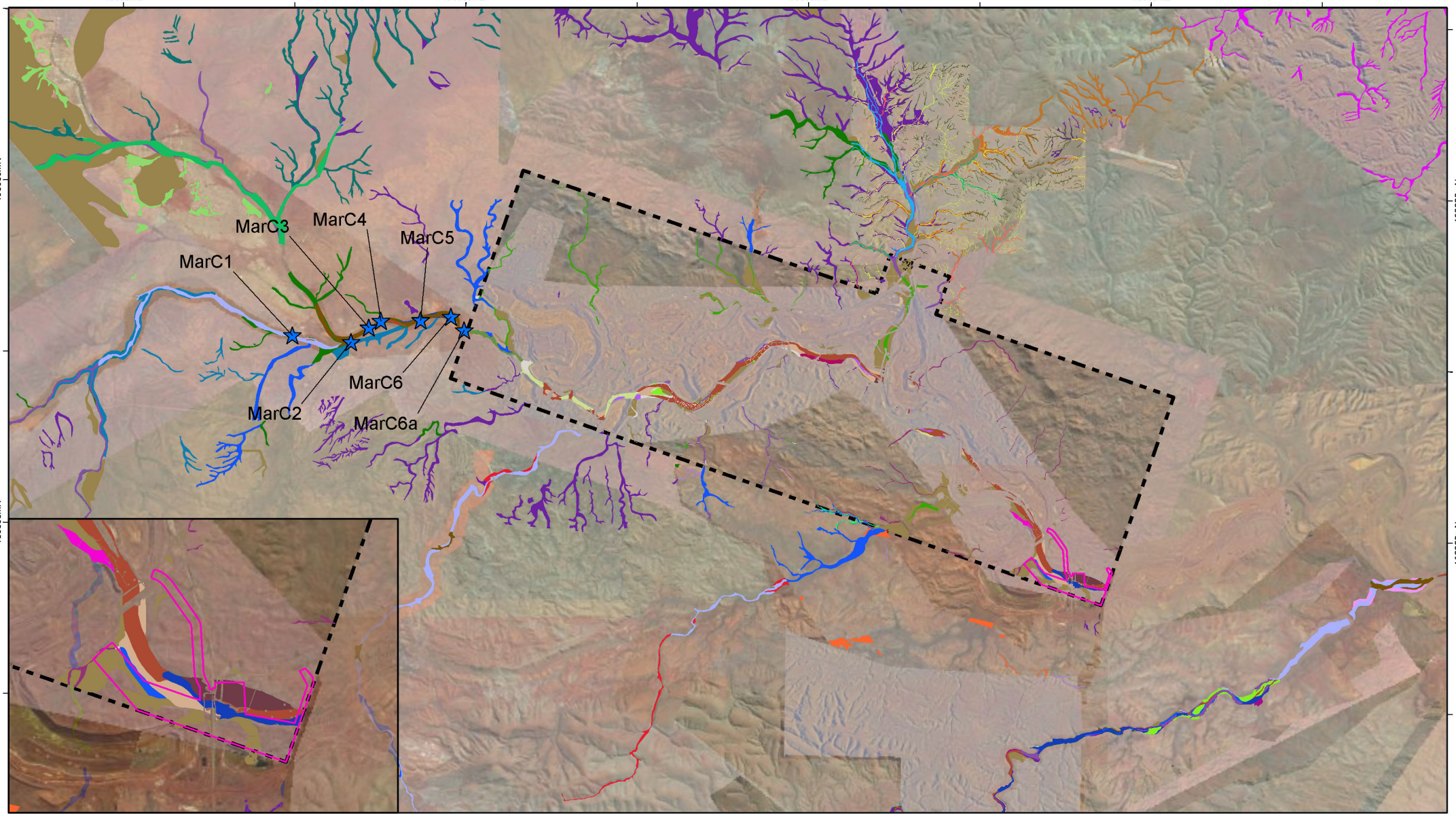
The groundwater dependency of the riparian vegetation associations was assessed by reviewing the flora assemblage present using the framework presented in Table 8-4. This framework is based on the vegetation description, as well as presence or absence of riparian flora taxa and/or taxa known to be potentially groundwater dependent, as described in Biologic (2024a), which was the most recent flora and vegetation survey in the Development Envelope and Indicative Footprint which included assessment of GDV presence/absence.

Table 8-4: Groundwater dependence likelihood ratings of riparian vegetation types

Likelihood of Groundwater Dependence	Reasoning
High (GDV)	• Presence of mature obligate phreatophyte (*Melaleuca argentea*) and several taxa dependent upon permanent surface water (e.g. *Eleocharis geniculata*, *Fimbristylis sieberiana* (P3), *Imperata cylindrica*) • Major drainage line landform

Likelihood of Groundwater Dependence	Reasoning
Moderate (potential GDV)	• Obligate phreatophytes absent • Presence of mature facultative phreatophyte *Eucalyptus camaldulensis* subsp. *refulgens* • Mesic indicator taxa more prevalent • Major drainage line landform
Low	• Obligate phreatophytes absent • Scattered presence of Eucalyptus camaldulensis subsp. refulgens • Mature Eucalyptus victrix present, but not dominant • Vadophytes more prevalent e.g., *Eucalyptus xerothermica* • Major and medium drainage line landforms
Negligible	• Obligate/ facultative phreatophytes absent. Scattered/ occasional presence of Eucalyptus victrix • Other vadophytes present e.g., *Eucalyptus xerothermica*, *Corymbia hamersleyana* • Medium and minor drainage line landforms

Source: Biologic 2024a



Indicative Footprint
Development Envelope
Marillana Creek Pools (Biologic 2022)
FP Tp ChHallEv TefcApy
FP TtEuaAri EvCa GoroErloAthe
MA AaAciApr CcTtChf EvEcr
MA AciAcpAthe Tp EteEnl
MA AtpApypAse Ecr ThmbTtCyp
MA AtuGrwAl EcEv TtCyaCc
MA CcCs Aci EcrEv
MA CcCs EvAciAthe
MA CocrTerfc EcrEv EteCcEpd
MA Eco EuaTtSogl AtpGoroCule
MA EcoMa AtpCuleGoro TtEuaSopl
MA EcrEv AciAcp Mg
MA EcrEv AciApypMg CcEuaTt
MA EcrEv AcpAtheEv TpTl
MA EcrEv SoplEuaTt ApyAtpPl
MA EcrEvEx ApypAtpGoro TtEuaCyp
MA EcrEvMa AcpAamAh TydCyv
MA EcrEvMa AcpAamAthe TydCyv
MA Ev TefcCocrApy TtSoplCya
MA EvAciEcr TercCocrApyp CcEuaTt
MA EvEcoAcp Mg PldClvPhm
MA MaEc AamAtAl TtCyaCc
MA MaEco CyvTydFis TtEua
MA MaEcrEv MgAcpAtr Cyv
MA MgAcpGoro EuaTtErmu EvEco
MA Pt Ecr TdScsuCyv
MA TydCyv EcrEv AciAcp
ME AtGrwAl Ch TpErmuTtCya
ME TpTlo ExAciCh PlApypGoro
ME TtAriCya ChEll AmPlAnl
ME TtChfEua ExEvCh PlApaApyp
ME TtCyaEnl Cyv AcpEvCh
ME TtErteCya Ev AbAtVf
ME TtEuaEte ApyAtpPl EvCh
ME TtEuaEte ApypAtpPl EvCh
Ml AadsAnlDop Tp EllCh
Ml AbAdAma Tp TtPamuEua
Ml AmAmaGoro TtCyaPamu ChEll
Ml AmAncPl TsTwTp TtErmuErt
Ml AtpGrwhApyp TpTb CcCs
Ml AtpGwApy TpTb CcCs
Ml AtpPlAm TpTs Ch Ell
Ml AtpPlAm TpTs ChEll
Ml ChExEv AtpAppPl AlTrfMa CcTtCam Tp
Ml CyncDishCynt NeggGlfVsh
Ml TtErmu ChEl AlPlGrw
Ma EvEco AtpGoroAnl TtEuaCyo
1/3 Mosaic

N
0 2.5 5
KILOMETRES
GDA 1994 MGA ZONE 50

BHP

PUBLIC

YANDI SIGNIFICANT AMENDMENT
RIPARIAN VEGETATION

WAIO PLANNING, TECHNICAL AND ENVIRONMENT

SCALE @ A3:	1:150,000	REQUESTOR:	ENVIRONMENT	FIGURE:	8-6
DATE:	1/05/2025	PREPARED:	GEOMATICS	NO:	A1205/099_RevD
		REVIEWED:			

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Inside the Development Envelope

Of the 20 riparian vegetation associations within the Development Envelope, 16 were rated low-high likelihood for groundwater dependence and five were rated as negligible likelihood (Table 8-5, Figure 8-7). The 10 vegetation associations with a moderate or high likelihood of being groundwater dependent are considered to represent GDV/potential GDV and are identified in Table 8-5 and shown on Figure 8-8.

Outside the Development Envelope

In addition to the 20 riparian vegetation types that occur within the Development Envelope, a further 28 occur in the local region surrounding the Development Envelope (Table 8-5). These vegetation associations are shown on Figure 8-7 and their GDV potential rating shown on Figure 8-8. A total of 23 of these have a High or Moderate likelihood of being groundwater dependent (Table 8-5; Figure 8-8). The GDV ratings were assigned to these vegetation associations by applying the same framework as Biologic (2024a) (Table 8-4). The areas of High likelihood GDV are considered as such based on the vegetation associations having a High likelihood of being groundwater dependent due to the presence of *Melaleuca argentea*.

The areas of Moderate potential GDV occur in various locations surrounding the Development Envelope as shown in Figure 8-8. These areas have been identified as potential GDV based on their Moderate likelihood of being groundwater dependent, absence of *Melaleuca argentea*, and presence of one or both of the facultative phreatophyte species *Eucalyptus camaldulensis* subsp. refulgens and *Eucalyptus victrix*.

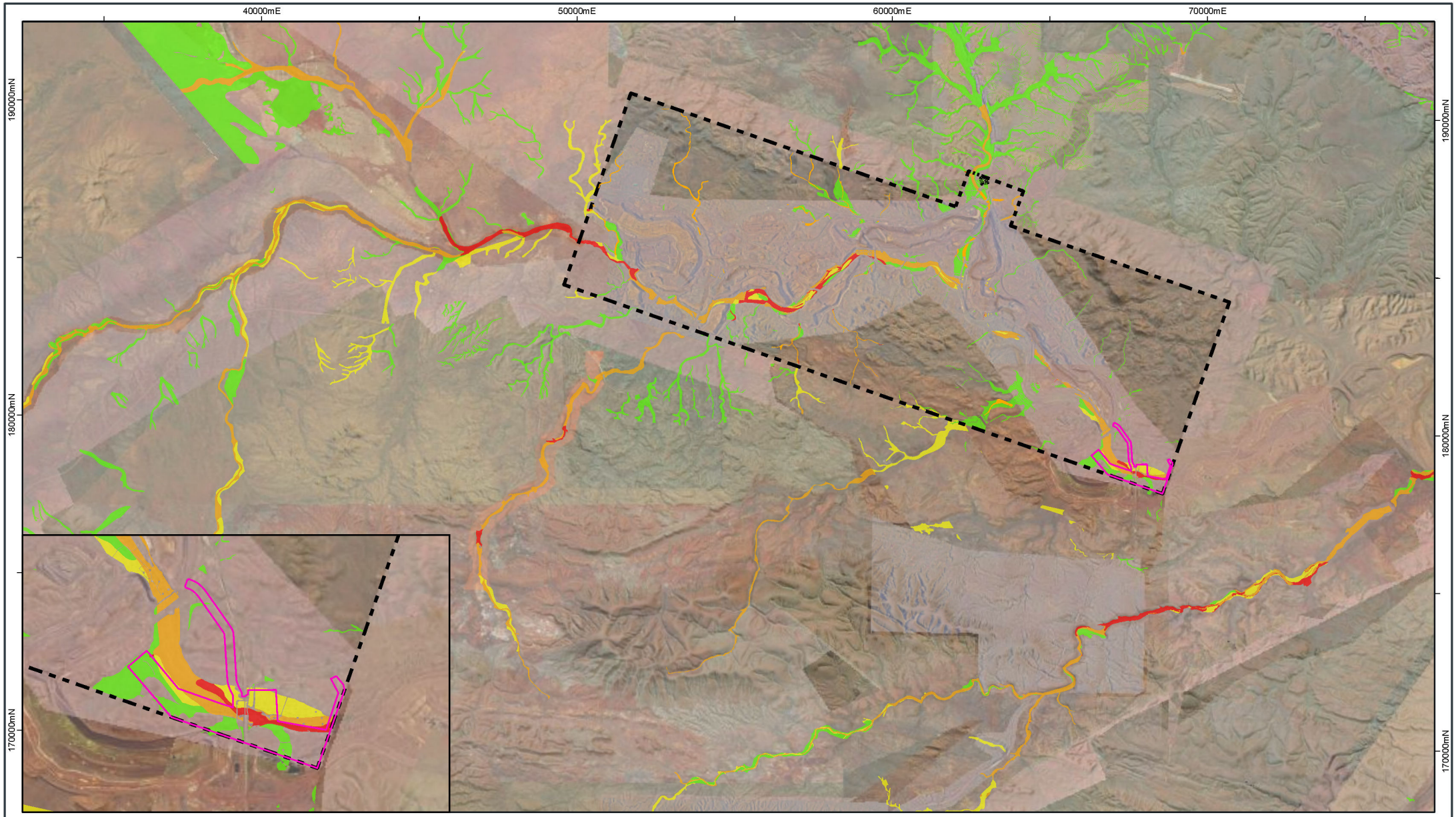
Table 8-5: Groundwater dependence likelihood assessment of riparian vegetation inside and outside the Development Envelope

GDV likelihood	Vegetation association	Vegetation description	Occurs within Development Envelope
High	MA Eco EuaTtSogl AtpGoroCule	Mid open woodland (to mid woodland) of *Eucalyptus camaldulensis* subsp. *obtusa* (with occasional *Melaleuca argentea*) over high to mid open tussock grassland of *Eulalia aurea*, *Themeda triandra* and *Sorghum plumosum* with high sparse shrubland of *Acacia tumida* var. *pilbarensis*, *Gossypium robinsonii* and *Cullen leucanthum* on red/ brown sandy clay loam on major drainage lines.	
High	MA EcoMa AtpCuleGoro TtEuaSopl	Mid open woodland of *Eucalyptus camaldulensis* subsp. *obtusa* and *Melaleuca argentea* over high open shrubland of *Acacia tumida* var. *pilbarensis*, *Cullen leucanthum* and *Gossypium robinsonii* over high to mid open tussock grassland *Themeda triandra*, *Eulalia aurea* and *Sorghum plumosum* on brown silty clay loam on major drainage lines.	
High	MA EcrEvMa AcpAamAh TydCyv	Open Forest of *Eucalyptus camaldulensis* var. *refulgens*, *Eucalyptus victrix* and *Melaleuca argentea* over Low Open Forest of *Acacia coriacea* subsp. *pendens*, *Acacia ampliceps* and *Atalaya hemiglauca* over Open Sedges of *Typha domingensis* and *Cyperus vaginatus*	
High	MA EcrEvMa AcpAamAthe TydCyv	Open Forest of *Eucalyptus camaldulensis* var. *refulgens*, *Eucalyptus victrix* and *Melaleuca argentea* over Low Open Forest of *Acacia coriacea* subsp. *pendens*, *Acacia ampliceps* and *Atalaya hemiglauca* over Open Sedges of *Typha domingensis* and *Cyperus vaginatus* on brown sandy clay loam along major rivers with permanent water	✓
High	MA MaEc AamAtAl TtCyaCc	Low woodland to open woodland of *Melaleuca argentea*, *Eucalyptus camaldulensis* over high shrubland of *Acacia ampliceps*, *Acacia tumida*, *Androcalva luteiflora* over open tussock grassland of *Themeda triandra*, *Cymbopogon ambiguus*, **Cenchrus ciliaris* on brown sandy loam on major drainage lines	
High	MA MaEco CyvTydFis TtEua	Mid woodland of *Melaleuca argentea* and *Eucalyptus camaldulensis* subsp. *obtusa* over high to low open sedgeland of *Cyperus vaginatus*, *Typha domingensis* and *Fimbristylis sieberiana* over mid sparse tussock grassland of *Themeda triandra* and *Eulalia aurea* on black clay loam on major drainage lines.	
High	MA MaEcrEv MgAcpAtr Cyv	High Open Forest of *Melaleuca argentea*, *Eucalyptus camaldulensis* var. *refulgens* and *Eucalyptus victrix* over High Open Shrubland of *Melaleuca glomerata*, *Acacia coriacea* subsp. pendens and *Acacia trachycarpa* over Very Open Sedges of *Cyperus vaginatus* on alluvial gravelly soils on major drainage channels with seasonal pools	✓
High	MA Pt Ecr TdScsuCyv	Open Herbs of *Potamogeton tricarinatus* with Open Woodland of *Eucalyptus camaldulensis* and Very Open Sedges of *Typha domingensis*, *Schoenoplectus subulatus* and *Cyperus vaginatus* on brown light clay on dolerite platforms of major drainage lines	✓
High	MA TydCyv EcrEv AciAcp	Sedges of *Typha domingensis* and *Cyperus vaginatus* with Open Woodland of *Eucalyptus camaldulensis* subsp. *refulgens* and *Eucalyptus victrix* over Low Open Woodland of *Acacia citrinoviridis* and *Acacia coriacea* subsp. *pendens* on brown clayey sand on permanent pools along major drainage lines	
Moderate	MA AaAciApr CcTtChf EvEcr	Low Open Forest of *Acacia aptaneura*, *Acacia citrinoviridis* and *Acacia pruinocarpa* very Open Tussock Grassland of **Cenchrus ciliaris*, *Themeda triandra* and *Chrysopogon fallax* with Open Woodland of *Eucalyptus victrix* and *Eucalyptus camaldulensis* subsp. *refulgens* on brown loamy sand on major drainage lines with broad and deeply incised drainage channels	✓
Moderate	MA AtuGrwAl EcEv TtCyaCc	High shrubland of *Acacia tumida, Grevillea wickhamii, Androcalva luteiflora* with low open woodland of *Eucalyptus camaldulensis, Eucalyptus victrix* over open tussock grassland of *Themeda triandra*, *Cymbopogon ambiguus*, **Cenchrus ciliaris* on red-brown sandy loam on major creeklines	
Moderate	MA EcrEv AciAcp Mg	Open Woodland of *Eucalyptus camaldulensis* and *Eucalyptus victrix* over Low Open Woodland of *Acacia citrinoviridis* and *Acacia coriacea* subsp. *pendens* over High Open Shrubland of *Melaleuca glomerata* on river bed with brown sand	✓
Moderate	MA EcrEv AciApypMg CcEuaTt	Woodland of *Eucalyptus camaldulensis* subsp. *refulgens* and *Eucalyptus victrix* over High Open Shrubland of *Acacia citrinoviridis*, *Acacia pyrifolia* var. *pyrifolia* and *Melaleuca glomerata* over Tussock Grassland of **Cenchrus ciliaris, Eulalia aurea* and *Themeda triandra* on brown clay loam on banks of major drainage lines	
Moderate	MA EcrEv AcpAtheEv TpTl	Woodland to Open Woodland of *Eucalyptus camaldulensis* and *Eucalyptus victrix* over Low Woodland of *Acacia coriacea* subsp. *pendens*, *Atalaya hemiglauca* and *Eucalyptus victrix* over Open Hummock Grassland of *Triodia pungens* and *Triodia longiceps* on brown sand	✓
Moderate	MA EcrEv SoplEuaTt ApyAtpPl	Woodland of *Eucalyptus camaldulensis* subsp. *refulgens* and *Eucalyptus victrix* over Open Tussock Grassland of *Sorghum plumosum, Eulalia aurea* and *Themeda triandra* with High Open Shrubland of *Acacia pyrifolia, Acacia tumida* var. *pilbarensis* and *Petalostylis labicheoides* on brown clayey sand on major drainage lines	
Moderate	MA EcrEvEx ApypAtpGoro TtEuaCyp	Low Open Forest of *Eucalyptus camaldulensis* subsp. *refulgens*, *Eucalyptus victrix* and *Eucalyptus xerothemica* over High Shrubland of *Acacia pyrifolia* var. *pyrifolia*, *Acacia tumida* var. *pilbarensis* and *Gossypium robinsonii* over Open Tussock Grassland of *Themeda triandra, Eulalia aurea* and *Cymbopogon procerus* on red brown clay loam on major drainage lines	✓

GDV likelihood	Vegetation association	Vegetation description	Occurs within Development Envelope
Moderate	MA EvAciEcr TercCocrApyp CcEuaTt	Woodland of Eucalyptus victrix, Acacia citrinoviridis and Eucalyptus camaldulensis subsp. refulgens over Low Open Shrubland of Tephrosia rosea var. clementii, Corchorus crozophorifolius and Acacia pyrifolia var. pyrifolia over Very Open Tussock Grassland of *Cenchrus ciliaris, Eulalia aurea and Themeda triandra on brown loamy sand on channels of major drainage lines	✓
Moderate	Ma EvEco AtpGoroAnl TtEuaCyo	Mid to low open woodland of *Eucalyptus victrix* and *Eucalyptus camaldulensis* subsp. *obtusa* over high sparse shrubland of *Acacia tumida* var. *pilbarensis*, *Gossypium robinsonii* and *Androcalva luteiflora* over mid open tussock grassland of *Themeda triandra*, *Eulalia aurea* and *Cymbopogon obtectus* on red sandy clay loam on major drainage lines.	
Moderate	MA EvEcoAcp Mg PldClvPhm	Mid to low open woodland of *Eucalyptus victrix*, *Eucalyptus camaldulensis* subsp. *obtusa* and *Acacia coriacea* subsp. *pendens* over high open shrubland of *Melaleuca glomerata* over low sparse herbland of *Pluchea dentex, Cleome viscosa* and *Phyllanthus maderaspatensis* on red/ brown clay loam on major drainage lines.	
Moderate	MA MgAcpGoro EuaTtErmu EvEco	High shrubland (to high open shrubland) of *Melaleuca glomerata*, *Acacia coriacea* subsp. *pendens* and *Gossypium robinsonii* over mid open tussock grassland of *Eulalia aurea, Themeda triandra* and *Eriachne mucronata* with mid to low open woodland (to sparse woodland) of *Eucalyptus victrix* and *Eucalyptus camaldulensis* subsp. *obtusa* on brown clayey loam sand on major drainage lines.	
Moderate	Mosaic 1/3	1: High Open Forest of *Melaleuca argentea*[1], *Eucalyptus camaldulensis* var. obtusa over High Shrubland of *Melaleuca glomerata*, *Acacia bivenosa*, *Acacia sericophylla* over Very Open Sedges of *Cyperus vaginatus* in alluvial gravelly soils along major drainage channels. 3: Open Forest (to Woodland) of *Eucalyptus camaldulensis* var. obtusa, *Eucalyptus victrix* over Open Scrub of *Acacia pyrifolia*, *Acacia tumida*, *Gossypium robinsonii* over Low Shrubland of *Corchorus crozophorifolius*, *Indigofera monophylla*, *Tephrosia rosea* var. *glabrior* Pedley ms in dark red brown loam soils along major drainage lines.	✓
Low	FP Tp ChHallEv TefcApy	Open Hummock Grassland of *Triodia pungens* with Low Open Woodland of *Corymbia hamersleyana*, *Hakea lorea* subsp. *lorea* and *Eucalyptus victrix* over Low Open Shrubland of *Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186) and *Acacia pyrifolia* on brown sandy loam on floodplains and drainage lines	✓
Low	FP TtEuaAri EvCa GoroErloAthe	Tussock Grassland of *Themeda triandra*, *Eulalia aurea* and *Aristida inaequiglumis* with Open Woodland of *Eucalyptus victrix* and *Corymbia aspera* and High Open Shrubland of *Gossypium robinsonii*, *Eremophila longifolia* and *Atalaya hemiglauca* on brown sandy loam on plains	✓
Low	MA AtpApypAse Ecr ThmbTtCyp	High Shrubland of *Acacia tumida* var. *pilbarensis*, *Acacia pyrifolia* var. *pyrifolia* and *Acacia sericophylla* with Scattered Trees of *Eucalyptus camaldulensis* subsp. *refulgens* over Open Tussock Grassland of *Themeda* sp. Mt Barricade (M.E. Trudgen 2471), *Themeda triandra* and *Cymbopogon procerus* on brown loam and gravels on major drainage channels.	
Low	MA CcCs Aci EcrEv	Closed Tussock Grassland of **Cenchrus ciliaris* and **Cenchrus setiger* with Low Open Forest of *Acacia citrinoviridis* and Scattered Low Trees of *Eucalyptus camaldulensis* and *Eucalyptus* victrix on banks and floodplains of major drainage line with brown sandy	✓
Low	MA CcCs EvAciAthe	Tussock Grassland **Cenchrus ciliaris* and **Cenchrus setiger* with Low Woodland of *Eucalyptus victrix*, *Acacia citrinoviridis* and *Atalaya hemiglauca* on brown sandy loam on major drainage lines and adjacent flood plains	
Low	MA CocrTerfc EcrEv EteCcEpd	Low Open Heath of *Corchorus crozophorifolius* and *Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186) with Scattered Trees of *Eucalyptus camaldulensis* and *Eucalyptus victrix* and Scattered Tussock Grasses of *Eriachne tenuiculmis*, *Cenchrus ciliaris and *Eriachne pulchella* subsp. *dominii* on creekbed of major drainage line with brown clay loam	✓
Low	MA Ev TefcCocrApy TtSoplCya	Low Woodland of *Eucalyptus victrix* over Low Shrubland of *Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186), *Corchorus crozophorifolius* and *Acacia pyrifolia* over Open Tussock Grassland of *Themeda triandra*, *Sorghum plumosum* and *Cymbopogon ambiguus* on brown sand on major drainage lines.	✓
Low	ME TtChfEua ExEvCh PlApaApyp	Tussock Grassland of *Themeda triandra*, *Chrysopogon fallax* and *Eulalia aurea* with Low Open Woodland of *Eucalyptus xerothermica, Eucalyptus victrix* and *Corymbia hamersleyana* and Shrubland of *Petalostylis labicheoides*, *Acacia pachyacra* and *Acacia pyrifolia* var. *pyrifolia* on red sandy loam on medium drainage lines	✓
Low	ME TtCyaEnl Cyv AcpEvCh	Open Tussock Grassland of *Themeda triandra*, *Cymbopogon ambiguus* and *Enneapogon lindleyanus* with Open Sedges of *Cyperus vaginatus* with Low Open Woodland of *Acacia coriacea* subsp. *pendens*, *Eucalyptus victrix* and *Corymbia hamersleyana* on brown silty loam on medium drainage lines.	
Low	ME TtEuaEte ApypAtpPl EvCh	Tussock Grassland of *Themeda triandra*, *Eulalia aurea* and *Eriachne tenuiculmis* with High Shrubland of *Acacia pyrifolia* var. *pyrifolia*, *Acacia tumida* var. *pilbarensis* and *Petalostylis labicheoides* and Open Woodland of *Eucalyptus victrix* and *Corymbia hamersleyana* on red brown silty loam on medium drainage lines and flood plains	✓
Negligible	MA AciAcpAthe Tp EteEnl	Low Woodland of *Acacia citrinoviridis*, *Acacia coriacea* subsp. *pendens* and *Atalaya hemiglauca* with Open Hummock Grassland of *Triodia pungens* and Open Tussock Grassland of *Eriachne tenuiculmis* and *Enneapogon lindleyanus* on brown loam on raised levee banks of major drainage line	✓

GDV likelihood	Vegetation association	Vegetation description	Occurs within Development Envelope
Negligible	ME AtGrwAl Ch TpErmuTtCya	High open shrubland to shrubland of *Acacia tumida*, *Grevillea wickhamii, Androcalva luteiflora* with low open woodland to low scattered trees of *Corymbia hamersleyana* over open to scattered hummock grassland of *Triodia pungens* and open to scattered tussock grassland of *Eriachne mucronata, Themeda triandra*, *Cymbopogon ambiguus* on brown sandy loam on medium to minor drainage lines	
Negligible	ME TpTlo ExAciCh PlApypGoro	Hummock Grassland of *Triodia pungens* and *Triodia longiceps* with Low Woodland of *Eucalyptus xerothermica*, *Acacia citrinoviridis* and *Corymbia hamerselyana* over High Shrubland of *Petalostylis labicheoides*, *Acacia pyrifolia* var. *pyrifolia* and *Gossypium robinsonii* on red brown clay loam on medium drainage lines and surrounding floodplains	✓
Negligible	ME TtAriCya ChEll AmPlAnl	Open Tussock Grassland of *Themeda triandra*, *Aristida inaequiglumis* and *Cymbopogon ambiguus* with Low Open Woodland of *Corymbia hamerselyana* and *Eucalyptus leucophloia* subsp. *leucophloia* over Open Shrubland of *Acacia monticola, Petalostylis labicheoides* and *Androcalva luteiflora* on red brown alluvium on minor and medium drainage lines	
Negligible	ME TtErteCya Ev AbAtVf	Open tussock grassland of *Themeda triandra*, *Eragrostis tenellula*, *Cymbopogon ambiguus* with open woodland of *Eucalyptus victrix* over high open shrubland of *Acacia bivenosa*, *Acacia tumida*, **Vachellia farnesiana* on red-brown sandy loam on medium drainages lines	
Negligible	ME TtEuaEte ApyAtpPl EvCh	Tussock Grassland of *Themeda triandra*, *Eriachne tenuiculmis* and *Cymbopogon ambiguus* with High Shrubland of *Acacia monticola, Androcalva luteiflora* and *Santalum lanceolatum* and Low Open Woodland of *Eucalyptus victrix, Corymbia hamersleyana* and *Eucalyptus leucophloia* subsp. *leucophloia* in minor drainage lines	
Negligible	MI AadsAnlDop Tp EllCh	Open Heath of *Acacia adsurgens*, *Androcalva luteiflora* and *Dodonaea pachyneura* over Open Hummock Grassland of *Triodia pungens* with Low Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* on brown loamy sand on minor drainage lines	
Negligible	MI AbAdAma Tp TtPamuEua	Shrubland of *Acacia bivenosa*, *Acacia dictyophleba* and *Acacia maitlandii* over Open Hummock Grassland of *Triodia pungens* over Open Tussock Grassland of *Themeda triandra*, *Paraneurachne muelleri* and *Eulalia aurea* on brown sandy loam on minor drainage lines.	✓
Negligible	MI AmAmaGoro TtCyaPamu ChEll	Open Scrub of *Acacia monticola*, *Acacia maitlandii* and *Gossypium robinsonii* with Open Tussock Grassland of *Themeda triandra*, *Cymbopogon ambiguus* and *Paraneurachne muelleri* with Low Open Woodland of *Corymbia hamersleyana* and *Eucalyptus leucophloia* subsp. *leucophloia* on brown sandy loam on minor drainage lines	
Negligible	MI AmAncPl TsTwTp TtErmuErt	Open Scrub of *Acacia monticola*, *Acacia ancistrocarpa* and *Petalostylis labicheoides* over Open Hummock Grassland of *Triodia* sp. Shovelanna Hill (S. van Leeuwen 3835), *Triodia wiseana* and *Triodia pungens* over Open Tussock Grassland of *Themeda triandra, Eriachne mucronata* and *Eriachne tenuiculmis* on brown sandy clay loam on minor drainage lines	
Negligible	MI AtpGrwhApyp TpTb CcCs	Open Scrub of *Acacia tumida* var. *pilbarensis*, *Grevillea wickhamii* subsp. *hispidula* and *Acacia pyrifolia* var. *pyrifolia* over Hummock Grassland of *Triodia pungens* and *Triodia basedowii* over Open Tussock Grassland of **Cenchrus ciliaris* and **Cenchrus setiger* on brown sandy loam on minor drainage lines and floodplains	
Negligible	MI AtpGwApy TpTb CcCs	Open Scrub of *Acacia tumida* var. *pilbarensis*, *Grevillea wickhamii* subsp. *hispidula* and *Acacia pyrifolia* var. *pyrifolia* over Hummock Grassland of *Triodia pungens* and *Triodia basedowii* over Open Tussock Grassland of **Cenchrus ciliaris* and **Cenchrus setiger* on brown sandy loam on minor drainage lines and floodplains	
Negligible	MI AtpPlAm TpTs Ch Ell	High Shrubland of *Acacia tumida* var. *pilbarensis*, *Petalostylis labicheoides* and *Grevillea wickhamii* over Open Tussock Grassland of *Cymbopogon ambiguus, Eriachne tenuiculmis* and *Themeda triandra* with Low Open Woodland of *Corymbia hamersleyana* in minor drainage lines and gorges	
Negligible	MI AtpPlAm TpTs ChEll	Open Scrub of *Acacia tumida* var. *pilbarensis*, *Petalostylis labicheoides* and *Acacia monticola* over Open Hummock Grassland of *Triodia pungens* and *Triodia* sp. Shovelanna Hill (S.van Leeuwen 3835) with Low Open Woodland of *Corymbia hamerselyana* and *Eucalyptus leucophloia* subsp. *leucophloia* on red brown sandy loam on minor drainage lines	✓
Negligible	MI ChExEv AtpAppPl AlTrfMa CcTtCam Tp	*Corymbia hamersleyana* and *Eucalyptus xerothermica* low scattered trees, with occasional *Eucalyptus victrix* mid scattered trees over *Acacia tumida* var. *pilbarensis*, *A. pyrifolia* var. *pyrifolia* and *Petalostylis labicheoides*	
Negligible	MI CyncDishCynt NeggGlfVsh	Tussock Grassland of *Cynodon convergens*, *Dichanthium sericeum* subsp. *humilius* and *Cynodon tenellus* with Herbs of *Neptunia gracilis* forma *gracilis*, *Glycine falcata* and *Vigna* sp.Hamersley Clay (A.A. Mitchell PRP 113) with Low Open Woodland of *Acacia aptaneura* and *Eucalyptus xerothermica* on brown light medium clay on minor gilgai drainage lines/zones	
Negligible	MI TtErmu ChEl AlPlGrw	Tussock grassland of *Themeda triandra, Eriachne mucronata* with low to open woodland of *Corymbia hamersleyana*, *Eucalyptus leucophloia* over high shrubland to open shrubland of *Androcalva luteiflora, Petalostylis labicheoides*, *Grevillea wickhamii* on red-brown sandy clay loam on minor creeklines	

[1] The tributaries within the Development Envelope where this mosaic vegetation occurs was originally mapped in 2011 as containing *Melaleuca argentea*. However, this is considered an error as more recent knowledge of the vegetation within the Development Envelope indicates it is unlikely this species occurs at those locations.



Indicative Footprint
Development Envelope

GDV Likelihood Rating

- High
- Moderate
- Low
- Negligible

N

0 2 4 6 8 10
KILOMETRES

GDA 1994 MGA ZONE 50

BHP

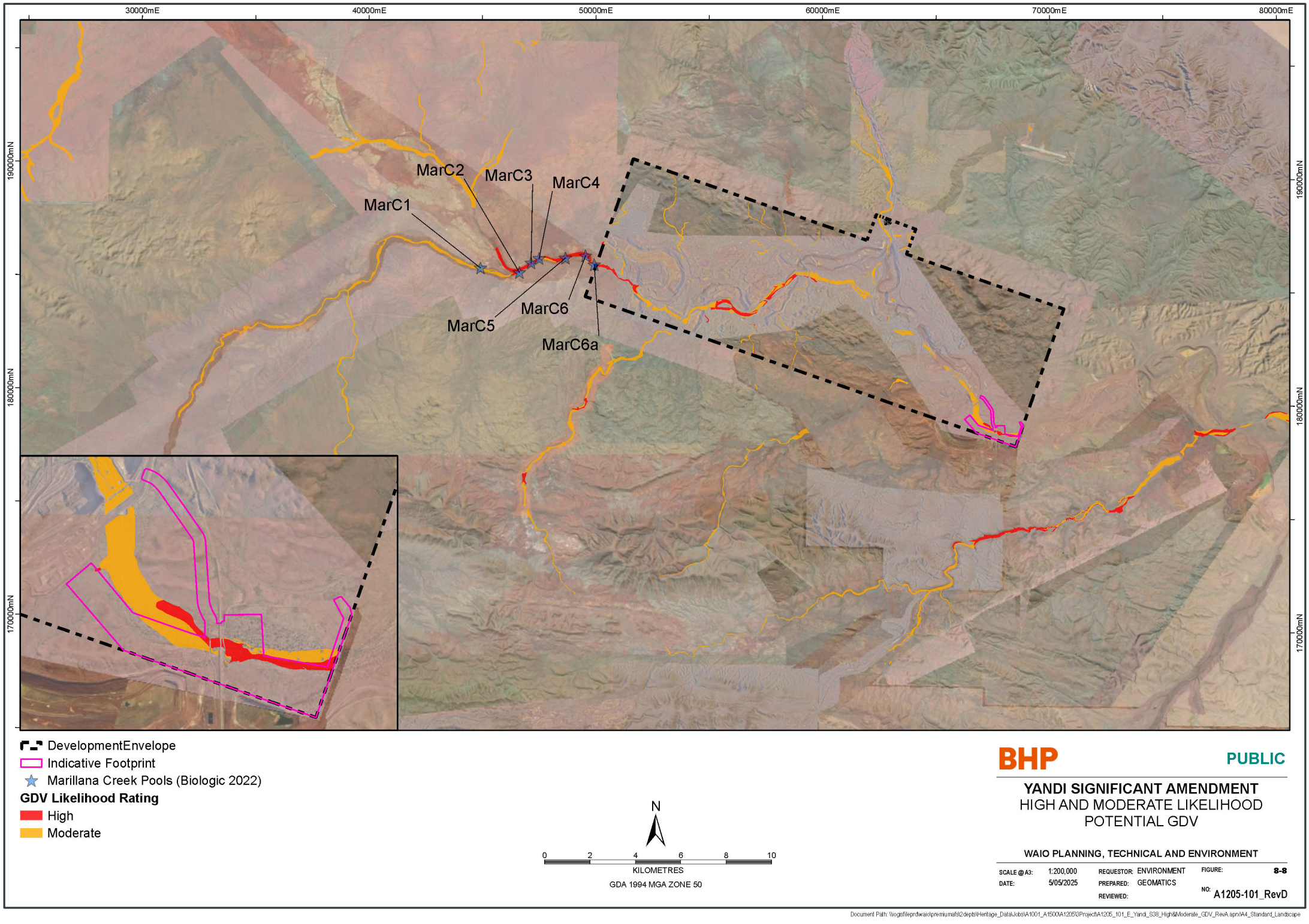
PUBLIC

YANDI SIGNIFICANT AMENDMENT
REGIONAL POTENTIAL GROUNDWATER DEPENDENT VEGETATION

WAIO PLANNING, TECHNICAL AND ENVIRONMENT

SCALE @ A3:	1:160,000	REQUESTOR:	ENVIRONMENT	FIGURE:	8-7
DATE:	1/05/2025	PREPARED:	GEOMATICS	NO:	A1205/100_RevC
		REVIEWED:			

Document Path: \\bgisfileprdwaio\premiumafs\2depts\Heritage_Data\Jobs\A1001_A1500\A1205\3Project\A1205_100_E_Yandi_S38_RegionalPotentialGDV_RevA.aprx\A4_Standard_Landscape


30000mE
40000mE
50000mE
60000mE
70000mE
80000mE
190000mN
180000mN
170000mN
MarC1
MarC2
MarC3
MarC4
MarC5
MarC6
MarC6a
DevelopmentEnvelope
Indicative Footprint
Marillana Creek Pools (Biologic 2022)
GDV Likelihood Rating
High
Moderate
N
0 2 4 6 8 10
KILOMETRES
GDA 1994 MGA ZONE 50
BHP
PUBLIC
YANDI SIGNIFICANT AMENDMENT
HIGH AND MODERATE LIKELIHOOD
POTENTIAL GDV
WAIO PLANNING, TECHNICAL AND ENVIRONMENT
SCALE @ A3: 1:200,000
DATE: 5/05/2025
REQUESTOR: ENVIRONMENT
PREPARED: GEOMATICS
REVIEWED:
FIGURE: 8-8
NO: A1205-101_RevD
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Threatened and Priority Ecological Communities

No Threatened Ecological Communities (TECs) or Priority Ecological Communities (PECs) occur within or adjacent to the Development Envelope. Two confirmed PECs occur within 15 km of the Development Envelope; Weeli Wolli Spring community (Priority 1), located 9 km to the south-east, and Vegetation of sand dunes of the Hamersley Range/Fortescue Valley (previously 'Fortescue Valley Sand Dunes'), located 15 km to the north-east.

The vegetation and floristic assemblage present within Yandicoogina Gorge approximately 4 km south of the Development Envelope have affinities with the Priority 2 Ecological Community: *Riparian flora and plant communities of springs and river pools with high water permanence of the Pilbara* (hereafter referred to as the Pilbara Pools PEC; DBCA 2023); however, are not recognised as a confirmed PEC. Biologic (2020a) identified a number of vegetation and floristic assemblages at the Yandicoogina Gorge pools that have affinities with the Priority 2 Ecological Community, which are described further in Section 8.3.2.3.

None of the vegetation associations present in the Development Envelope align with any TECs and PECs known to occur in the Pilbara bioregion, and therefore ecological communities are not discussed further.

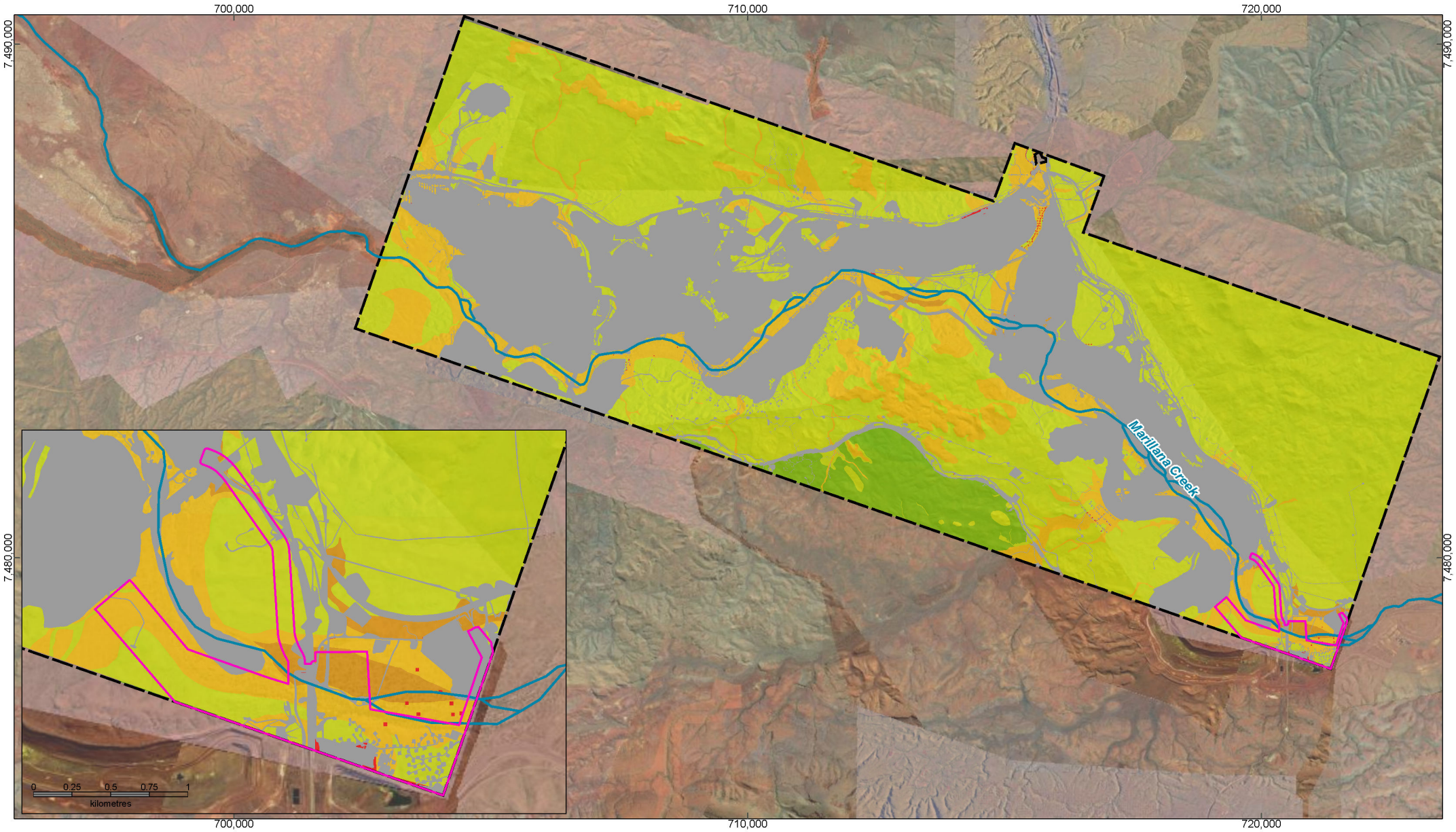
Vegetation condition

The majority of vegetation in the Development Envelope is in Very Good (74%) or Good (19%) condition based on the vegetation condition scales outlined in the EPA *Technical Guidance Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016b) (Table 8-6 and Figure 8-9).

Table 8-6: Vegetation condition in the Development Envelope

Vegetation condition	Extent in the Development Envelope (ha)	% of total vegetation in Development Envelope
Excellent	495.1	6
Very Good	6,299.5	74
Good	1,583.3	19
Poor	47.1	<1
Degraded	0	<1
Completely Degraded	5.9	<1
No survey data*	50.4	<1
Cleared (MS 679)	4,492	
Other clearing**	184.6	
TOTAL	**13,158**	

* These are periphery areas of the Development Envelope that have minimal or no survey information available due to survey boundary misalignment and age of surveys, with mining commencing at the Yandi (Yandi) mine in 1988. Collectively, these areas account for <1% of the Development Envelope.
** Areas of other disturbance which includes non-BHP Clearing, historic BHP clearing (prior to MS 679), NVCP clearing (2843, 5826, 5889, 7009 and 8940), exploration, POW's and State Agreement clearing. The majority of this disturbance has occurred to previously mapped vegetation types.



Indicative Footprint
Development Envelope
Existing Disturbance
Marillana Creek

Vegetation Condition
Completely Degraded
Degraded
Poor
Good
Very Good
Excellent
Pristine

N

0 1 2 3 4
kilometres

GDA 1994 MGA ZONE 50

BHP

PUBLIC

MARILLANA CREEK (YANDI) SIGNIFICANT AMENDMENT
VEGETATION CONDITION

WAIO PLANNING, TECHNICAL & ENVIRONMENT

SCALE @A4:	1:100,000	PREPARED:	GEOMATICS	FIGURE:	8-9
DATE:	30/04/2025	REQUESTOR:	ENV APPROVALS		

A1205-015-RevE

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8.3.2.2 Significant flora

Threatened flora

No plant taxon gazetted as Threatened flora under the BC Act or under the EPBC Act have been recorded within the Development Envelope. One species has been recorded which is currently in the process of being delisted as a Threatened species; *Seringia exastia*. A recent revision of the *Seringia* genus found that *Seringia exastia* (EPBC Act: Critically Endangered) and *Seringia elliptica* (not threatened) are the same species, with the latter currently being subsumed into *S. exastia* (Binks et al. 2020 as cited in Biologic 2021). *Seringia exastia*, a species previously only known to occur in the Kimberley, now has a significantly wider distribution in WA. A nomination to delist the species has been made to the WA Threatened Species Scientific Committee and has been authorised under the BC Act (from Critically Endangered to not threatened) and authorisation under the EPBC Act is expected to follow (Biologic 2021). Until this change is officially made at the Commonwealth level, *Seringia exastia* is still listed as Threatened under the EPBC Act, however for the purposes of this report it is not considered significant and will not be discussed further.

Priority flora

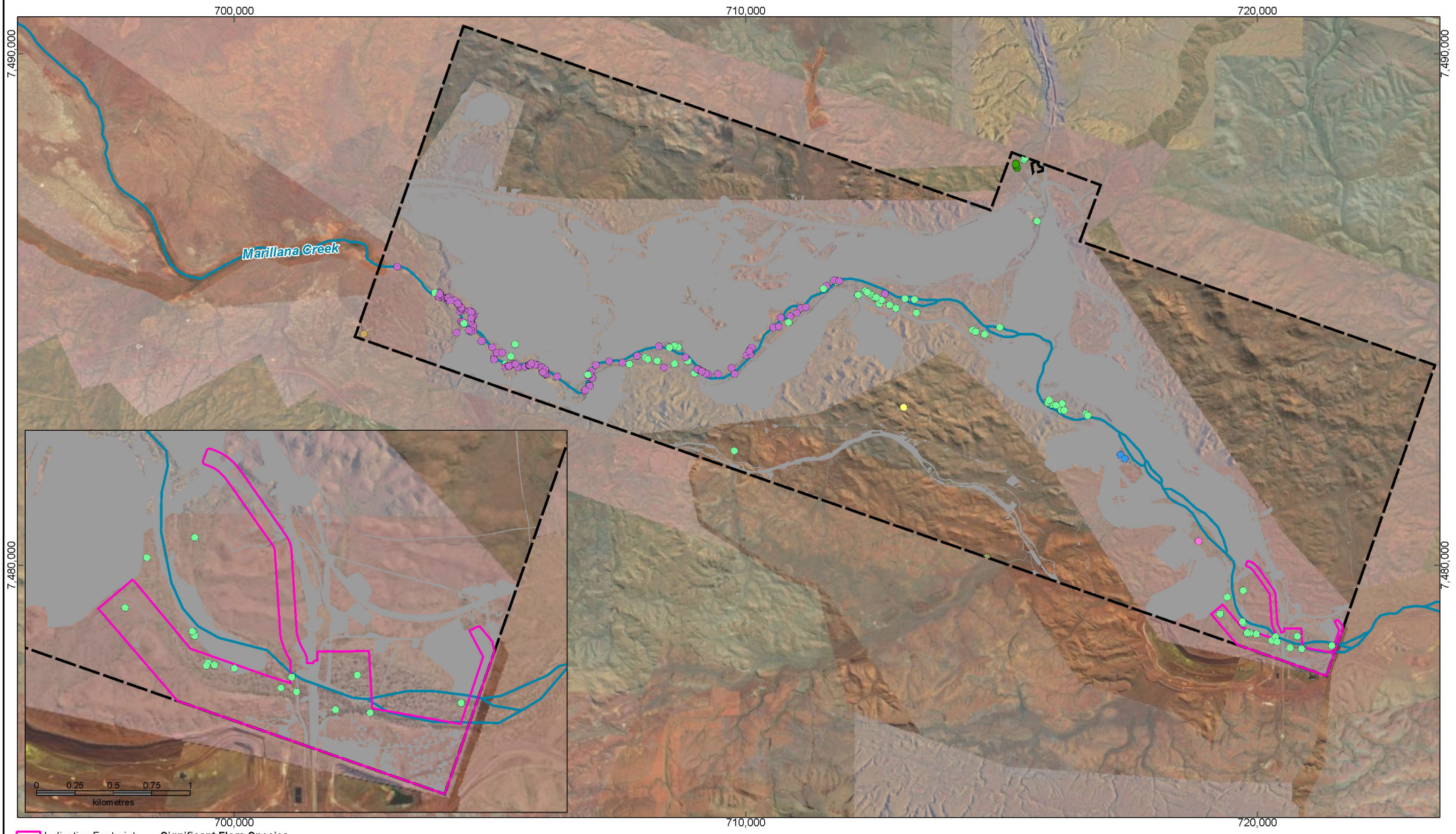
A total of seven Priority flora species, as listed by the DBCA, have been recorded from within the Development Envelope (Figure 8-10):

- *Acacia subtiliformis* – Priority 3
- *Amaranthus centralis* – Priority 3
- *Aristida lazaridis* – Priority 2
- *Ipomoea racemigera* – Priority 2
- *Lepidium catapycnon* – Priority 4
- *Rostellularia adscendens* var. *latifolia* – Priority 3
- *Sida* sp. Barlee Range (S. van Leeuwen 1642) – Priority 4

Introduced flora (weeds)

A total of 27 introduced flora (weed) species have been recorded in the Development Envelope (Figure 8-11). The species with the highest number or records in the Development Envelope are **Vachellia farnesiana* (Mimosa Bush), **Malvastrum americanum* (Spiked Malvastrum), **Bidens bipinnata* (Bipinnate Beggartick) and **Cenchrus ciliaris* (Buffel Grass). The introduced flora species largely occur along existing disturbance and infrastructure areas, or along drainage channels.

None of the introduced flora species are listed as a Declared Pest under the *Biosecurity and Agriculture Management Act 2007* (BAM Act).



Indicative Footprint
Development Envelope
Existing Disturbance
Marillana Creek

Significant Flora Species

- *Acacia subtiliformis* - Priority 3
- *Amaranthus centralis* - Priority 3
- *Aristida lazaridis* - Priority 3
- *Ipomoea racemigera* - Priority 3
- *Lepidium catapycnon* - Priority 4
- *Rostellularia adscendens* var. *latifolia* - Priority 3
- *Sida sp. Barlee Range (S. van Leeuwen 1642)* -Priority 4

N

0 1 2 3 4
kilometres

GDA 1994 MGA ZONE 50

BHP

PUBLIC

MARILLANA CREEK (YANDI) SIGNIFICANT AMENDMENT

SIGNIFICANT FLORA SPECIES

WAIO PLANNING, TECHNICAL & ENVIRONMENT

SCALE @A4:	1:100,000	PREPARED:	GEOMATICS	FIGURE:	8-10
DATE:	30/04/2025	REQUESTOR:	ENV APPROVALS		

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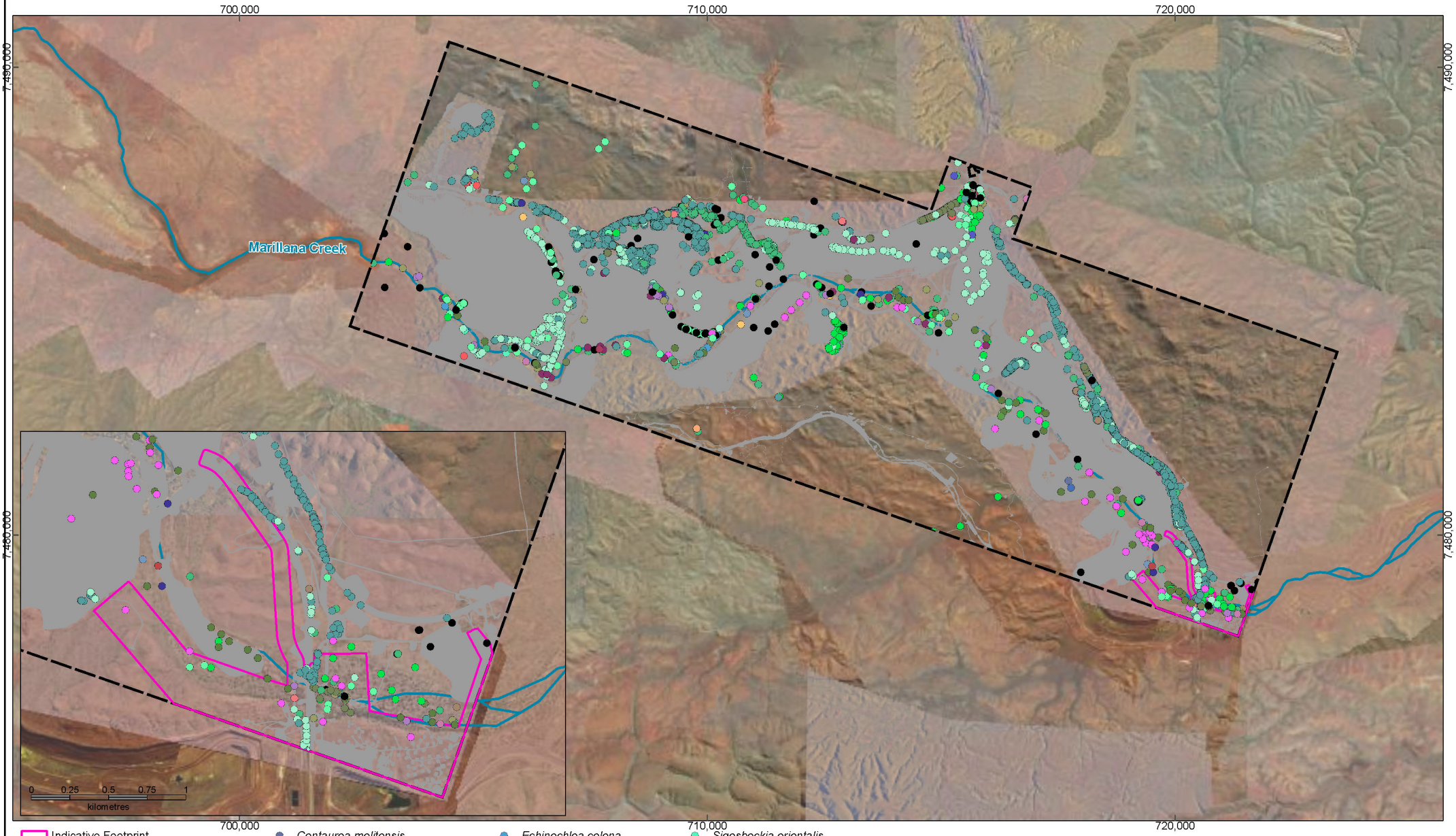
Document Path: \\ogisfileprdwaio\premiumafs\2depts\Heritage_Data\Jobs\A1001_A1500\A1205\3Project\A1205_017_E_Yandi_S38_FloraSignificant_RevC.aprx



- Indicative Footprint
- Development Envelope
- Existing Disturbance
- Marillana Creek
- *Aerva javanica*
- *Argemone ochroleuca*
- *Argemone ochroleuca subsp. ochroleuca*
- *Bidens bipinnata*
- *Cenchrus ciliaris*
- *Cenchrus setiger*
- *Centaurea melitensis*
- *Chloris barbata*
- *Chloris virgata*
- *Citrullus amarus*
- *Citrullus colocynthis*
- *Cynodon dactylon*
- *Datura leichhardtii*
- *Datura leichhardtii subsp. leichhardtii*
- *Digitaria ciliaris*
- *Distimake dissectus var. dissectus*
- *Echinochloa colona*
- *Erigeron bonariensis*
- *Euphorbia hirta*
- *Flaveria trinervia*
- *Lactuca serriola*
- *Lactuca serriola forma serriola*
- *Malvastrum americanum*
- *Rostraria cristata*
- *Rumex vesicarius*
- *Setaria verticillata*
- *Sigesbeckia orientalis*
- *Sisymbrium orientale*
- *Solanum nigrum*
- *Sonchus asper*
- *Sonchus oleraceus*
- *Tribulus terrestris*
- *Tridax procumbens*
- *Vachellia farnesiana*

N

0 1 2
kilometres
GDA 1994 MGA ZONE 50

BHP

PUBLIC

MARILLANA CREEK (YANDI) SIGNIFICANT AMENDMENT

INTRODUCED FLORA (WEEDS)

WAIO PLANNING, TECHNCIAL & ENVIRONMENT

SCALE @A4:	1:110,000	PREPARED:	GEOMATICS	FIGURE:	8-11
DATE:	7/04/2025	REQUESTOR:	ENV APPROVALS		A1205-018-RevE

Document Path: \\bgsfileprdwaio\premiumafs\2depts\Heritage_Data\Jobs\A1001_A1500\A1205\3Project\A1205_018_E_Yandi_S38_IntroducedFlora_RevC.aprx

8.3.2.3 Regional flora and vegetation values

Flat Rocks and Marillana Creek Pools

As described in Section 7.3.3.1, Flat Rocks is an area within Marillana Creek that occurs in the western section of the Development Envelope and extends approximately 2-3 km outside of the Development Envelope to the west (Figure 7-2 in Section 7.3.2.2). Flat Rocks comprises areas of exposed bedrock, areas of riparian vegetation and GDV, and permanent, ephemeral and semi-permanent pools. Although minimal vegetation is present where the bedrock is exposed, riparian vegetation extends adjacent to the Flat Rocks formation upstream and downstream along Marillana Creek.

The riparian vegetation upstream of Flat Rocks extends outside of the Development Envelope and has been mapped during several surveys; Astron (2019), Onshore (2014b) and Onshore (2015). The riparian vegetation in this area generally reflects the riparian vegetation associations that occur along Marillana Creek within the Development Envelope, comprising *Eucalyptus* Open Forest and *Eucalyptus* Woodland containing one or more of the species *Eucalyptus camaldulensis*, *Eucalyptus victrix* and *Melaleuca argentea*. Declines in health, and death, of these tree species in the Flat Rocks area have been recorded since 2010 and continue to be observed, with the cause being identified as dewatering for the Approved Proposal. Further discussion of these impacts and how they are being mitigated by BHP is provided in Sections 8.4.2, 8.6.2 and 7.5.2.

Upstream of Flat Rocks are a series of semi-permanent pools referred to as the Marillana Creek pools. The pools support groundwater dependent ecosystems (GDEs) of varying levels of significance, including GDV. The vegetation mapping for the area containing the pools is shown on Figure 8-6, and comprises predominantly the vegetation association MA EcrEvMa AcpAamAh TydCyv which includes *Eucalyptus camaldulensis* var. *refulgens*, *Eucalyptus victrix* and *Melaleuca argentea*. This vegetation is mapped as having High likelihood of being GDV (Figure 8-8). At a more localised level, the recent aquatic monitoring survey of the pools conducted by Biologic for the Mining Area C project described the riparian vegetation of the Marillana Creek pools as being characterised by an open overstorey of *Eucalyptus camaldulensis*, *Melaleuca argentea* and *M. glomerata* over *Cyperus vaginatus* (Biologic (2024b). As described in Section 7.3.3.1, two pools in particular have a high diversity of GDV species; MarC2 and MarC4 (Figure 8-6). The pools are monitored annually for aquatic ecosystem values and are located in between two of the riparian monitoring sites from the Marillana Creek RVMP (MC9 and MC7) that have shown signs of vegetation decline and tree deaths in recent years, particularly MC7.

Yandicoogina Gorge

As described in Section 7.3.2.8, Yandicoogina Gorge (approximately 4 km south of the Development Envelope) is an important feature of the Pilbara ecohydrological system, located at the convergence of surface and groundwater flows from the upstream catchment. Vegetation in the gorge is typically characteristic of riparian and/or GDV, including mature *M. argentea* and *E. camaldulensis* woodland. In addition, as described in Section 8.3.2.1, the vegetation and floristic assemblage present within Yandicoogina Gorge have affinities with the Priority 2 Pilbara Pools PEC; however, are not recognised as a confirmed PEC (Biologic 2020a). As described in Section 7.4.2.1, regional groundwater level decline has been observed in Yandicoogina Gorge in recent years. Tree health decline has also been observed in Yandicoogina Gorge over the same period and is discussed further in Section 16.2.

8.4 Potential environmental impacts

BHP has considered the potential impacts outlined in the EPA's Environmental Factor Guideline – Flora and Vegetation (EPA 2016a) and considers that those relevant to the Proposal are:

- loss of vegetation and flora from clearing (direct)
- changes to, and loss of, vegetation from changes to groundwater regimes (indirect)
- changes to vegetation from changes to surface water regimes (indirect)
- changes to vegetation and flora from dust, fire and weeds (indirect).

BHP has focused the discussion on potential impacts of the Proposal within the Indicative Footprint of the Development Envelope. Potential impacts extending beyond the boundaries of the Indicative Footprint and Development Envelope have been considered. BHP has provided information on the Approved Proposal so that the EPA can consider the environmental effects of the Proposal in the context of the Approved Proposal. BHP has also outlined the combined effects which the implementation of the Approved Proposal and the Proposal might have on the environment. Unless specified otherwise, the potential impacts discussed in this section are unmitigated (i.e. potential impacts before mitigation measures are applied, if required).

Cumulative impacts to Flora and Vegetation are addressed in Section 16.3 and include a discussion of cumulative impacts outside the Development Envelope (where relevant and where causation is still unclear nor can be attributed to regional or a single mining operation or climate process, i.e. Yandicoogina Gorge).

8.4.1 Loss of vegetation and flora from clearing

The Proposal will result in the direct removal of up to 95 ha of native vegetation (in an Indicative Footprint of 125 ha) within the Development Envelope (additional to that approved for the Approval Proposal) (Section 2.1).

8.4.1.1 Vegetation

Direct clearing of native vegetation for the Proposal has the potential to affect the ecological integrity of vegetation (at the regional and local scale) and reduce the condition of vegetation, particularly where existing vegetation is in Good to Excellent condition.

Regional vegetation

Two vegetation associations (as mapped by Beard (1975) and refined by Shepherd et al. (2002) are located within the Development Envelope (Figure 8-3). Table 8-7: Potential impacts to Beard vegetation units shows the area of each association within the proposed Development Envelope and Indicative Footprint.

Proposal

Assuming disturbance occurs within the Indicative Footprint, the potential impact of the Proposal on association 82 (as a reduction of the percentage of current extent) will be less than 0.01% the Pilbara bioregion (Table 8-7: Potential impacts to Beard vegetation units). Association 18 will not be impacted by the Proposal.

Combined Proposal

When considering the Combined Proposal, association 82 will have more than 99% remaining (Table 8-7: Potential impacts to Beard vegetation units).

Table 8-7: Potential impacts to Beard vegetation units

Beard Vegetation Association	Pre-European Extent (ha)[1]	Current Extent (ha)	% of Association Remaining	Development Envelope		Area within Indicative Footprint (ha)	% impact to area of Association remaining within Development Envelope[3]	% of Association remaining after clearing for Proposal[4]	% of Association remaining after combined clearing[5]
				Total area within DE (ha)	Area of DE (ha) already cleared[2]				
Pilbara Bioregion									
18	676,557	671,843	99.3	1,422.3	693	0	0	99.3	99.2
82	2,563,583	2,550,888	99.5	11,735.5	3,983.6	94.7	1.2	99.5	99.3
Total				**13,158**	**4,677**	**95**	**-**	**-**	**-**

1. Pre-European Extent and Current Extent based on current DBCA data for the Pilbara bioregion (Government of Western Australia 2019a)
2. This includes MS 679 clearing (4,492 ha) as well as non-BHP Clearing, historic BHP clearing (prior to MS 679), NVCP clearing (2843, 5826, 5889, 7009 and 8940), exploration, POW's and State Agreement clearing. The majority of this disturbance has occurred to old vegetation associations mapped prior to Onshore (2020).
3. Area within Indicative Footprint as a percentage of current extent of Association in Development Envelope
4. Current Extent minus area within the Indicative Footprint as a percentage of Pre-European Extent
5. Current Extent minus area within the Indicative Footprint for the Proposal and already cleared under the Approved Proposal (MS 679), as a percentage of Pre-European Extent. The majority of MS 679 clearing already undertaken has likely already been captured in the current extent values (Government of Western Australia 2019a) however BHP has taken a conservative approach and included them in the calculation of values in this column.

Local vegetation

This section describes the predicted loss of vegetation within the Indicative Footprint, noting that flexibility has been allowed for the final location of Proposal elements.

The Proposal will clear up to 95 ha of native vegetation within the 13,158 ha Development Envelope (of which 4,677 ha has already been cleared, comprising 4,492 ha under MS 679 and 184.6 ha of other clearing (Table 8-3)). Of the 43 vegetation associations mapped within the Development Envelope, 14 occur within the Indicative Footprint and will be directly impacted by clearing. The proposed clearing of each vegetation association is shown in Table 8-8.

Proposal

The Proposal will clear up to 48 ha of riparian vegetation, comprising eight vegetation associations, along Marillana Creek. Six of these vegetation associations potentially represent 'ecosystems at risk' as described by DBCA, and four of these also have the potential to contain GDV (Section 8.3.2.1) (Table 8-8).

Four of the eight riparian vegetation associations to be impacted will have >10% of their remaining extent in the Development Envelope cleared as a result of the Proposal (Table 8-8). One of these; vegetation association MA EcrEvMa AcpAamAthe TydCyv is highly likely to contain GDV and will have up to 77% of its remaining extent in the Development Envelope cleared as a result of the Proposal. Within the Development envelope, this vegetation association only occurs in the south-eastern corner where the Indicative Footprint is located. This association has also been mapped outside the Development Envelope.

Combined Proposal

It is not possible to assess the potential impacts of the Combined Proposal on baseline vegetation associations within the Development Envelope. This is due to the majority of clearing for the Approved Proposal having been undertaken prior to recent vegetation mapping across the Development Envelope (Onshore 2020). Some historical vegetation mapping exists for the now cleared areas of the Development Envelope however it was mapped at differing levels of detail and to meet previous survey requirements, which makes alignment of new and old vegetation association mapping problematic. The impacts of the Combined Proposal can be assessed based on impacts to Beard vegetation associations as presented in Table 8-7: Potential impacts to Beard vegetation units above.

Table 8-8: Potential impacts to vegetation associations

Vegetation association[1]	Current extent in DE (ha)	Area within Indicative Footprint (ha)	Approximate % to be cleared from the DE	Approximate % remaining in DE after proposed clearing	Significance		
					Riparian vegetation	Ecosystem at risk	GDV potential
FP AcaoAaEx Erff Tp	12.2	0.33	3	97			
HC Tw AiAb InrSeao	5,670.6	29.9	1	99			
HC TwTbrTp EllCh AmaGrwhAb	201.4	4.0	2	98			
HS TsTwTp EllCh AhiAaa	769.7	3.4	<1	100			
ME TpTlo ExAciCh PlApypGoro	316.6	17.4	5	95	✓		
MI AbAdAma Tp TtPamuEua	46.0	0.4	1	99	✓		
SP TbTp HlAancAi Ch	92.1	8.3	9	91			
Sub-total		**65**					
Locally significant vegetation							
MA EcrEvMa AcpAamAthe TydCyv	11.2	8.6	77	23	✓	✓	**High**
MA MaEcrEv MgAcpAtr Cyv	13.7	0.05	<1	100	✓	✓	**High**
MA EcrEv AcpAtheEv TpTl	56.5	6.2	12	88	✓	✓	**Moderate**
MA EvAciEcr TercCocrApyp CcEuaTt	143.1	1.0	1	99	✓	✓	**Moderate**
MA CcCs Aci EcrEv	23.4	9.3	40	60	✓	✓	
ME TtEuaEte ApypAtpPl EvCh	18.2	4.3	24	76	✓	✓	
Sub-total (locally significant vegetation)		**30**					
Other[2]							
C2	0.5	0.04	8	92			

Vegetation association[1]	Current extent in DE (ha)	Area within Indicative Footprint (ha)	Approximate % to be cleared from the DE	Approximate % remaining in DE after proposed clearing	Significance		
					Riparian vegetation	Ecosystem at risk	GDV potential
No Survey Data	6.2	0.01					
Disturbed[3]	7.9	1.4					
Sub-total (Other[2])		**0.05**					
Cleared areas							
Cleared (MS 679)	4,492	20.6					
Other clearing[4]	184.6	0.1					
Sub-total (cleared areas)		**30**					
Sub-total (total proposed clearing in Indicative Footprint)		**95**					
TOTAL		**125**					

[1] One additional vegetation association will be cleared for the Proposal; FS TsTpTw Ell AbApaAanc. However, the proposed clearing is 0.00098 ha which will have a negligible impact on the extent of this non-significant association in the Development Envelope (712.2 ha). Therefore, this impact has not been considered further.

[2] These are periphery areas of the Development Envelope that have minimal or no survey information available due to survey boundary misalignment and age of surveys, with mining commencing at the Yandi mine in 1988. Collectively, these areas account for <1% of the Development Envelope.

[3] These areas are classified as 'Completely Degraded' in the vegetation condition mapping or were mapped as 'disturbed' or 'cleared' during flora and vegetation surveys.

[4] The only 'other clearing' as described in the footnotes to Table 8-3 that occurs in the Indicative Footprint is non-BHP clearing.

Vegetation Condition

Over one third of the Development Envelope has already been cleared for the Approved Proposal. As described in Section 8.3.2.1, the majority of vegetation remaining in the Development Envelope is in Very Good (74%) or Good (19%) condition. Areas in Poor condition (<1% of native vegetation mapped in the Development Envelope) are generally adjacent to creek lines (due to impacts from cattle grazing) or adjacent to existing mining operations.

Proposal

The Indicative Footprint overlaps some areas that have previously been disturbed as part of the Approved Proposal (Figure 8-9), or that have been cleared by a third party. Collectively, these areas represent 30 ha or 24% of the Indicative Footprint (Table 8-9). Of the remaining areas of vegetation within the Indicative Footprint, most is mapped as being in Very Good (41.2 ha) or Good (43 ha) condition, representing 90% of the Indicative Footprint (Figure 8-9).

It is notable that there was a bushfire in the Indicative Footprint and elsewhere in the Development Envelope in January 2024. A significant portion of the Indicative Footprint was affected, as shown in Figure 8-12. BHP does not consider this to influence the impact assessment to vegetation condition given the subsequent regeneration that will occur. Therefore, potential impacts to vegetation have been based on the status of condition mapping prior to the fire.

A total of to 85 ha of native vegetation in Good to Excellent condition will be impacted by the Proposal (Table 8-9).

Combined Proposal

The Combined Proposal will result in loss of up to 593 ha of native vegetation in Good to Excellent condition. This consists of 508 ha[2] from the Approved Proposal and 85 ha for the Proposal.

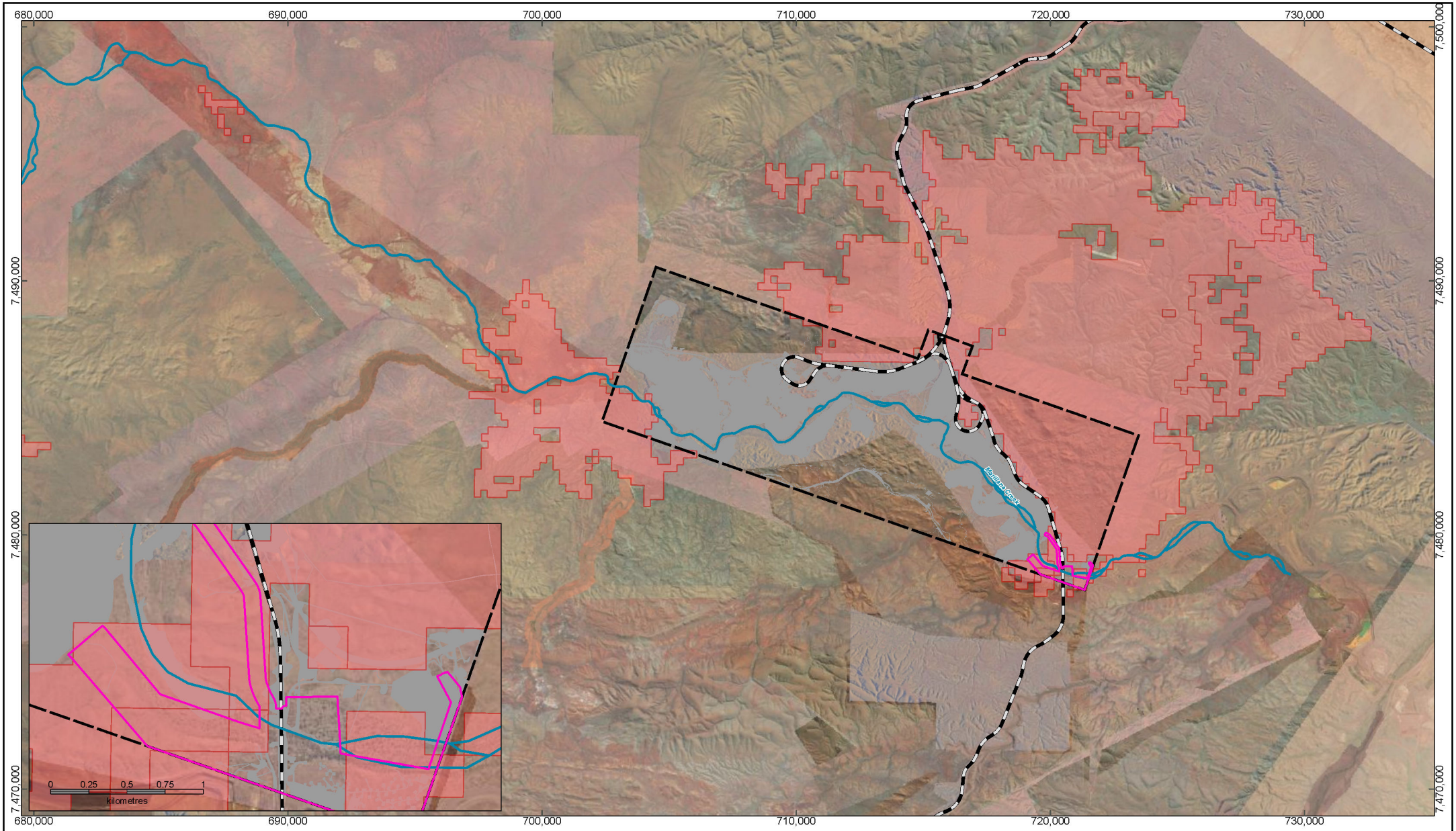
[2] 4,558 ha approved for disturbance under Ministerial Statement 679 Attachment 6, minus the 4,050 ha of clearing approved for disturbance under Ministerial Statement 679 Attachment 5, to which offsets do not apply. Ministerial Statement 679 has a total clearing limit, and does not specify limits for vegetation condition.

Table 8-9: Flora and Vegetation - potential impacts to vegetation condition

Vegetation condition	Extent in the Development Envelope (ha)	% of total vegetation remaining in Development Envelope	Area within Indicative Footprint (ha)	% of total remaining vegetation in Indicative Footprint
Excellent	495.1	6	0.3	<1
Very Good	6,299.50	74	41.2	44
Good	1,583.30	19	43	46
Poor	47.1	<1	9.7	10
Degraded	0	<1	0	<1
Completely Degraded	5.9	<1	0.1	<1
No survey data*	50.4	<1	0.05	<1
Cleared (MS 679)	4,492		30	
Other clearing**	184.6		0.1	
TOTAL	**13,158**		**125**	

* These are periphery areas of the Development Envelope that have minimal or no survey information available due to survey boundary misalignment and age of surveys, with mining commencing at the Yandi mine in 1988. Collectively, these areas account for <1% of the Development Envelope.

** Areas of other disturbance which includes non-BHP Clearing, historic BHP clearing (prior to MS 679), NVCP clearing (2843, 5826, 5889, 7009 and 8940), exploration, POW's and State Agreement clearing. The majority of this disturbance has occurred to previously mapped vegetation types.



Indicative Footprint
Development Envelope
Existing Disturbance
Fire Scar Data 2024 (Northern Australian Fire Information)
Rail
Marillana Creek

N

0 2 4 6 8 10
kilometres

GDA 1994 MGA ZONE 50

BHP

PUBLIC

MARILLANA CREEK (YANDI)
SIGNIFICANT AMENDMENT
BUSHFIRE EXTENT 2024

WAIO PLANNING, TECHNICAL & ENVIRONMENT

SCALE @A4:	1:200,000	PREPARED:	GEOMATICS	FIGURE:	8-12
DATE:	1/05/2025	REQUESTOR:	ENV APPROVALS		

A1205-032-RevF

Document Path: \\ogisfileprdwaio\premiumafs\2depts\Heritage_Data\Jobs\A1001_A1500\A1205\3Project\A1205_032_E_Yandi_S38_Bushfire_RevC.aprx

8.4.1.2 Significant flora

The Proposal has the potential to affect the representation and distribution of significant flora species as a result of direct clearing native vegetation.

Priority flora

Seven Priority flora species, as listed by the DBCA, have been recorded within the Development Envelope (Figure 8-10).

Proposal

One Priority flora species has been recorded within the Indicative Footprint; *Rostellularia adscendens* var. *latifolia* (Priority 3). Table 8-10 shows the potential impact to this species from the Proposal. Based on disturbance occurring within the Indicative Footprint, the potential impact to *Rostellularia adscendens* var. *latifolia* is less than 2% based on known populations and records.

There are no predicted impacts from the Proposal to the remaining Priority flora species occurring in the Development Envelope.

Combined Proposal

When considering the impact of the Combined Proposal on *Rostellularia adscendens* var. *latifolia*, a quantitative analysis of impacts to this species from the Approved Proposal is unfeasible for the Development Envelope. This is due to numbers of populations and records of Priority flora not being included in previous approval documents for the Approved Proposal, as well as not being available in BHPs database for the areas that have been historically cleared since this species was first recorded in the Development Envelope (2007). The combined impact to *Rostellularia adscendens* var. *latifolia* is described in Section 8.6.1.2 and has been assessed based on previous impact assessment conclusions from the Approved Proposal as well as current known populations and records of this species.

Table 8-10: Potential impacts to significant flora

Species	Known populations[1] (and records[2]) within Pilbara	Populations (and records) within Development Envelope	% of known populations (and records) within Development Envelope	Populations (and records) within Indicative Footprint	% of Development Envelope populations (and records) within Indicative Footprint	% of known populations (and records) within Indicative Footprint
Acacia subtiliformis (Priority 3)	29 (643)	1 (1)	3.4 (0.2)	0	0	0
Amaranthus centralis (Priority 3)	1 (1)	1 (1)	100 (100)	0	0	0
Aristida lazaridis (Priority 2)	69 (595)	1 (2)	1.4 (0.3)	0	0	0
Ipomoea racemigera (Priority 2)	51 (482)	2 (180)	3.9 (37.3)	0	0	0
Lepidium catapycnon – Priority 4	78 (1,102)	1 (1)	1.3 (0.1)	0	0	0
Rostellularia adscendens var. latifolia (Priority 3)	76 (576)	10 (78)	13.2 (13.5)	1 (10)	10 (12.8)	1.3 (1.7)
Sida sp. Barlee Range (S. van Leeuwen 1642) – Priority 4	38 (597)	1 (16)	2.6 (2.7)	0	0	0

1. A population is defined as a spatially discrete individual or group of individuals of a taxon that is separated by more than 500 m from the nearest spatially discrete individual or group of individuals (as defined by DBCA)
2. Based on BHP database, comprising of BHP survey data, publicly available data and data sourced from DBCA

8.4.2 Changes to, or loss of, vegetation from changes to groundwater regimes

As discussed in Section 7.4.2, the Proposal involves the abstraction of groundwater to enable below water table mining, in addition to what is authorised for the Approved Proposal. Groundwater abstraction has the potential to impact GDV by lowering the groundwater table beyond the rooting depth of vegetation, which may result in a decline in vegetation health.

Proposal

The potential impacts of groundwater drawdown from the Proposal on riparian vegetation are limited to shallow water tables in the alluvium where GDV is likely to occur. Groundwater drawdown for the Proposal in the CID aquifer will result in drawdown in the alluvium which may change the cycle of saturation and drying.

Dewatering is planned to reduce the groundwater level in the E8 pit to 12 m below the pit base (468 mAHD). This will result in groundwater being reduced 20 m from the existing groundwater level of 488 mAHD to 468 mAHD. (Section 7). Dewatering in the E8 pit for the Proposal will not increase the total volume of authorised dewatering across the Development Envelope, and no increase to the existing licence to take groundwater (GWL89501) is proposed. Spatially, dewatering of the E8 pit for the Proposal will introduce groundwater drawdown to the south-eastern portion of the Development Envelope for the first time.

The predicted CID groundwater drawdown contours for the Proposal in relation to the location of potential GDV are shown on Figure 8-13. The extent of potential GDV located in each of the drawdown contour bands outside of the Indicative Footprint, but within the Development Envelope (which represents potential additional impact to vegetation over and above the extent that will be impacted by direct clearing), is presented in Table 8-11.

Table 8-11: Potential impacts to potential GDV from groundwater drawdown

Vegetation association	Likelihood of containing GDV	Extent of GDV within drawdown band (ha)		
		0-2 m	2-5 m	5-20 m
MA EcrEvMa AcpAamAthe TydCyv	High	0.006	0.05	0.6
MA EvAciEcr TercCocrApyp CcEuaTt	Moderate	0.4	1	1.6
	TOTAL	**0.4**	**1**	**2.2**

Indirect impacts to groundwater dependent vegetation from changes to groundwater levels are likely to increase based on the extent of drawdown. Vertical drawdown between 0-2 m is within the approximate natural seasonal variation expected for the Pilbara and is therefore considered minor and unlikely to impact Moderate Potential GDV. However, it could impact High likelihood GDV which contains *Melaleuca argentea*. Drawdown greater than 2 m is considered likely to impact High and Moderate likelihood GDV.

The area of High likelihood GDV which falls within the 0-2 m drawdown zone is <0.01 ha and may experience a decline in condition. A total of 3.2 ha of potential GDV (High and Moderate) occurs within the modelled groundwater drawdown zone, which may experience between 2-20 m of groundwater drawdown. Some of this vegetation may experience a decline in condition, however the proposed surplus water discharge along Marillana Creek is predicted to maintain groundwater levels which is discussed further in Section 8.6.2.

The predicted drawdown of the Proposal does not intersect with sensitive environmental receptors in the region including Flat Rocks, Marillana Creek pools or Yandicoogina Gorge.

Combined Proposal

The potential impacts (unmitigated) by 2029 from groundwater drawdown as a result of the cumulative proposal (Combined Proposal and third-party operation) are as follows:

- Drawdown in the CID adjacent to Flat Rocks and MarC5 pool is estimated to be approximately 15 m. Measured groundwater levels at Flat Rocks estimate current drawdown is approximately 12 m, this therefore represents an increase of 3 m.
- Drawdown in the CID is estimated to propagate 10 km west of the Development Envelope and potentially impact groundwater levels in the MarC2 pool where the CID discharges directly into the pool. For the pools; MarC3 and MarC4, drawdown in the Basement is predicted to be approximately 1-2 m. The CID does not underly these pools.

Riparian vegetation in the Development Envelope has been subject to groundwater drawdown and discharge of surplus groundwater as part of the Approved Proposal since the early 1990s. Observed groundwater drawdown has ranged from 50 to 60 m in the CID.

Groundwater abstraction across the Development Envelope has reduced in recent times, as dewatering requirements have decreased across the Yandi mine, with maximum groundwater abstraction occurring during 2012-2015.

Monitoring of GDV and tree health in the Development Envelope has been undertaken since 1991. The location of sites currently being monitored is shown on Figure 8-15. The sites currently being monitored specifically for drawdown impacts are within the western half of the Development Envelope and along an approximate 3 km stretch of Marillana Creek adjacent to the western boundary of the Development Envelope, including Flat Rocks. The monitoring site along Marillana Creek immediately north-west of the proposed E8 pit (MC1) is being actively monitored for discharge impacts. This site has been monitored intermittently since 2009, as it is located immediately downstream of the main surplus water discharge point for the Approved Proposal.

The monitoring results within and outside of the Development Envelope have shown numerous tree deaths and decline in riparian vegetation health since the early 2000s as reported in the BHP AERs. Of the three phreatophytic tree species, *Melaleuca argentea* has been the most impacted. Episodes of tree death in the Development Envelope have been attributed to various causes including fire and groundwater drawdown or are unknown. Tree deaths and signs of decline in health of *Melaleuca argentea* stands have also occurred at Flat Rocks along Marillana Creek outside of the Development Envelope to the west, at monitoring points MC7 and MC8, as well as at the Marillana Creek Pools further upstream, in particular MarC3 and MarC4 (Figure 8-14 and Figure 8-15).

Decline in tree health has been observed in the vicinity of reference site MC7 (outside the Development Envelope; Figure 8-15) since its establishment in 2010, and subsequently additional monitoring points were established nearby in 2016 (MC8) and 2020 (MC9) (Figure 8-15). *Melaleuca argentea* plant health has trended below control limits at MC8 since the site was established in 2016. Continued trends of declining tree health (particularly deaths of *Melaleuca argentea*) observed at MC8 since its establishment (BHP 2023a) have been attributed to dewatering for the Approved Proposal at W0 and W1N which have lowered groundwater levels in the CID aquifer upgradient and off tenement. Approximately 2 ha of riparian vegetation has died as a result of groundwater drawdown impacts from the Approved Proposal at Flat Rocks. The Combined Proposal (unmitigated) is predicted to drawdown groundwater in the CID adjacent to Flat Rocks by an additional 3 m, decreasing the groundwater level further from an estimated 12 m currently, to 15 m. If unmitigated, this could potentially result in further impacts to GDV at Flat Rocks and upstream GDV including adjacent to the Marillana Creek Pools.

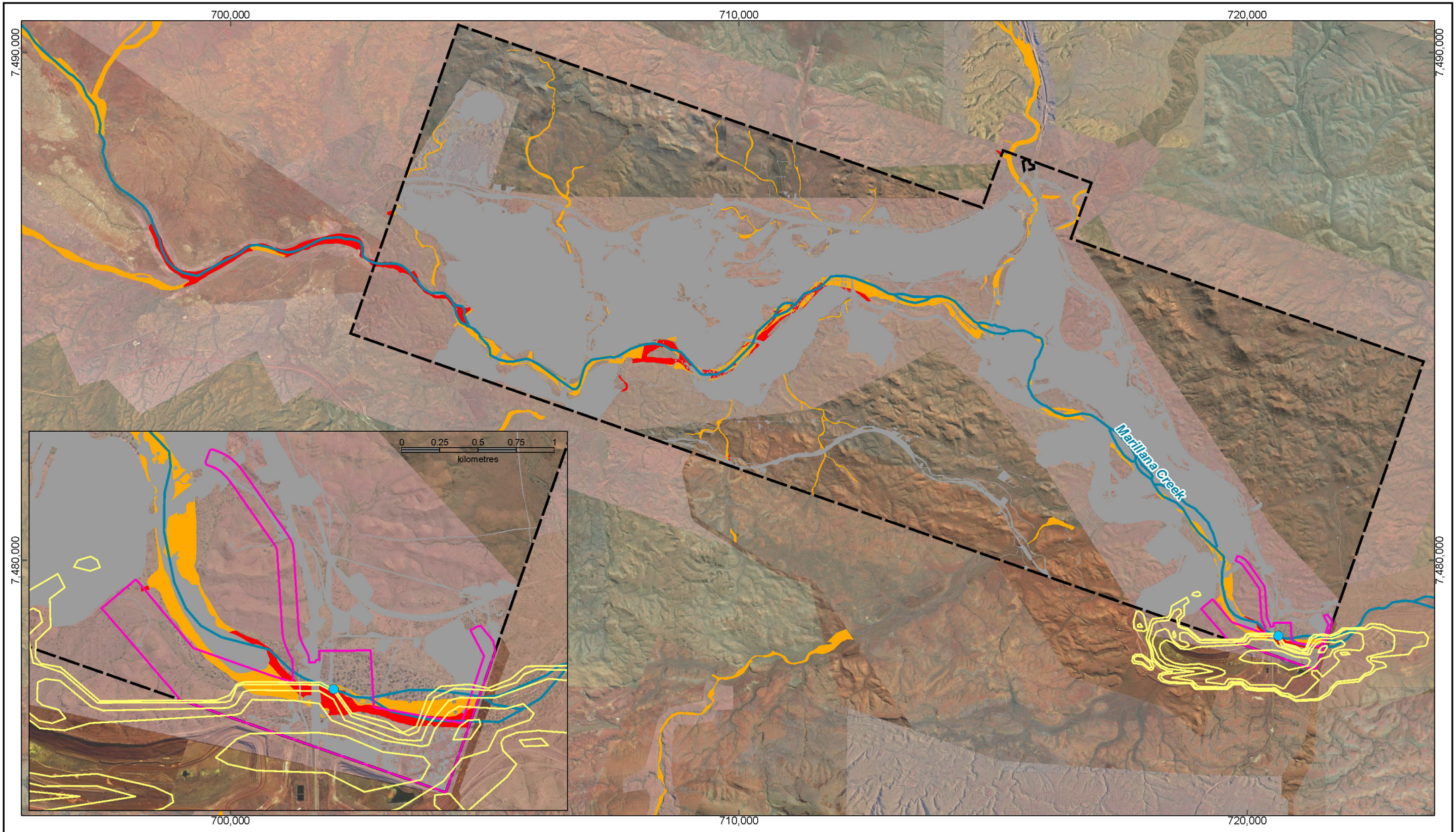
During the FY2020 AER reporting period BHP undertook a historical review of Marillana Creek riparian vegetation that considered tree deaths and health trends over the period Yandi mine has been operating (Astron 2020). The review focused on the three main phreatophytic species, *Melaleuca argentea*, *Eucalyptus camaldulensis* and *Eucalyptus victrix* within, and upstream of, the Development Envelope. The estimated proportion of dead *M. argentea* within the Development Envelope was 24% overall, and 60% upstream of the permanent discharge point (Astron

2020). The proportion of dead *M. argentea* immediately upstream of the Development Envelope (at Flat Rocks) was 51%. The remaining canopy of *E. camaldulensis* and *E. victrix* within the Development Envelope was healthy overall, but with some areas of death and decline, most significantly where *M. argentea* had also died. It was noted that trees that had died more than 10-15 years prior to the 2019 survey may have since fallen over and/or been washed away, and therefore not included in the estimate (Astron 2020). From the results of the review, BHP delineated 30 ha of deceased riparian vegetation within the Development Envelope which was included in the land disturbance reporting total for MS679 in the FY2020 AER (BHP 2020a). At the time, BHP was investigating options to remediate the area of observed decline outside the lease boundary at Flat Rocks, and as discussed above, a suite of these options are being, or are proposed to be implemented, to mitigate the impacts of groundwater drawdown on riparian vegetation.

Although there has been some tree health improvement within recent individual monitoring years in the Development Envelope, the overall monitoring trends have showed ongoing decline. Numerous tree deaths were also recorded across Marillana Creek in early 2024 mostly from fire and some likely due to below average dry conditions. A total of 31 new potential tree deaths were recorded over the 2023-2024 monitoring period including *Eucalyptus camaldulensis, Eucalyptus victrix* and *Melaleuca argentea*; eight outside the Development Envelope in the Flat Rocks area and 23 inside the Development Envelope (Astron 2024a). Within the Development Envelope the tree deaths were recorded at monitoring sites MC1 (five trees), MC5b (14 trees) and *Melaleuca argentea* monitoring Stand H (four trees) (Figure 8-15; Astron 2024a). The majority of these recent deaths were due to fire events. A total of six of the deaths inside the Development Envelope (two at MC5b and four at Stand H) were not related to fire, with water stress the possible cause (Astron 2024a). BHP considers the water stress is likely to have resulted from below average rainfall. Astron (2024) considered the 2024 fire related tree deaths ‘potential’ because delayed resprouting can occur in stressed or fire damaged trees, and therefore these trees were re-assessed to confirm mortality in the November 2024 field visit. The most recent monitoring results (from November 2024) indicated none of the deceased trees from early 2024 showed signs of recovery. In addition, no new tree deaths were recorded in November 2024 (Astron 2025). Monitoring results in November 2024 indicated that changes in GDV health were mostly negligible or slightly improved since the previous monitoring survey (May 2024), however, results continued to highlight some negative trends in GDV health across the 2024 monitoring compared to previous years. These included multiple exceedances of control limits for CCS across two of the potential drawdown impact sites (MC5b and MC8) and the potential discharge impact site MC1 (Astron 2025).

Aside from the loss of GDV reported in the past year from fire and likely below average rainfall, in the years leading up to 2023 the monitoring showed some positive trends for the health of riparian vegetation and GDV along Marillana Creek inside the Development Envelope, particularly at the discharge monitoring location MC1 in the vicinity of proposed drawdown for the Proposal.

In relation to the Indicative Footprint for the Proposal specifically, some historical tree deaths have occurred within this boundary. These occurred during the years 2000-2004 and were attributed to drawdown impacts from the then Hamersley Iron mine immediately adjacent. No further significant vegetation health decline has been recorded in the Indicative Footprint, excluding the five tree deaths at MC1 from recent fires.



BHP

PUBLIC

MARILLANA CREEK (YANDI) SIGNIFICANT AMENDMENT

PREDICTED GROUNDWATER DRAWDOWN AND GDV (PROPOSAL)

WAIO PLANNING, TECHNICAL & ENVIRONMENT

SCALE @A4:	1:100,000	PREPARED:	GEOMATICS	FIGURE:	8-13
DATE:	1/05/2025	REQUESTOR:	ENV APPROVALS		

A1205-031-RevF

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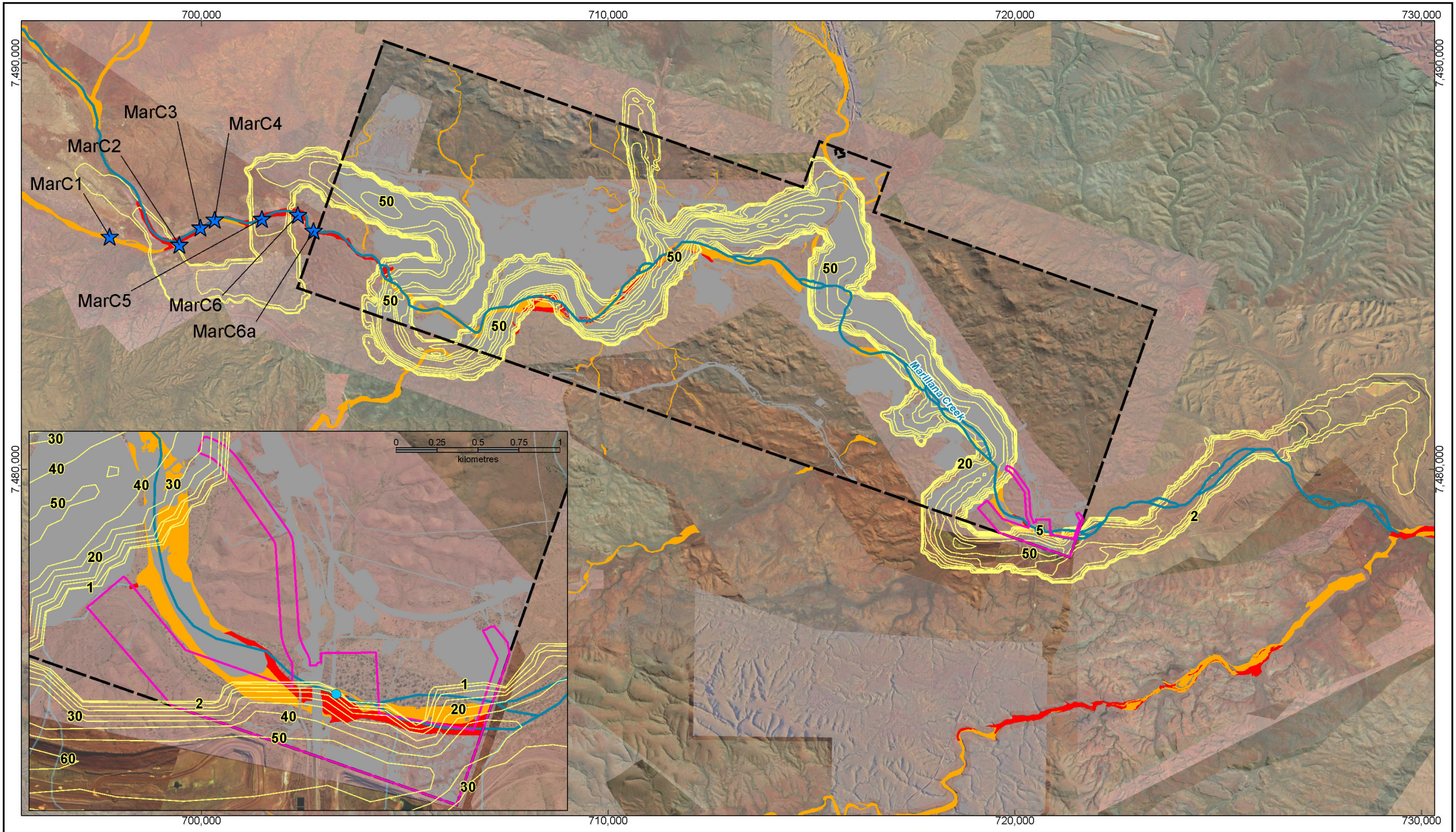

Indicative Footprint
Development Envelope
Existing Disturbance
Marillana Creek Pools (Biologic 2022)
Surface Water Discharge Point
Marillana Creek
Cumulative Impacts Drawdown in the CID (end of 2029)

GDV Likelihood Rating
High
Moderate

N
0 1 2 3 4
kilometres
GDA 1994 MGA ZONE 50

BHP

PUBLIC

MARILLANA CREEK (YANDI)
SIGNIFICANT AMENDMENT
PREDICTED GROUNDWATER DRAWDOWN AND GDV (COMBINED PROPOSAL)

WAIO PLANNING, TECHNICAL & ENVIRONMENT

SCALE @A4:	1:125,000	PREPARED:	GEOMATICS	FIGURE:	8-14
DATE:	1/05/2025	REQUESTOR:	ENV APPROVALS		

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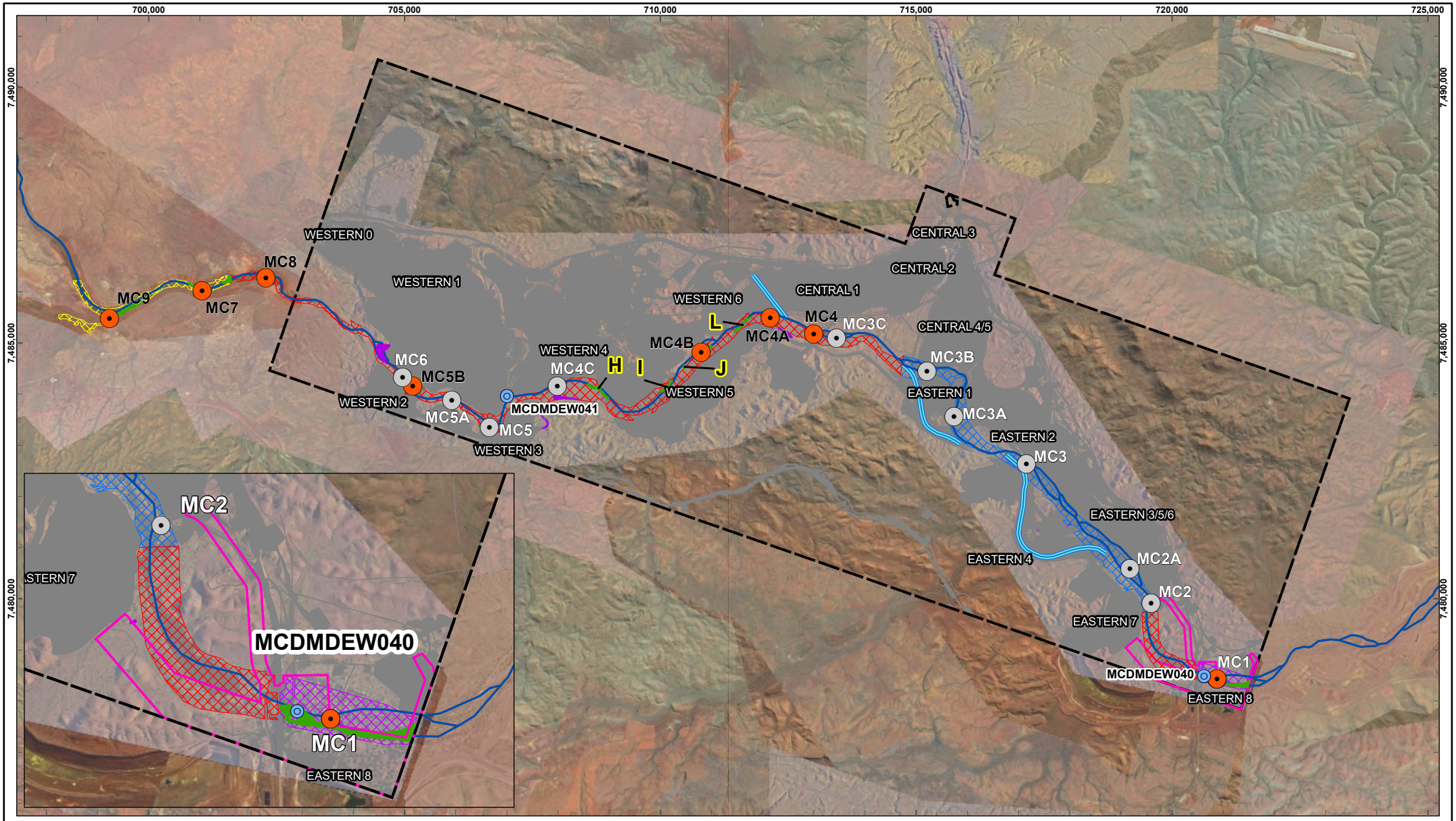

Indicative Footprint
Development Envelope
Existing Disturbance
Marillana Creek
Constructed creek diversion
Discharge point

Yandi tree health monitoring sites

Active
Retired

Melaleuca monitoring stands
Vegetation Association dominated by *Melaleuca argentea* (MA MaEcrEv MgAcpAtr Cyv)

Proposed Monitoring Zones

Potential impact - creek diversion
Potential impact - discharge
Potential impact - drawdown
Reference Zone

N

0 1 2 3 4
KILOMETRES

GDA 1994 MGA ZONE 50

BHP

PUBLIC

MARILLANA CREEK (YANDI)
SIGNIFICANT AMENDMENT
MELALEUCA ARGENTEA VEGETATION
MONITORING STANDS
AT MARILLANA CREEK

WAIO PLANNING, TECHNICAL & ENVIRONMENT

SCALE @ A4:	1:100,000	PREPARED:	GEOMATICS	FIGURE:	8-15
DATE:	29/04/2025	REQUESTOR:	ENV APPROVALS		

A1205-073-RevE

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8.4.3 Changes to vegetation from changes to surface water regimes

Dewatering for the Proposal will result in the discharge of surplus water into Marillana Creek, in addition to discharge already being undertaken for the Approved Proposal along the same creek line (Section 7.4.1.1). Surplus water discharge is authorised at two locations along Marillana Creek MCSW040 (main discharge, Figure 8-13) and MCSW031 (supplementary, located towards the centre of the Development Envelope).

The release of surplus water into the environment has the potential to alter the hydrological regimes within the Marillana Creek catchment as well as potentially create mounding in the alluvial aquifer which could cause waterlogging for deep rooted vegetation and an associated change to vegetation types.

Proposal

The discharge of surplus water for the Proposal will occur at the discharge point shown in Figure 8-13. The proposed discharge rate is a maximum of 26 ML/day and will be via the existing infrastructure in Marillana Creek for which the impacts were assessed and approved under MS 679. The existing discharge of surplus water to Marillana Creek is regulated by L6168/1991/10 which authorises the discharge of up to 15,000,000 tonnes per annum (tpa) of mine dewater (41.1 ML/day). The proposed discharge rate for surplus water from the Proposal is within the licence requirements. Monitoring of the vegetation downstream of the discharge location, within the Development Envelope, has shown no significant negative impacts on riparian vegetation health since 2009 (excluding the impacts from recent fires; Section 8.4.2) and is discussed further in Section 8.6.3. Based on this, and the proposed discharge rate being within licence requirements, potential impacts to vegetation are considered unlikely.

There is anecdotal evidence from recent site flyovers that riparian vegetation downstream and off BHP tenure, has declined in heath and composition since discharge volumes and the wetting front have decreased. Wetting front limits have not previously been set for this location, however the maximum recorded was 9 km in 2008, and more recently 2.5 km in 2023. The surface discharge from the Proposal will increase the flow of water along Marillana Creek causing permanent/semi-permanent flow for up to 9 km during the time where the discharge point is utilised. It is not anticipated that flows will increase past the existing 9 km wetting front due to the Proposal.

Combined Proposal

As discussed in Section 7.3.2.2, most of the 15,000,000 tpa of mine dewater (41.1 ML/day) for the Approved Proposal has been historically utilised as part of the mine operations for purposes such as dust suppression and wash down/cleaning. Since 2018, dewatering volumes have declined as the dewatering objective moves from drawing down water levels to maintaining water levels. In FY 2023, total surplus water generated from mine dewatering discharged into Marillana Creek north of the proposed E8 pit (at the discharge point to also be utilised for the Proposal) was 6,732 ML, well within the allowable licensed rate. The discharge of this water is continuous through the year and has created a permanent pool and an associated wetting front. As of June 2023, the wetting front extends downstream approximately 2.5 km from the discharge point to beyond the boundary of the Development Envelope with an associated discharge of approximately 10 ML/day. The proposed discharge rate for the Proposal (26 ML/day) includes the remaining discharge required for the Approved Proposal, and a maximum discharge of approximately 9,576,983 kL/annum is expected over the life of the Combined Proposal.

Monitoring of the vegetation downstream of the discharge location, within the Development Envelope, has shown no significant negative impacts on riparian vegetation health since 2009 (excluding the impacts from recent fires; Section 8.4.2) (Section 8.6.3). Based on the vegetation downstream of the discharge point not showing signs of vegetation decline or stress within the Development Envelope, and the proposed discharge rate being within licence requirements, potential impacts to vegetation from dewatering discharge for the Combined Proposal are considered unlikely. Discharge for the Proposal may assist in restoring GDV/riparian vegetation health downstream off BHP tenure due to increasing the wetting front from the recently observed reduced distance of 2.5 km (Section 8.6.3).

8.4.4 Changes to vegetation and flora from dust, fire and weeds

8.4.4.1 Dust

Increased levels of airborne dust have the potential to impact on vegetation health in instances where leaf physiology is affected. This could occur along unsealed roads and is pronounced during dry seasonal conditions. Studies from the Pilbara, such as Butler (2009), have not recorded evidence of negative impacts on plant function resulting from inert particulate matter deposition. Most arid plant species have much of their stomata closed during dry periods, when the potential for dust is greatest. This would limit the potential for dust generated during the dry season to have effects on the stomatal conductance of the plants (i.e. plant function) and therefore on the health of the plant. In high rainfall periods, when most species put on new growth and stomata are open, dust levels tend to be significantly less due the wet conditions (Grierson 2015). Long-term observations of vegetation in close proximity to mine sites across the Hamersley Ranges have demonstrated repeatedly the overall resilience of vegetation to extremely high levels of dust exposure (Grierson 2015).

Proposal

The Proposal is located within existing operational areas and is not expected to result in an increase in airborne dust. The processing limit for the Approved Proposal is not increasing as a result of the Proposal and dust levels are not predicted to increase beyond the limit already approved in the licence (Section 13). Therefore, the potential impact on vegetation from dust resulting from the Proposal is expected to be minimal.

Combined Proposal

The Proposal is not expected to result in an increase in airborne dust for the Approved Proposal. As such, the impact of the Combined Proposal on native vegetation from dust is predicted to be the same as that previously assessed for the Approved Proposal.

8.4.4.2 Fire

There is the potential to change the frequency of fire by actively extinguishing fires or by causing fires through mining activities. This may result in fire in certain parts of the landscape being too frequent or in other parts being not frequent enough, which may result in fire being intensified when it does occur. Altered fire regimes can encourage the growth of weeds at a landscape level and alter the ecological characteristics of communities through the dominance of early successional species.

Proposal

No fire sensitive species or communities have been identified within the proposed Development Envelope. BHP considers that the Proposal will have a negligible impact to vegetation or flora from the potential alteration of fire regimes.

Combined Proposal

The Proposal is not expected to change the frequency of fire within the Development Envelope. The impact of the Combined Proposal is therefore expected to be the same as for the Approved Proposal. As mentioned above, no fire sensitive species or communities have been identified from within the Development Envelope, and the Combined Proposal is predicted to have a negligible impact to vegetation or flora from the potential alteration of fire regimes.

8.4.4.3 Weeds

A total of 28 introduced flora (weed) species have been recorded from within the Development Envelope (8.3.2.2). Domestic stock such as cattle are significant vectors for weeds within lowland areas of the Pilbara (including the Development Envelope where there is evidence of cattle grazing). Another factor influencing weed establishment is

access. Increasing vehicular access combined with disturbance such as clearing for roads and other infrastructure, has the potential to introduce and/or spread weed species. The current distribution of introduced flora species within the Development Envelope largely reflect this, with higher weed occurrences present along drainage areas and existing infrastructure.

The presence of introduced flora species within the Development Envelope has the potential to impact on the condition and structure of native vegetation present, with operational activity potentially increasing the occurrence and spread of weeds. The occurrence of weeds within the Development Envelope is not expected to impact on any regionally significant vegetation (as none occur within or adjacent to the proposed Development Envelope), or the regional representation of significant flora species.

Proposal

The Proposal may result in the spread of weeds into areas of proposed new disturbance (mainly via vehicle movement); however, the Proposal is largely located within areas of existing disturbance or operations, and therefore not expected to significantly increase the occurrence of weeds within the Development Envelope. It is expected that the Proposal will have a negligible impact to vegetation from the potential spread of weeds.

Combined Proposal

The impact of the Combined Proposal on native vegetation from the presence of introduced flora species (weeds), is expected to be the same as the existing impacts from the Approved Proposal.

8.5 Mitigation

BHP considers that there are potentially significant impacts to Flora and Vegetation from the Proposal, and therefore additional avoidance and minimisation measures are required to be implemented. Additional measures are outlined in the following sections.

BHP will continue to implement the avoidance and minimisation measures for the Approved Proposal (summarised in Appendix 2) as part of the Combined Proposal (see Appendix 10: revised BEMP (BHP 2025a).

8.5.1 Avoid

Clearing of additional areas to facilitate the construction of infrastructure has been avoided where possible, as existing infrastructure will be used where practicable to support the development and operation of the Proposal. This includes the use of existing cleared tracks and roads, as well as mine processing infrastructure and overburden storage areas (OSAs).

There are no other specific avoidance measures proposed for the Proposal as no TECs or PECs, significant regional vegetation associations, or Threatened flora species are known from within the Development Envelope. However, the proposed clearing is limited (<100 ha) in the context of the Development Envelope and clearing for the Approved Proposal. The predicted impacts to the clearing of Priority flora species is also limited at less than 2% of currently known populations (Section 8.4.1.2).

8.5.2 Minimise

As part of the Combined Proposal, BHP propose to continue to manage potential impacts to Flora and Vegetation under the revised BEMP (BHP 2025a) (Appendix 10). Management measures include (but are not limited to):

- Clearing for the Proposal will be limited to a maximum extent of 95 ha of native vegetation to minimise impacts to flora and vegetation
- Excessive dust will be minimised as far as practical

- The Proposal will be operated within the existing groundwater licence limits for surplus water discharge
- Annual weed mapping and subsequent weed control and eradication will be undertaken as required.

Riparian tree health is currently monitored as part of the SWGWMP. This plan has been updated and renamed to the 'Marillana Creek Water Resource Management Plan' (MCWRMP; BHP 2025c) which has also been updated to include the Proposal and is attached as Appendix 6. Some of the key measures that will continue to be implemented include monitoring of tree health biannually, periodic use of remote sensing data to assess vegetation stress along Marillana Creek and potential irrigation of trees along Marillana Creek where there is evidence of tree stress or decline.

BHP proposes further mitigation measures to address declining tree health at Flat Rocks (Section 7.5.2.4) including:

- Manage water level recovery in W0 to support upgradient water levels
- Off-tenure injection in the CID at one location upstream of Flat Rocks (currently being investigated)
- Investigate the feasibility of low permeability barrier to slow groundwater flow into W1 Pit and force water to mound within the CID channel upstream.
- Develop a Flat Rock Springs Tree Restoration Program in collaboration with DBCA, Kings Park Science and the Banjima People (Elliott and Stevens 2025).

8.5.3 Rehabilitate

Rehabilitation for the Proposal is addressed in the Yandi MCP (BHP 2025b) (Appendix 5). The MCP has been revised to include the Proposal.

Management approaches relating to Flora and Vegetation for the Proposal include:

- undertake progressive rehabilitation
- design the revegetation program to establish native vegetation that blends with the surrounding areas
- undertake growth media management in accordance with standard business procedures
- use specified seed mix, including the use of local provenance native seed.
- develop a rehabilitation strategy for areas of riparian vegetation health decline within the Development Envelope, commensurate to:
  - groundwater level recovery predicted through closure modelling and
  - cessation of surplus discharge.

8.5.4 Other statutory decision-making processes

BHP's view is that there is no other statutory decision-making process to mitigate the potential environmental impacts of the Proposal on Flora and Vegetation, considering the EPA's *Taking decision making processes into account in EIA: Interim Guidance* (EPA 2021b).

8.6 Assessment and significance of residual impacts

BHP has considered the significance of flora and vegetation, and relevant issues outlined in the EPA's *Environmental Factor Guideline – Flora and Vegetation* (2016a) in assessing the significance of the impacts to Flora and Vegetation

from the Proposal. The assessment of potential impacts discussed in this section are following the application of mitigation as documented in Section 8.5.

8.6.1 Loss of vegetation and flora from clearing

8.6.1.1 Vegetation

Regional vegetation

As discussed in Section 8.4.1.1, BHP estimates the impact from the Proposal will be the clearing of less than 0.01% of Beard vegetation association 82 (Table 8-7), and there will be no impact on association 18. Association 82 will have 99.5% of its pre-European extent remaining following implementation of the Proposal, and 99.3% remaining following implementation of the Combined Proposal (i.e. the combined effect of the Proposal and Approval Proposal). BHP considers that the impact on regional vegetation associations will not be significant.

Local vegetation

Of the 11 locally significant vegetation associations within the Development Envelope that have been identified as potentially representing 'ecosystems at risk', six are proposed to be directly impact by the Proposal (based on the Indicative Footprint, which provides a likely indication of the potential impacts to vegetation associations). There is no proposed disturbance to the remaining five locally significant vegetation associations, based on the Indicative Footprint (Section 8.4.1.1).

Four of the eight riparian vegetation associations to be impacted will have >10% of their current remaining extent in the Development Envelope cleared as a result of the Proposal (Table 8-8). MA EcrEv AcpAtheEv TpTl is likely to contain GDV and will be subject to 6.2 ha of clearing from the Proposal (12% of its current extent in the Development Envelope). A total of 88% of this vegetation association will remain in the Development Envelope after clearing occurs. MA CcCs Aci EcrEv and ME TtEuaEte ApypAtpPl EvCh will have 40% and 24% of their remaining extent in the Development Envelope cleared for the Proposal respectively. Although MA CcCs Aci EcrEv is only known to occur in the Development Envelope, it is unlikely to contain GDV and will still have 60% remaining in the Development Envelope after the Proposal is implemented. ME TtEuaEte ApypAtpPl EvCh is also unlikely to contain GDV and will have 76% of its extent remaining in the Development Envelope after the Proposal is implemented. This vegetation association occurs widely outside the Development Envelope along other nearby creeklines and tributaries.

MA EcrEvMa AcpAamAthe TydCyv is highly likely to contain GDV and will have approximately 77% of its remaining extent in the Development Envelope cleared as a result of the Proposal. Within the Development Envelope, this vegetation association only occurs in the south-eastern corner where the Indicative Footprint is located. However, this vegetation association also occurs outside the Development Envelope, along Marillana Creek to the west and also Yandicoogina Creek to the south. A significant portion of the proposed clearing of MA EcrEvMa AcpAamAthe TydCyv falls within a buffer area of the proposed eastern E8 pit, as well as the buffer area applied to the proposed haul road and therefore direct impacts to this vegetation association are expected to be less than those predicted in Table 8-8.

The Proposal will impact locally significant vegetation through clearing of riparian vegetation. BHP considers this to be a significant residual impact and therefore proposes offsets (Section 14) to counterbalance the impacts to ensure the EPA's objective for Flora and Vegetation can be met.

Vegetation condition

As discussed in Section 8.4.1.1, over one third of the Development Envelope has already been cleared for the Approved Proposal. The majority of vegetation remaining in the Development Envelope is in Very Good (74%) or Good (19%) condition (Table 8-9).

The Proposal will result in the clearing of up to 95 ha of native vegetation within the Pilbara bioregion, of which up to 85 ha is in Good to Excellent condition. BHP has applied the residual impact significance model in the WA Environmental Offsets Guidelines (Government of Western Australia 2014) and considers the proposed clearing of up to 85 ha of the vegetation in Good to Excellent condition to be a significant residual impact. This is discussed further in section 14.

8.6.1.2 Significant flora

As discussed in Section 8.4.1.2, seven Priority flora species occur within the Development Envelope (Figure 8-10). One of these has been recorded from within the Indicative Footprint; *Rostellularia adscendens* var. *latifolia* (Priority 3), and the predicted direct impact to this species is the clearing of less than 2% of known populations and records (Table 8-10).

Impacts to *Rostellularia adscendens* var. *latifolia* were assessed under the Approved Proposal and it was concluded the activities of the Approved Proposal would not have a detrimental impact to the survival of this species as it is known from records from several localities (or more) which are not under imminent threat (BHP Billiton 2015)

This is still considered to be the case, including when considering the Proposal in addition to the Approved Proposal. Based on most recent survey data, *Rostellularia adscendens* var. *latifolia* is known from 10 populations and 78 records within the Development Envelope, mostly along Marillana Creek in uncleared areas. Regionally, the species is known from 76 populations and 576 records in the Pilbara. The Proposal will impact 10% of populations of *Rostellularia adscendens* var. *latifolia* within the Development Envelope and 12.8% of records within the Development Envelope. This is not considered significant given the considerable number of records of this species known regionally, and that the Proposal will impact less than 2% of populations and records in the Pilbara.

BHP considers that the Proposal will not result in a significant impact to Priority flora locally or regionally. The representation and viability of the Priority flora known from the proposed Development Envelope will be maintained in the Pilbara bioregion.

8.6.2 Changes to, or loss of, vegetation from changes to groundwater regimes

Groundwater abstraction for the Proposal has the potential to impact GDV by lowering the groundwater table beyond the rooting depth of vegetation, which may result in a decline in vegetation health. A total of <0.01 ha (0.006 ha) of High likelihood GDV (containing *Melaleuca argentea*) falls within the 0-2 m drawdown zone and 3.2 ha of High and Moderate likelihood GDV is located in the area predicted to have between 2-20 m of groundwater drawdown. These areas of vegetation lie outside the Indicative Footprint (Figure 8-13) and have not experienced vegetation health decline during monitoring undertaken since 2009 (excluding damage from fires in 2004) (Section 8.6.3). This vegetation could potentially experience a decline in condition as a result of the Proposal, however the proposed surplus water discharge along that area of Marillana Creek is predicted to mitigate the groundwater drawdown in this area.

Groundwater drawdown and discharge of surplus groundwater has been undertaken as part of the Approved Proposal since the early 1990s, and monitoring of GDV and tree health within, and to the west of the Development Envelope has been undertaken since 1991 (Section 8.4.2). Tree deaths and GDV health decline have been recorded historically in the Development Envelope (as well as very recently from fire and below average rainfall) and at Flat Rocks, west of the Development Envelope. A total of 30 ha of deceased riparian vegetation from groundwater drawdown within the Development Envelope has already been accounted for in the FY2020 AER clearing total and has been offset (BHP 2020a). Approximately 2 ha of riparian vegetation has died as a result of groundwater drawdown impacts from the Approved Proposal at Flat Rocks.

Drawdown from the Combined Proposal, if unmitigated, could result in further impacts to GDV at Flat Rocks and upstream, including adjacent to the Marillana Creek Pools, as described in Section 8.4.2. BHP has commenced and is investigating a number of other mitigation options to recover groundwater levels in the Flat Rocks area (including

off tenure reinjection and investigation into the feasibility of a low permeability barrier). As an initial step, BHP has ceased all dewatering in the western-most pit in the Development Envelope (W0), which has resulted in a rapid improvement in water levels; resulting in a water level recovery of over 17 m at the tenure boundary and has been effective in stopping the decline of groundwater off tenure at Flat Rocks. Water levels at the nearby HYW002M monitoring bore which is further upstream to the south-west have begun to recover and are above 610 mAHD (3 m below pre-development groundwater levels) which are now well above the trigger levels defined in the MCWRMP. (Section 7.6.2.1). Modelling indicates the groundwater levels will continue to increase in the Flat Rocks area due to the dewatering reduction (Section 7.5.2.2). BHP is also proposing reinjection trials off tenure upstream of Flat Rocks, to further reduce tree deaths and vegetation health decline at Flat Rocks and Marillana Creek Pools (Section 7.5.2.2).

In addition to hydrogeological mitigation measures, BHP is committed to rehabilitating the vegetation that has been affected at Flat Rocks. The Flat Rock Springs Tree Restoration Program is in the early stages of development in collaboration with DBCA, Kings Park Science and the Banjima People (Elliott and Stevens 2025). Kings Park Science has developed an integrated science approach to develop knowledge of tree species to understand barriers to plant establishment (including restoration of vegetation in rocky, semi-arid environments) that improve restoration outcomes and intend to apply this to replanting of *Melaleuca argentea*. A set of guidelines was recently developed for the program which identifies techniques and approaches that are available to inform the development of a restoration program that is specific to *Melaleuca argentea* and the habitat at Flat Rocks (Elliott and Stevens 2025). After implementation of the mitigation and rehabilitation measures discussed above, including proposed targeted rehabilitation of *Melaleuca argentea*, and based on the evidence demonstrating rapid groundwater level recovery from initial mitigation, BHP considers the likelihood of impact to GDV at the Marillana Creek Pools, and further decline to GDV at Flat Rocks from the Combined Proposal to be low.

Within the Development Envelope, numerous potential tree deaths were recorded during the 2023-2024 monitoring, mostly from the impacts of recent fires. A total of six of the deaths were not related to fire, with water stress from below average rainfall likely to be the cause (Section 8.4.2). Prior to the fire, the 2022-2023 monitoring period, showed mostly negligible change in GDV health across much of Marillana Creek within the Development Envelope, with no major negative changes in tree health of monitoring stands of live *Melaleuca argentea* since the previous assessment, although long term trends in riparian vegetation health were negative. No recent death of any sample trees across sites within the Development Envelope was recorded in the 2022-23 monitoring period or during the most recent monitoring in November 2024. Recruitment of GDV species was present throughout Marillana Creek during the 2021-2022 and 2022-23 monitoring periods, with saplings or seedlings of at least one target species observed at each monitoring site. However, the number of seedlings recorded was less than the number of dead trees recorded. The highest abundance of *Melaleuca argentea* seedlings and saplings was recorded at MC1 near the proposed E8 pit, which is expected as surface water is continuously present at this location due to the discharge of surplus water. The groundwater bore in the alluvium near MC1 maintains an almost fully saturated profile due to its proximity to the surplus water discharge outlet (Section 7.3.2.7), and monitoring at this site has recorded consistently positive trends in vegetation health overall (excluding the impacts from recent fires) (Section 8.4.3).

As described above, the continuation of surplus water discharge from the Combined Proposal is expected to mitigate the potential for vegetation health decline in the area of potential GDV located within the 0-20 m CID drawdown contours, as the discharge will maintain the presence of water in the alluvium for the GDV species to access. Recruitment of GDV species within and adjacent to Marillana Creek is also likely to continue for the duration of discharge and during wetter periods (cyclone/flood events), which is likely to assist in counterbalancing any vegetation health decline in this area which may be attributed to dewatering activities.

The riparian vegetation health will continue to be monitored for the Combined Proposal and management measures applied to minimise impacts to GDV. Given this, the small area of potential GDV within the 0-20 m drawdown zone (3.6 ha) and the continued discharge of water in the same location, BHP considers it is unlikely this area of GDV will be impacted by the Combined Proposal.

Based on the information presented and discussed above, BHP considers future changes to groundwater regimes from the Combined Proposal can be mitigated and/or managed moving forward (including hydrogeological measures as well as the proposed rehabilitation at Flat Rocks) and are not expected to be significant. However, the impacts at Flat Rocks to date from the Approved Proposal on riparian vegetation and GDV are considered to be a significant residual impact of the Combined Proposal on the basis of the EPA's objective for Flora and Vegetation (EPA 2016a) and the consideration of significance in the *Statement of Environmental Principles, Factors, Objectives and Aims of EIA* (EPA 2023a). BHP proposes to offset the 2 ha of vegetation which has died at Flat Rocks due to groundwater drawdown (Section 14), and will continue to do so should there be further loss of vegetation due to groundwater drawdown, to counterbalance the impacts to date. This, along with the current and proposed mitigation described in Section 8.5, will ensure the EPA's objective for Flora and Vegetation can be met.

BHP also acknowledges the potential impacts of the Combined Proposal, and those that have occurred as part of the Approved Proposal are considered significant to the Banjima People. Further assessment regarding culturally significant impacts to the Banjima People are described in Chapter 11 – Social Surroundings.

8.6.3 Changes to vegetation from changes to surface water regimes

Discharge of surplus water into Marillana Creek has the potential to cause waterlogging for deep rooted vegetation and an associated change to vegetation types. Together with the proposed future discharge for the Approved Proposal, the maximum amount of discharge to be released via the discharge location to the north of E8 will be 26 ML/day which is within the authorised limit of 41.1 ML/day.

As described in Section 8.4.2, the vegetation beyond the active discharge point to be utilised for the Proposal has been monitored at site MC1 since 2009. Monitoring at this site has not recorded any tree deaths or significant health decline, excluding the impacts from recent fires (Section 8.4.2), and has otherwise recorded positive trends in vegetation health which is expected due to the abundance of water from the continuous discharge. No negative effects of potential waterlogging have been recorded at MC1 except for a declining trend in the mean crown condition score (CCS) of some *Eucalyptus victrix* trees in 2014 and 2015, however the mean still remained higher than at reference sites.

Discharge to Lower Marillana Creek will occur at the existing discharge location in use at the Yandi mine which has shown no significant negative impacts on riparian vegetation health from surplus water discharge since its establishment in 2009 (Astron 2024a). A recent fire at the Yandi mine however, resulted in a total of 23 new potential tree deaths recorded in the 2023-2024 monitoring period including *Eucalyptus camaldulensis*, *Eucalyptus victrix* and *Melaleuca argentea*. Five of these were recorded at the discharge location (Astron 2024a). Aside from the recent tree deaths from fire, in the years leading up to 2023 the monitoring showed positive trends for the health of riparian vegetation and GDV along Marillana Creek within the Yandi mine lease, including at the discharge monitoring location MC1. There is anecdotal evidence that riparian vegetation downstream and off BHP tenure, has declined in health and composition since discharge volumes and the wetting front have decreased in recent years. The Proposal is not anticipated to result in decline of riparian vegetation from discharge, as there will be no changes to the existing maximum wetting front reached (9 km), and the proposed discharge rate for the Proposal will be within the licence requirements (L6168/1991/11). Discharge for the Proposal may assist in restoring GDV/riparian vegetation health downstream off BHP tenure due to increasing the wetting front from the recently observed 2.5 km. The potential for future decline in health of riparian vegetation following cessation of discharge for the Yandi mine is addressed in the Yandi mine Closure Plan (BHP 2025b) and includes reference to the potential opportunity to support the riparian vegetation downstream of the discharge location which is currently being explored with Traditional Owners, and if feasible, will be incorporated into future updates to the Yandi mine Closure Plan (BHP 2025b).

BHP considers there are unlikely to be any significant residual impacts to vegetation from changes to surface water regimes.

8.6.4 Changes to vegetation and flora from dust, fire and weeds

The Proposal is located within existing operational areas and is not expected to result in an increase in airborne dust. Therefore, the potential impact on vegetation from dust resulting from the Proposal is expected to be minimal.

The Proposal is not expected to change the frequency of fire within the Development Envelope and no fire sensitive species or communities have been identified from within the proposed Development Envelope. BHP considers that the Proposal will have a negligible impact to vegetation or flora from the potential alteration of fire regimes.

The Proposal may result in the spread of weeds into areas of proposed new disturbance (mainly via vehicle movement); however, the Proposal is largely located within areas of existing disturbance or operations, and therefore not expected to significantly increase the occurrence of weeds within the Development Envelope.

8.6.5 Significant residual impacts

Following the application of the mitigation hierarchy (Section 8.5) and applying the Residual Impact Significance Model in the *WA Offsets Guidelines* (Government of Western Australia 2014), BHP considers that there will be significant residual impacts to Flora and Vegetation from the Proposal. The impact to locally significant vegetation through clearing of riparian vegetation is a significant residual impact, as well as the area of vegetation which is now deceased at Flat Rocks due to groundwater drawdown from the Approved Proposal. BHP proposes offsets (Section 14) to counterbalance these impacts to ensure the EPA's objective for Flora and Vegetation can be met. Potential residual impacts to flora and vegetation values at Yandicoogina Gorge may be due to climate variability, or a combination of climate variability and groundwater drawdown from regional cumulative dewatering by both BHP and third-party operators, and are addressed in Section 16.2.

In addition, the EPA considers that the clearing of vegetation in Good to Excellent condition is a significant residual impact due to the cumulative impacts of clearing in the Pilbara, based on the EPA's advice to the Minister under Section 16(e) of the EP Act (EPA 2014).

The detailed assessment of offsets is discussed in Section 14, including how the proposed offset/s will counterbalance the significant residual impact on Flora and Vegetation (i.e. the clearing of native vegetation in Good to Excellent condition).

For the other impacts assessed, BHP considers that the residual impacts are not significant. However, BHP acknowledge the potential impacts of the Combined Proposal, and those that have occurred as part of the Approved Proposal are considered significant to the Banjima People. See Section 8.7 for the discussion on the outcomes relating to the identified residual impacts and BHP's proposed assurance (regulation) and monitoring, where required.

8.7 Environmental outcomes

Table 8-12 summarises the environmental outcomes, proposed assurance (regulation) and proposed monitoring (if required) for each residual impact for Flora and Vegetation. Detail of the proposed monitoring is set out in the Part IV environmental management plans and other relevant statutory decision-making documents discussed in Section 8.5. Table 8-12 demonstrates how the proposed environmental outcomes for the Combined Proposal, together with the proposed regulation and monitoring, are consistent with the EPA's objective for Flora and Vegetation (Section 8.1).

As required by the EPA's ERD Instructions for Significant Amendments, BHP has included information about the existing implementation conditions for the Approved Proposal (Appendix 2). BHP considers that the EPA should inquire into the Approved Proposal implementation conditions (relating to Flora and Vegetation), as provided for under s40AA(3), as part of the assessment of the Proposal under s40 and in the EPA's assessment report required under s44, for the following reasons:

- to contemporise the conditions to reflect the contemporary condition setting approach (in recommended conditions in EPA Reports and Ministerial Statement since early 2023).

As provided for as an option in the EPA's ERD Instructions, BHP has proposed conditions (including outcome-based conditions) for the EPA's consideration, in Appendix 3.

Table 8-12: Flora and Vegetation - environmental outcomes, proposed regulation and monitoring of the Proposal

Residual impact	Environmental outcome	Proposed regulation (Condition[1] or other statutory decision-making process)[1]	Proposed Monitoring	Consistency with EPA objective
Clearing up to 85 ha of native vegetation in Good to Excellent condition (in the Pilbara IBRA region)	Contributes to the cumulative clearing of Good to Excellent condition vegetation in the Pilbara bioregion (Section 8.6.1.1)	**Condition A1:** Limit on extent of proposal element • Up to 4,653 ha of native vegetation clearing within the Development Envelope **Condition B7**: Offsets • Offsets via contribution to the PEOF **Condition B6**: Decommissioning and Rehabilitation • Implement the MCP (BHP 2025b)	Standard management practices: • internal land disturbance approval process to manage ground disturbance • annual land disturbance reporting against approved limits/extents **Condition B7**: Offsets • Impact Reconciliation Procedure and Impact Reconciliation Report **Condition B6**: Decommissioning and Rehabilitation • Implement monitoring outlined in the MCP (BHP 2025b)	The significant residual impact of the proposed clearing to cumulative clearing in the Pilbara bioregion can be counterbalanced by offsets, so that the environmental outcome is consistent with EPA's objective.
Clearing of up to 48 ha of riparian vegetation for the Proposal (significant)	No impacts to regionally significant vegetation (TECs and PECs) Locally significant vegetation will be impacted through clearing of riparian vegetation	**Condition A1:** Limit on extent of proposal element • Up to 48 ha of riparian vegetation clearing for the E8 Proposal within the Development Envelope **Condition B7**: Offsets • Offsets via contribution to PEOF **Condition B6**: Decommissioning and Rehabilitation Implement the MCP (BHP 2025b)	Standard management practices: • internal land disturbance approval process to manage ground disturbance • annual land disturbance reporting against approved limits/extents **Condition B7**: Offsets • Impact Reconciliation Procedure and Impact Reconciliation Report **Condition B6**: Decommissioning and Rehabilitation	The significant residual impact of the proposed clearing of riparian vegetation can be counterbalanced by offsets, so that the environmental outcome is consistent with EPA's objective.

Residual impact	Environmental outcome	Proposed regulation (Condition[1] or other statutory decision-making process)[1]	Proposed Monitoring	Consistency with EPA objective
			Implement monitoring outlined in the MCP (BHP 2025b)	
Loss of 2 ha of riparian vegetation at Flat Rocks to date from the Approved Proposal (significant)	The viability of riparian vegetation and GDV within the Development Envelope and at Flat Rocks will be maintained	**Condition B1-1:** The proponent must ensure the implementation of the proposal achieves the following environmental outcomes: (2) no significant changes to the health, extent or diversity of riparian vegetation communities within the development envelope as a result of changes to groundwater regimes or groundwater quality associated with the implementation of the proposal **Condition B1-2** The proponent must: **(**1) implement the Marillana Creek Water Resource Management Plan (MCWRMP; Rev 2), with the purpose of ensuring the riparian vegetation communities and habitat environmental outcomes in condition B1-1 (1) and B1-1 (2) are achieved, monitored, substantiated and satisfy the requirements of conditions C2 and condition C3; and (2) implement the Marillana Creek Diversion Management Plan (MCDMP; Rev 0), with the purpose of ensuring the environmental outcomes in condition B1-1 (3) are achieved, monitored, substantiated.	**Condition B1-1:** The proponent must implement the Marillana Creek Water Resource Management Plan (MCWRMP; Rev 2). **Condition B6**: The proponent must implement monitoring outlined in the MCP (BHP 2025b). Additional management practices are outlined in the MCWRMP (Rev 2)	The biological diversity and ecological integrity of flora and vegetation values within the Development Envelope will be maintained, which is consistent with the EPA's objective for Flora and Vegetation (Section 8.1). The significant residual impact of the loss of 2 ha of riparian vegetation at Flat Rocks to date from the Approved Proposal can be counterbalanced by offsets, so that the environmental outcome is consistent with EPA's objective for Flora and Vegetation.

Residual impact	Environmental outcome	Proposed regulation (Condition[1] or other statutory decision-making process)[1]	Proposed Monitoring	Consistency with EPA objective
Clearing of 0.2% of one Beard vegetation association (82)	The representation of both Beard vegetation associations in the Pilbara bioregion will be maintained (Section 8.6.1.1)	**Condition A1:** Limit on extent of proposal element • Up to 4,653 ha of native vegetation clearing within the Development Envelope	Standard management practices: • internal land disturbance approval process to manage ground disturbance • annual land disturbance reporting against approved limits/extents • Marillana Creek Water Resources Management Plan (Condition B1)	The representation of regional vegetation and locally significant vegetation will not be significantly impacted, and the local and regional extent of significant flora will be maintained which is consistent with EPA's objective
Clearing of no more than 1.3%[3] of known populations of *Rostellularia adscendens* var. *latifolia* (Priority 3)	No impacts to Threatened flora The viability of the Priority flora known from the Development Envelope will be maintained in the Pilbara bioregion (Section 8.6.1.2)			

[1] See Appendix 3 for proposed implementation conditions for the Combined Proposal

[2] 4,558 ha approved for disturbance under Ministerial Statement 679 Attachment 6, minus the 4,050 ha of clearing approved for disturbance under Ministerial Statement 679 Attachment 5, to which offsets do not apply. Ministerial Statement 679 has a total clearing limit and does not specify limits for vegetation condition.

[3] This number is for the Proposal only as a quantitative analysis of impacts to this species from the Approved Proposal is unfeasible for the Development Envelope (Section 8.4.1.2).

9 Terrestrial Fauna

9.1 EPA environmental factor and objective

The EPA's objective for the Terrestrial Fauna factor is:

> *To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.*

9.2 Relevant policy and guidance

BHP assessed this environmental factor considering the following relevant EPA (and other State and/or Commonwealth) policies and guidance, as outlined in Table 9-1.

Table 9-1: Terrestrial Fauna - policy and guidance

EPA (and other State and Commonwealth) policy and guidance	Consideration of EPA policy and guidance
EPA policy and guidance	
Statement of environmental principles, factors, objectives and aims of EIA (EPA 2023a)	• Identified the relevant environmental factor and objectives to guide the EIA process • Followed the aims of the EIA process • Considered cumulative effects when assessing potential impacts on terrestrial fauna. • Applied the mitigation hierarchy for terrestrial fauna.
Environmental Factor Guideline - Terrestrial Fauna (EPA 2016c)	• Identified the EPA's objective for Terrestrial Fauna • Applied the relevant considerations for environmental impact assessment • Identified the values of terrestrial fauna, and their significance • Identified activities that can impact on terrestrial fauna • Considered the links with other environmental factors.
Technical Guidance - Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA 2020a) *Technical Guidance - Sampling of short range endemic invertebrate fauna* (EPA 2016d)	• Surveys described in Section 9.3.1 were undertaken in accordance with these guidance documents • Considered in the design (methods and approach) of the fauna surveys or previous guidance (if survey undertaken before current guidelines).
Other policy and guidance	
WA Environmental Offsets Policy (Government of Western Australia 2011)	• Applied avoidance and mitigation measures to the Proposal • Considered cumulative impacts in a regional context for determining significant residual impact • Quantified the significant residual impact.
WA Environmental Offsets Guidelines (Government of Western Australia 2014)	

9.3 Receiving environment

9.3.1 Studies and surveys

At least 27 vertebrate fauna surveys and seven short-range endemic (SRE) invertebrate surveys have been undertaken wholly or partially within the Development Envelope. Seven surveys have been undertaken within the last five years including four vertebrate fauna surveys and three SRE invertebrate fauna surveys. A summary of historical surveys is provided in Appendix 11, with recent surveys described in Table 9-2 (note this includes habitat mapping originally undertaken in 2014 [and updated in 2018] which is still considered relevant to the Proposal). The surveys include basic surveys, detailed surveys, targeted surveys, and desktop assessments. Collectively, these surveys cover the entire Development Envelope including the Indicative Footprint (Appendix 11; Figure 9-1 and Figure 9-2) and have been used to support the assessment of terrestrial fauna for this Proposal.

Sampling effort for vertebrate fauna has been extensive with 124 sample sites within the Development Envelope, including nine vertebrate fauna sampling sites within the Indicative Footprint (Figure 9-1). In addition, there are over 820 vertebrate fauna sampling sites within 10 km of the Development Envelope (Figure 9-1). Targeted fauna surveys have included extensive sampling effort for significant fauna species including *Liasis olivaceus barroni* (Pilbara Olive Python), *Dasyurus hallucatus* (Northern Quoll), *Macroderma gigas* (Ghost Bat), *Rhinonicteris aurantius* [Pilbara form] (Pilbara Leaf-nosed Bat), *Pezoporus occidentalis* (Night Parrot), *Falco hypoleucos* (Grey Falcon) and *Macrotis lagotis* (Greater Bilby) (Astron 2023a; Appendix 12). Sampling methods for vertebrate fauna have included habitat assessments, motion sensitive cameras, acoustic bat surveys using Song Meter (SM) 4, passive acoustic surveys and Autonomous Recording Units (ARU), targeted bilby plot searches and targeted searches for other significant species (Astron 2023a; Appendix 12). Historical surveys included additional sampling methods such as Elliot traps, funnel traps, cage traps, and bat surveys using ANABAT acoustic recorders (Biologic 2011; Appendix 11).

Sampling effort for SRE invertebrate fauna includes 194 SRE sample sites within the Development Envelope including five sample sites within the Indicative Footprint (Figure 9-2; Bennelongia 2024a; Biologic 2013, 2015). A further 500 SRE sites have also been sampled in regional locations (within 10 km; Figure 9-2). Sampling methods for SREs included hand foraging, litter collection and dry pitfall trapping (Bennelongia 2024a; Biologic 2021; Appendix 11).

In addition, at least nine aquatic ecosystem surveys have been undertaken either within the Development Envelope, or in regional areas that may be subject to groundwater drawdown or surface water impacts from the Combined Proposal (i.e. Yandicoogina Gorge, Upper Marillana Creek and Flat Rocks; Table 9-2; Figure 9-3; Appendix 11). Sampling effort for aquatic fauna has included eight sample sites at Yandicoogina Gorge and 12 sample sites along Marillana Creek including the Marillana Creek Pools (Figure 9-3). Monitoring at the Marillana Creek Pools and Yandicoogina Gorge is undertaken on an on-going basis, with surveys undertaken during the dry and wet seasons every year since 2015 (Table 9-2; Appendix 12).

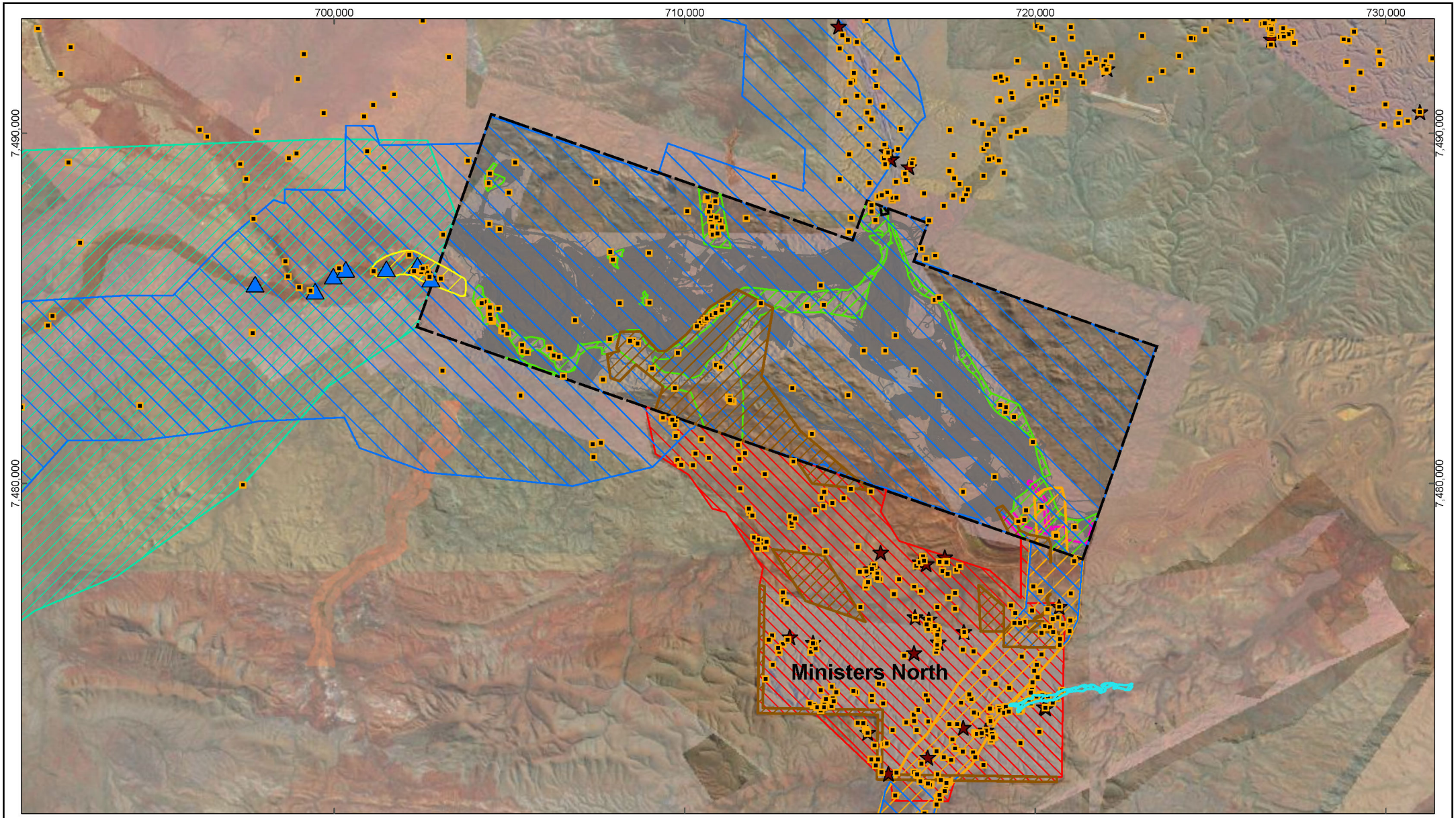
All surveys have been completed in accordance with the EPA requirements relevant at the time of surveying. Terrestrial fauna surveys undertaken post-2009 have also been completed in accordance with BHP's *Guidance for Terrestrial Vertebrate Fauna Surveys in the Pilbara* (BHP 2023d) or the *Short-range Endemic Invertebrate Fauna Assessment Methods Procedure* (BHP 2022c). These procedures were developed to ensure a consistent approach for all terrestrial fauna surveys undertaken for BHP. BHP has provided the associated survey reports in Appendix 12 and the survey data as part of the IBSA data package (see Appendix 9).

Table 9-2: Terrestrial Fauna – recent studies and surveys

Title	Survey Date	Summary	Appendix
Vertebrate fauna surveys			
Ministers North Consolidated Targeted Significant Vertebrate Fauna Surveys (Astron 2024b)	13-22 April 2023 7-18 June 2024	This study involved a targeted significant vertebrate fauna survey, focussing on Matters of National Environmental Significance (MNES) within parts of the Development Envelope. The study included a desktop assessment, targeted vertebrate fauna surveys and mapping of fauna habitats. Covered a combined area of 6,519.6 ha.	Appendix 12
Yandi 45C Targeted Significant Vertebrate Fauna Survey (Astron 2023a)	23 September – 2 October 2022	This study involved a targeted significant vertebrate fauna survey, focussing on MNES within parts of the Development Envelope. The study included a desktop assessment, targeted vertebrate fauna survey and mapping of fauna habitats. The survey covered a total area of 1,596 ha within the Development Envelope.	Appendix 12
Central Pilbara Hub Targeted Matters of National Environmental Significance Vertebrate Fauna Survey (Biologic 2023b)	11-15 November 2021 23-28 November 2021 4-13 April 2022 27 April - 6 May 2022 25 - 30 May 2022	A desktop assessment and single season targeted vertebrate fauna survey of the Central Pilbara Hub. This survey covered a portion of the Development Envelope in the south-eastern corner. The overarching objective of this assessment was to determine the presence, or likely presence, of significant species within the Study Area, with a specific focus on MNES. The survey covered an approximate area of 60,000 ha, including 144 ha of the Development Envelope.	Appendix 12
Ministers North Level 1 Fauna Survey (GHD 2021)	9-20 September 2019	A Level 1 vertebrate fauna survey undertaken for the Ministers North Project to the south of the Development Envelope. The purpose of the survey was to identify ecological values, further add to the biodiversity knowledge within the areas surveyed and support future approvals documentation. The study included habitat mapping, opportunistic species list, and bird and bat acoustic data. The survey covered a total area of 2,507.7 ha, including 1,406 ha of the Development Envelope.	Appendix 12
Consolidated Fauna Habitat Mapping (Biologic 2014 and 2018a)	2014 and updated in 2018	This study combined all available and relevant fauna habitat mapping into one consolidated regional dataset that provides consistency in naming across BHP tenure. Analysis of aerial photography, previous fauna habitat mapping, vegetation mapping available at the time (Onshore 2014a) and information gathered during site visits, was conducted to create the consolidated fauna habitat dataset. The dataset was updated in 2017 where errors were corrected, and additional areas of mapping incorporated. The survey covers the entire Development Envelope.	Not attached

Title	Survey Date	Summary	Appendix
Short-Range Endemic (SRE) Invertebrate Fauna			
Yandi Operations Short-Range Endemic Fauna Survey Report (Bennelongia 2024a)	August 2023	A two-season SRE invertebrate field survey as well as a desktop assessment to identify possible SRE taxa and habitats within the Development Envelope. The survey covered a total area of 1,596 ha within the Development Envelope.	Appendix 12
Ministers North Short-Range Endemic (SRE) Desktop and Field Survey (Bennelongia 2024d)	April 2023	A single season field survey targeting invertebrates belonging to SRE Groups within the Ministers North licence area. Does not intersect the Development Envelope, but has been included as it occurs directly adjacent to the south of the Development Envelope and provides contextual information of relevance.	Appendix 12
Ministers North and Yandicoogina Creek Short-Range Endemic Invertebrate Fauna Survey (Biologic 2021)	9-13 Sept 2019 3-10 April 2020	A single season targeted SRE invertebrate fauna survey covering the Ministers North licence area and a two season Level 2 SRE invertebrate fauna survey within a GDE in Yandicoogina Creek. The survey covered approximately 1,406 ha of the Development Envelope.	Appendix 12
Aquatic ecosystem surveys			
Ministers North Yandicoogina Creek Aquatic Ecosystem Survey Dry 2022 and Wet 2023 (Biologic 2024c)	September 2022 (dry season) March 2023 (wet season)	The fourth round of sampling for the two-season aquatic ecosystem survey along Yandicoogina Creek. Ecosystem sampling methods included habitat assessments and sampling of water quality, wetland flora (submerged and emergent macrophytes), zooplankton, hyporheos, macroinvertebrates and fish.	Appendix 12
MAC Phase 4: Aquatic monitoring Dry 2022 and Wet 2023 (Biologic 2024b)	September 2022 (dry season) March - April 2023 (wet season)	The third aquatic ecosystem survey of the two season, baseline aquatic fauna survey of the semi-permanent pools of Upper Marillana Creek. The surveys included habitat assessments and sampling of water quality, wetland flora and dominant riparian vegetation, and aquatic fauna.	Appendix 12

Title	Survey Date	Summary	Appendix
MAC Phase 4: Marillana Creek Baseline Aquatic Ecosystem Survey Dry 2021 & Wet 2022 (Biologic 2023e)	October 2021 (dry season) April 2022 (wet season)	The second round of the two season, baseline aquatic fauna survey of the semi-permanent pools of Upper Marillana Creek. The surveys included habitat assessments and sampling of water quality, wetland flora and dominant riparian vegetation, and aquatic fauna.	Appendix 12
MAC Phase 4: Marillana Creek Baseline Aquatic Ecosystem Survey Dry 2020 & Wet 2021 (Biologic 2022a)	September 2020 (dry season) April 2021 (wet season)	The first round of a two season, baseline aquatic ecosystem survey undertaken within Upper Marillana Creek, focussing on the semi-permanent pools to the west of the area known as Flat Rocks. The surveys included habitat assessments and sampling of water quality, wetland flora and dominant riparian vegetation, and aquatic fauna.	Appendix 12
Ministers North Aquatic Ecosystem Survey: Dry 2021 – Wet 2022 (Biologic 2023d)	October 2021 (dry season) April 2022 (wet season)	The third round of sampling for the two-season aquatic ecosystem survey along Yandicoogina Creek. Ecosystem sampling methods included habitat assessments and sampling of water quality, wetland flora (submerged and emergent macrophytes), zooplankton, hyporheos, macroinvertebrates and fish.	Appendix 12
Ministers North: Yandicoogina Creek Aquatic Ecosystem Surveys Dry 2020 and Wet 2021 (Biologic 2022b)	October 2020 (dry season) April 2021 (wet season)	The third round of sampling for the two-season aquatic ecosystem survey of the pools at Yandicoogina Creek. Sampling methods included habitat assessments and sampling of water quality, wetland flora (submerged and emergent macrophytes), zooplankton, hyporheos, macroinvertebrates and fish.	Still being finalised. Will be provided at a later date.
Ministers North: Yandicoogina Creek Aquatic Ecosystem Surveys (Biologic 2020b)	October 2019 (dry season) April 2020 (wet season)	The first round of sampling for a two-season (baseline) aquatic ecosystem survey of the perennial and semi-permanent pools located along a 3 km stretch of Yandicoogina Creek. Ecosystem sampling methods included habitat assessments and sampling of water quality, wetland flora (submerged and emergent macrophytes), zooplankton, hyporheos, macroinvertebrates and fish.	Still being finalised. Will be provided at a later date.



- Development Envelope
- Indicative Footprint
- Existing Disturbance
- Vertebrate Fauna Sample Sites
- Targeted Bat Cave Site
- Marillana Creek Pools
- Yandicoogina Gorge
- Indicative location of Flat Rocks
- Consolidated Fauna Habitat Mapping 2017 (Biologic 2014 and 2018)
- Ministers North Fauna Survey Level 1 (GHD 2021)
- MAC Phase 4 Marillana Creek Targeted MNES Fauna Survey (Biota 2022)
- Yandi 45C Targeted Significant Vertebrate Fauna Survey (Astron 2023a)
- Central Pilbara Hub Targeted MNES Survey (Biologic 2023b)
- Ministers North Consolidated Targeted Significant Vertebrate Fauna Surveys (Astron 2024b)

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BHP

PUBLIC

MARILLANA CREEK (YANDI)
SIGNIFICANT AMENDMENT
VERTEBRATE FAUNA SURVEYS AND SAMPLING EFFORT

WAIO PLANNING, TECHNICAL & ENVIRONMENT

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DATE: 6/05/2025 REQUESTOR: ENV APPROVALS

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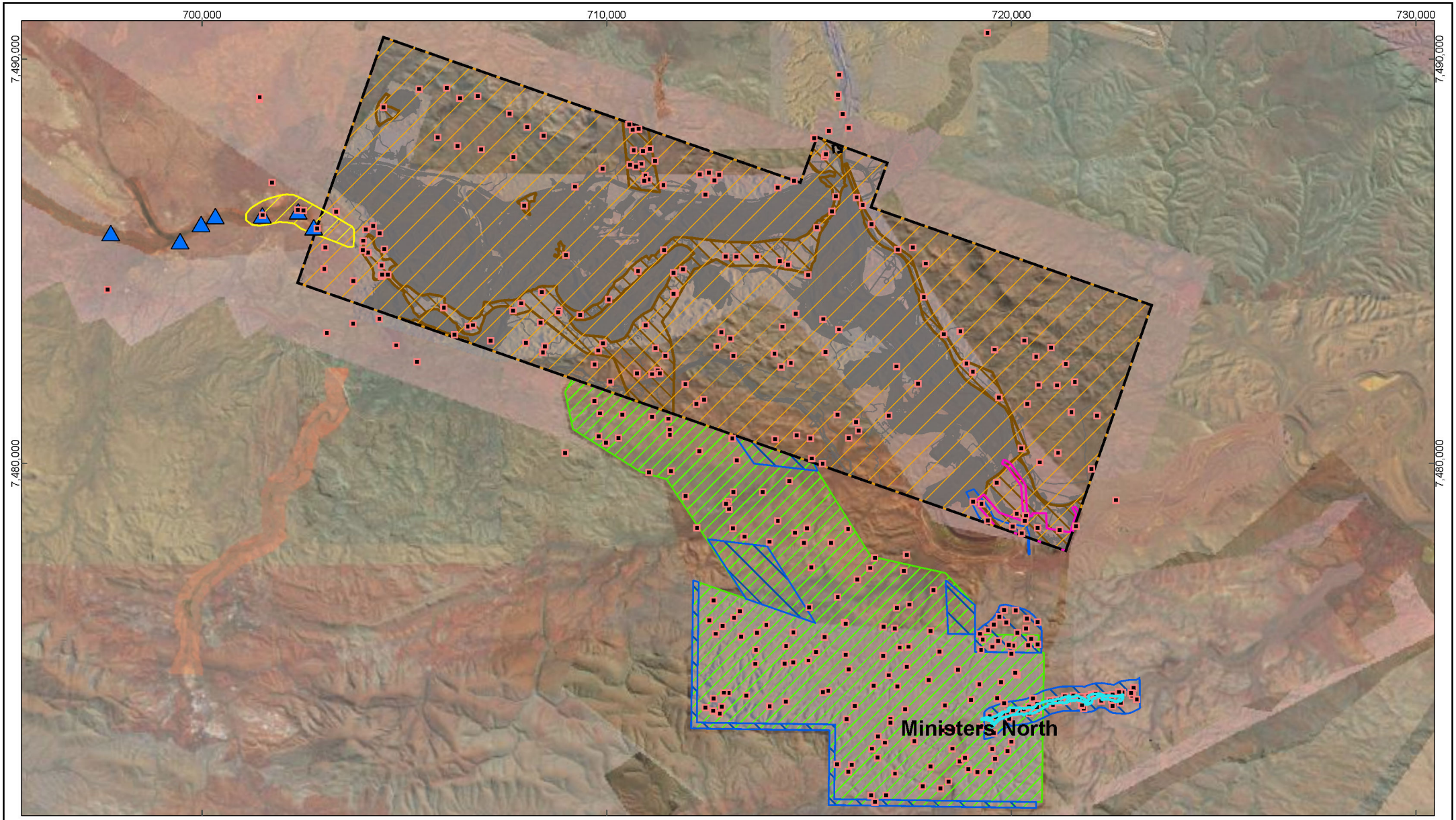

- Development Envelope
- Indicative Footprint
- Existing Disturbance
- Short Range Endemic Fauna Sample Sites
- Marillana Creek Pools
- Yandicoogina Gorge
- Indicative location of Flat Rocks
- Yandi Tenement Short-range Endemic Invertebrate Survey (Biologic 2014)
- Ministers North and Yandicoogina Creek Short Range Endemic Invertebrate Fauna Survey (Biologic 2021)
- Yandi Operations Short-Range Endemic Fauna Survey Report (Bennelongia 2024a)
- Ministers North Short-Range Endemic (SRE) Desktop and Field Survey (2024d)

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BHP

PUBLIC

MARILLANA CREEK (YANDI) SIGNIFICANT AMENDMENT

SRE INVERTEBRATE FAUNA SURVEYS AND SAMPLING EFFORT

WAIO PLANNING, TECHNICAL & ENVIRONMENT

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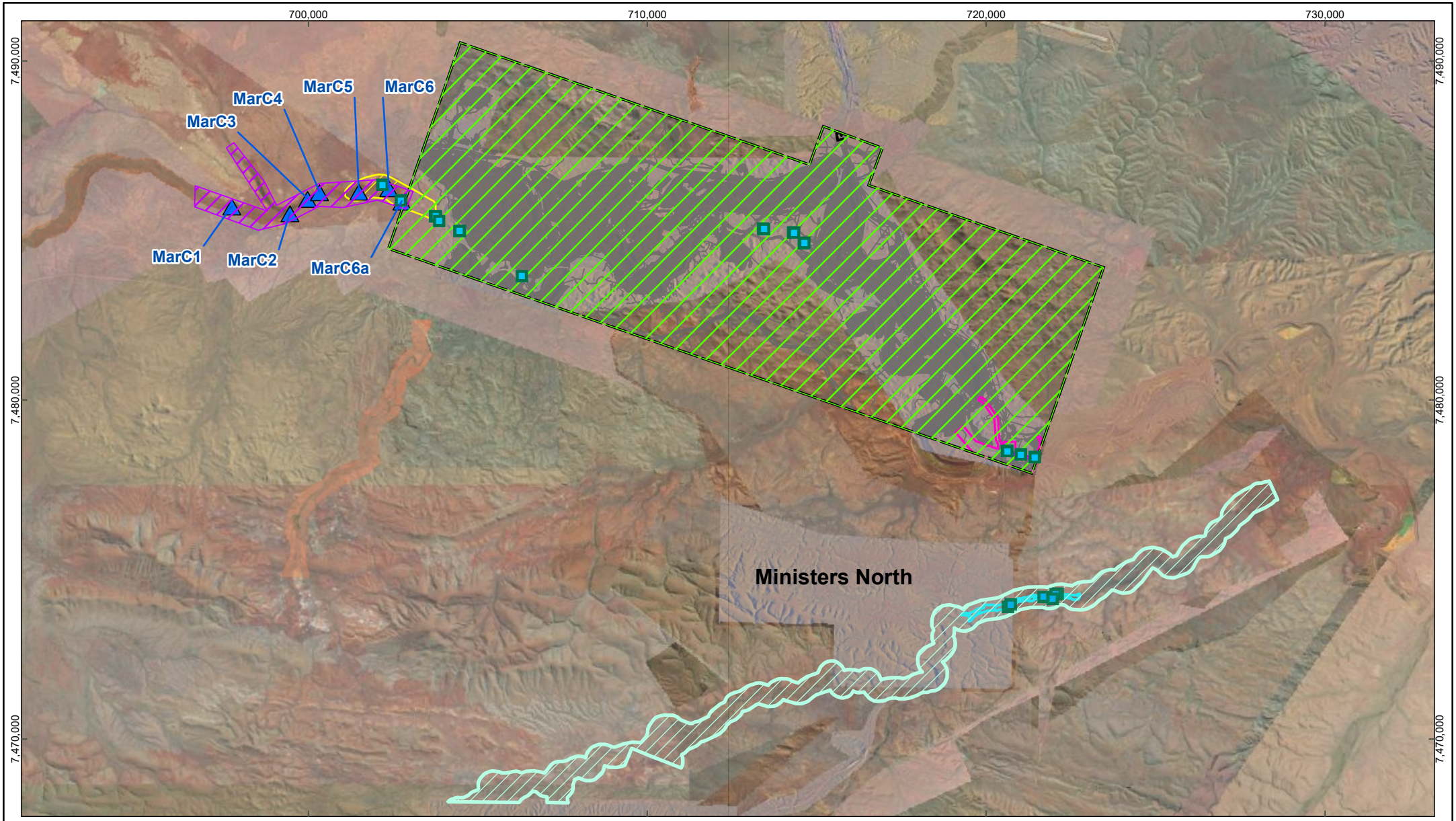

- Development Envelope
- Indicative Footprint
- Existing Disturbance
- Freshwater Aquatic Fauna Sample Sites
- Marillana Creek Pools
- Indicative location of Flat Rocks
- Yandicoogina Gorge
- Yandi: Marillana Creek Aquatic Surveys (WRM 2018, 2015)
- Ministers North Yandicoogina Creek Aquatic Ecosystem Surveys (Biologic 2024c)
- Marillana Creek Aquatic Monitoring Surveys (Biologic 2024b)

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PUBLIC

MARILLANA CREEK (YANDI)
SIGNIFICANT AMENDMENT
AQUATIC FAUNA SURVEYS AND SAMPLING EFFORT

WAIO PLANNING, TECHNICAL & ENVIRONMENT

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9.3.2 Environmental values

9.3.2.1 Fauna habitats

Detailed fauna habitat mapping of the Development Envelope, including the Indicative Footprint, has been completed as part of the numerous surveys undertaken for the area (Table 9-3; Appendix 11). Habitat mapping was reviewed and consolidated across BHP tenements, with habitat descriptions aligned between surveys undertaken across the Pilbara in 2014 (Biologic 2014). Since this time, the consolidated habitat mapping has been revised and updated as new survey data has become available (Biologic 2018b; GHD 2021; and Astron 2023a). Based on recent surveys and the consolidated habitat mapping, a total of 14 fauna habitat types have been described and mapped within the Development Envelope (Astron 2023a; Biologic 2011a, 2014, 2018b; Table 9-3; Figure 9-4). Eight of the 14 mapped habitat types occur within the Indicative Footprint including Wetland, Hillcrest/Hillslope, Major Drainage Line, Medium Drainage Line, Minor Drainage Line, Drainage Area/Floodplain, Stony Plain, and Undulating Low Hills (Astron 2023a; Figure 9-4).

The majority of the mapped fauna habitats are broadly distributed and well represented across the Pilbara bioregion and surrounding regions, and support fauna assemblages which are generally common and widespread. The Wetland, Hardpan Plains, Mulga Woodland and Calcrete Plain habitats all have a limited extent within the Development Envelope. Of these, the Wetland fauna habitat is a relatively uncommon habitat type in the Pilbara region, supporting a distinct ecosystem and fauna assemblage (Astron 2023a). As such, the Wetland habitat has elevated significance, whereas the Hardpan Plains, Mulga Woodland and Calcrete Plain habitats, whilst uncommon in the Development Envelope, are relatively common throughout the Pilbara (Astron 2023a).

Nine of the mapped fauna habitats are considered to be high or moderate value for terrestrial vertebrate fauna as they provide critical and/or supporting habitat for significant fauna species, specifically Wetland, Major Drainage Line, Breakaway/Cliff, Medium Drainage Line, Hardpan Plains, Mulga Woodland, Drainage Area/Floodplain, Stony Plain and Sandy/Stony Plain (Table 9-3). Three of these habitat types may provide critical habitat for Ghost Bat, but only where they occur within 12 km of critical roosting habitat (refer to Section 9.3.2.4) including Drainage Area/Floodplain, Sandy/Stony Plain and Stony Plain (Table 9-3). The remaining habitats are considered moderate to low or low value for vertebrate fauna due to containing low vegetation complexity and/or a lack of microhabitats or features utilised by fauna.

All of the mapped fauna habitat types are prospective for SREs due to containing suitable microhabitats, levels of shade and/or humidity, or suitable soils for burrowing species (Bennelongia 2024a; Table 9-3). Habitat types that retain moisture such as Drainage Lines, Drainage Area/Floodplain, south-facing slopes within Hillcrest/Hillslope habitats, Breakaway/Cliff and Wetland habitats are particularly prospective for SREs requiring high humidity, including millipedes and molluscs, as well as SREs such as pseudoscorpions that live amongst leaf litter and vegetation, whereas habitats such as Stony Plain, Hardpan Plain and Sand Plain may be prospective habitat types for mygalomorph spiders and scorpions (Bennelongia 2024a).

The condition of fauna habitats present within the Development Envelope ranges from Excellent to Completely Degraded. Completely Degraded areas are associated with areas that have been cleared for mining activities and/or are in close proximity to active mining, or tracks and haul roads (Astron 2023a). Other disturbances are due to grazing by cattle (**Bos taurus*) and/or weed invasion, mostly occurring within the Major Drainage Line and Drainage Area/ Floodplain habitats (Astron 2023a).

Table 9-3: Terrestrial Fauna –fauna habitat types

Habitat Type	Description	Extent in Development Envelope	Value to significant fauna*	Value to SRE invertebrate fauna
Wetland	Wetland habitats differ from permanent/semi-permanent pools as they are generally a larger water body that supports their own distinct ecosystem and aquatic fauna assemblages (waterfowl, fish etc.). There are two main areas within the Marillana Creek system that are categorised as wetlands: • Flat Rocks: a section of the creek on the western side of the Development Envelope which widens and holds permanent water and is surrounded by rocky habitat. • The dewatering discharge outlet: located on the eastern side of the Development Envelope within Marillana Creek where excess water discharging into this section of the creek has created a permanent artificial pool (WYAN-10) running for over one kilometre downstream.	Limited	Provides **critical foraging** habitat for Pilbara Olive Python and **supporting habitat** for Northern Quoll critical foraging habitat for Ghost Bat (when within 12 km of critical roosting habitat). Provides supporting habitat for the Pilbara Leaf-nosed Bat. Also provides suitable habitat for some Migratory listed bird species.	Wetland habitats are similar to drainage lines in terms of suitability for SREs. The major difference is that wetland habitats tend to be isolated within the broader landscape; accordingly, moisture dependent SREs may not have distribution corridors away from wetlands. Acacia provides bark and leaf litter at this site, and rocks provide sheltered microhabitats for invertebrates. Isopods, molluscs, centipedes, and pseudoscorpions were collected from the wetland habitat during the survey.
Major Drainage Line	This fauna habitat type consists of large drainage channels over 10 m in width, typically lined with mature Eucalyptus/Corymbia and Melaleuca species. It exhibits a moderate diversity of microhabitats, with some tree hollows and woody debris (logs and leaf litter). Within the Development Envelope, buffel grass (**Cenchrus ciliaris*) was present in the ground storey vegetation, reducing floral diversity. Major Drainage Lines support permanent or semi-permanent water bodies in multiple sections of the Development Envelope. A permanent water body exists at the discharge point and a large potentially permanent water body persists at Flat Rocks.	Widespread	Provides **critical** breeding, foraging and dispersal habitat for the Grey Falcon, critical foraging and dispersal habitat for Pilbara Olive Python, and critical foraging habitat for Ghost Bat (when within 12 km of critical roosting habitat). Provides **supporting habitat** for Northern Quoll, Ghost Bat (if outside the 12 km radius) and Pilbara Leaf-nosed Bat.	Contains vegetation providing microhabitats under bark and/or in leaf litter for invertebrates. Sandy soils further away from the watercourse at the survey sites provide suitable habitat for burrowing invertebrates such as mygalomorph spiders. Residual seasonal moisture from drainage lines provides elevated humidity suitable for gastropods, isopods, and millipedes. Gastropods, isopods, millipedes, centipedes, pseudoscorpions, and mygalomorphs were all collected from drainage lines during the survey.

Habitat Type	Description	Extent in Development Envelope	Value to significant fauna*	Value to SRE invertebrate fauna
Breakaway/Cliff	Breakaway/Cliff habitat is characterised by large rocky outcrops that were not cave forming with little vegetation and limited soft soil, leaf litter and dense vegetation. Contains large rock fragments and more rock outcropping than other fauna habitats; however, is generally unsuitable for many fauna species due to the lack of soft soil, leaf litter and/or dense vegetation.	Widespread	May provide **critical** foraging and dispersal habitat for the Ghost Bat where it occurs within 12 km of critical roosting habitat, and Pilbara Olive Python where it occurs in proximity to a water source. Otherwise, provides **supporting habitat** for Northern Quoll, Ghost Bat, Pilbara Olive Python, Pilbara Leaf-nosed Bat. Given this habitat type was generally not cave or shelter forming it is not considered critical roosting or breeding habitat for significant species.	Described as Gorge/Gully in the recent survey report (Bennelongia 2024a) – this habitat type is often rocky, with higher humidity at the base of declivities which hosts various plant species and humidity-dependent SRE Groups such as millipedes and isopods. Often contains vegetation providing bark and leaf litter microhabitats. Mygalomorphs, isopods, centipedes, millipedes, and occasional pseudoscorpions were collected from this habitat type during the survey. Gorges and gullies tend to be isolated habitat types.
Medium Drainage Line	Typically consists of small drainage channels with eucalypt woodlands growing in the riparian zone. A moderate diversity of microhabitats occurs with some seasonal presence of pools, tree hollows and woody debris (logs and leaf litter). Buffel grass is often present in the ground story vegetation, reducing floral diversity.	Widespread	Provides **critical foraging habitat** for Ghost Bat where it occurs within 12 km of critical roosting habitat. Otherwise, provides **supporting habitat** for Northern Quoll, Pilbara Olive Python, Ghost bat and Pilbara Leaf-nosed Bat.	As for Major Drainage Line

Habitat Type	Description	Extent in Development Envelope	Value to significant fauna*	Value to SRE invertebrate fauna
Hardpan Plains	Hardpan Plains consists of mainly alluvial, silty to sandy clay loam floodplains associated with drainage lines and comprise clay-based soils, both cracking and non-cracking in low lying areas that have slight to no gradient. This habitat exhibits a moderate diversity of microhabitats, with some tree hollows and logs and deep sandy soils suitable for burrowing.	Limited	Provides **critical foraging habitat** for Ghost Bat where it occurs within 12 km of critical roosting habitat. Otherwise, provides **supporting habitat** for Northern Quoll, Ghost bat and Grey Falcon.	Leaf litter from Acacia and Eucalyptus provided suitable microhabitat for invertebrates at this site. Hardpan plains are highly prospective for mygalomorphs in the genus Conothele, which often prefer to burrow in claypan. Centipedes, including the SRE-rich families Geophilidae and Cryptopidae, are also often more abundant in this habitat type. Centipedes, millipedes, mygalomorphs, molluscs, and pseudoscorpions were collected from hardpan during the survey.
Mulga Woodland	Mulga Woodland habitat comprises stands of mulga (*Acacia aneura*) over clay or stony substrates. Differs from other plains by having a monoculture of mulga compared to a diversity of other Acacia species.	Limited	May provide important habitat for a range of fauna species in general. May provide **critical foraging habitat** for Ghost Bat where it occurs within <12 km of critical roosting habitat.	Leaf litter from Acacia provides suitable microhabitat for invertebrates at this site. May be prospective for species which prefer to burrow in claypan such as Conothele.
Drainage Area/Floodplain	Lower lying plain, often subjected to sheet flow following large rainfall events. Vegetation and substrates within this habitat are variable, often comprising scattered Eucalyptus over *Acacia* and/or *Grevillea* shrubs with an understory dominated by *Triodia* hummock grasses and/or mixed tussock grasses on alluvial substrates, often comprising heavy clays and gravel. This habitat type is represented well both in and out of the Development Envelope.	Widespread	Provides microhabitats for many fauna species including reptiles and mammals. Provides **critical foraging habitat** for Ghost Bat where it occurs within 12 km of critical roosting habitat. Otherwise, provides supporting habitat for Northern Quoll, Ghost Bat, Pilbara Leaf-nosed Bat and Grey Falcon.	As for Major Drainage Line

Habitat Type	Description	Extent in Development Envelope	Value to significant fauna*	Value to SRE invertebrate fauna
Sandy/Stony Plain	This habitat is characterised by large hummock *Triodia* grasses or stands of Acacia or other shrubs over clay or stony substrates. Common throughout the Pilbara region and provides habitat for a wide spectrum of fauna species. Contains logs, tree hollows, thick undergrowth, leaf litter, soft soil (burrows), and old *Triodia*.	Widespread	Provides suitable burrowing and foraging habitat for a number of fauna species. Provides **critical foraging habitat** for Ghost Bat where it occurs within 12 km of critical roosting habitat. Otherwise, provides **supporting habitat** for Northern Quoll, Ghost bat and Grey Falcon.	Provides burrowing habitat for SREs requiring firmer soils as well as areas containing loose soil more suitable for species such as *Urodacus* scorpions and anamid mygalomorphs lacking a rastellum. Some areas contain rocks and vegetation which provides suitable microhabitat for *Lychas* scorpions, centipedes, millipedes, and pseudoscorpions, and areas with vegetation may also retain enough humidity to support isopods.
Stony Plain	Stony Plain habitat comprises flat to low undulating areas and low hills with vegetation dominated by *Triodia* hummock grasses of various life stages with scattered eucalypts and patches of various small to medium shrub species on gravelly clay loam substrates. In some low-lying areas, isolated patches of sandy substrate occur.	Widespread	Provides **critical foraging habitat** for Ghost Bat where it occurs within 12 km of critical roosting habitat. May also provide **supporting habitat** for some significant species that may utilise it for occasional foraging and/or dispersal purposes such as the Pilbara Leaf-nosed Bat, Northern Quoll, and Grey Falcon. Also provides suitable habitat for Western Pebble-mound Mouse.	Stony plains typically provide habitat for burrowing SREs requiring firmer soils (e.g. most mygalomorph spiders) but not for burrowing SREs requiring looser soils (e.g. some *Urodacus* scorpions). The presence of rocks and vegetation throughout stony plains provides suitable microhabitat for *Lychas* scorpions, centipedes, millipedes, and pseudoscorpions, which may occur beneath rocks, under bark, and/or in leaf litter; rocks and vegetation may also retain enough humidity to support isopods.

Habitat Type	Description	Extent in Development Envelope	Value to significant fauna*	Value to SRE invertebrate fauna
Hillcrest/Hillslope	This habitat comprises rocky outcrops, ridges and stony plains on the tops of ranges, supporting *Triodia* hummock grassland with scattered *Eucalyptus* and *Acacia*. Such areas are not highly complex and generally have skeletal soils and sparse open vegetation that can provide pockets of protection from exposure.	Widespread	Provides **critical habitat** for the Ghost Bat where it occurs within 12 km of critical roosting habitat. Provides supporting foraging and dispersal habitat for Northern Quoll and Pilbara Leaf-nosed Bat. Provides suitable habitat for the Western Pebble-mound Mouse.	South-facing slopes within this habitat type are highly prospective for SREs as they have higher humidity than other aspects and are at least partially sheltered from sunlight. Millipedes, anamid mygalomorphs, and *Lychas* scorpions are all likely to occur in south-facing slopes in the Pilbara. Hillslopes hosting Acacia species often provide bark and leaf litter for pseudoscorpions as well. Mygalomorphs, pseudoscorpions, isopods, centipedes, millipedes, and molluscs were collected from south-facing slopes during the survey.
Undulating Low Hills	Undulating low hills, footslope, hillslope, hillcrest/upper hillslope, ironstone outcrops, with Scattered eucalypts over open *Acacia* shrubland over *Triodia* hummock grassland over gravelly silty or sandy clay loam. This habitat is widespread and common throughout the Pilbara region and exhibits low vegetation complexity and low diversity of microhabitats.	Widespread	May provide supporting habitat for the Grey Falcon but is otherwise low value as it has low vegetation complexity and low diversity of microhabitats.	Undulating Low Hills provide different microhabitats for a variety of SREs including burrowing species or those found beneath rocks, under bark, and/or in leaf litter; rocks and vegetation may also retain enough humidity to support isopods.
Minor Drainage line	Located within the minor gullies and depressions, generally through the Hillcrest/Hillslope habitat. Consists primarily of Acacia low shrubland. The understory generally lacks density and often consists solely of sparse tussock grassland, often including the weed Buffel Grass where it has been introduced. The substrate can be sandy in places but generally consists of a skeletal loam gravel or stone.	Widespread	Does not provide critical or supporting habitat for any significant species. Due to the general lack of tall, hollow-bearing trees, most Minor Drainage Lines are not commonly used for nesting. Some species may utilise this habitat transiently, as corridors during dispersal. However, this habitat generally has low vegetation complexity and microhabitat diversity and is considered of low value for fauna.	As for Major Drainage Line

Habitat Type	Description	Extent in Development Envelope	Value to significant fauna*	Value to SRE invertebrate fauna
Calcrete Areas	This habitat type is mostly low in the landscape. The vegetation occurring on calcrete differs from that of the surroundings, largely due to the differences in soil type. The substrate is white and consists of skeletal soil, gravel and small jagged pebbles. Trees are isolated and the shrub layer tends to be sparse, with a low hummock grassland (*Triodia* sp.) dominant.	Limited	Does not provide critical or supporting habitat for any significant species. Overall value to fauna is low; however, the Western Pebble-mound Mouse is known to build mounds in this habitat type.	Scattered *Corymbia* trees and Acacia shrubs may provide leaf litter and shade for some SREs, but is generally devoid of other microhabitats.
Sand Plain	Sand Plain habitat is characterized by relatively deep sandy soils supporting dense spinifex grasslands and sparse shrubs. This habitat often occurs as terraces along Major Drainage Lines.	Limited	Does not provide critical or supporting habitat for any significant species. May provide suitable burrowing habitat for a number of fauna species, but does not support any significant species that occur within the Development Envelope.	Sand plains with loose soil are suitable for *Urodacus* scorpions and anamid mygalomorphs lacking a rastellum. Mygalomorph spiders, centipedes, millipedes, pseudoscorpions, and isopods were collected from this habitat type during the survey, demonstrating that this habitat provides suitable habitat for SREs, despite l limited vegetation.

Sources: Astron 2023a; Biologic 2014, 2018b and 2023b; Bennelongia 2024a

* Value to significant vertebrate fauna relates to those species that have been recorded or which are considered to have a high or moderate likelihood of occurrence within the Development Envelope and is discussed further for each fauna species in Section 9.3.2.4.

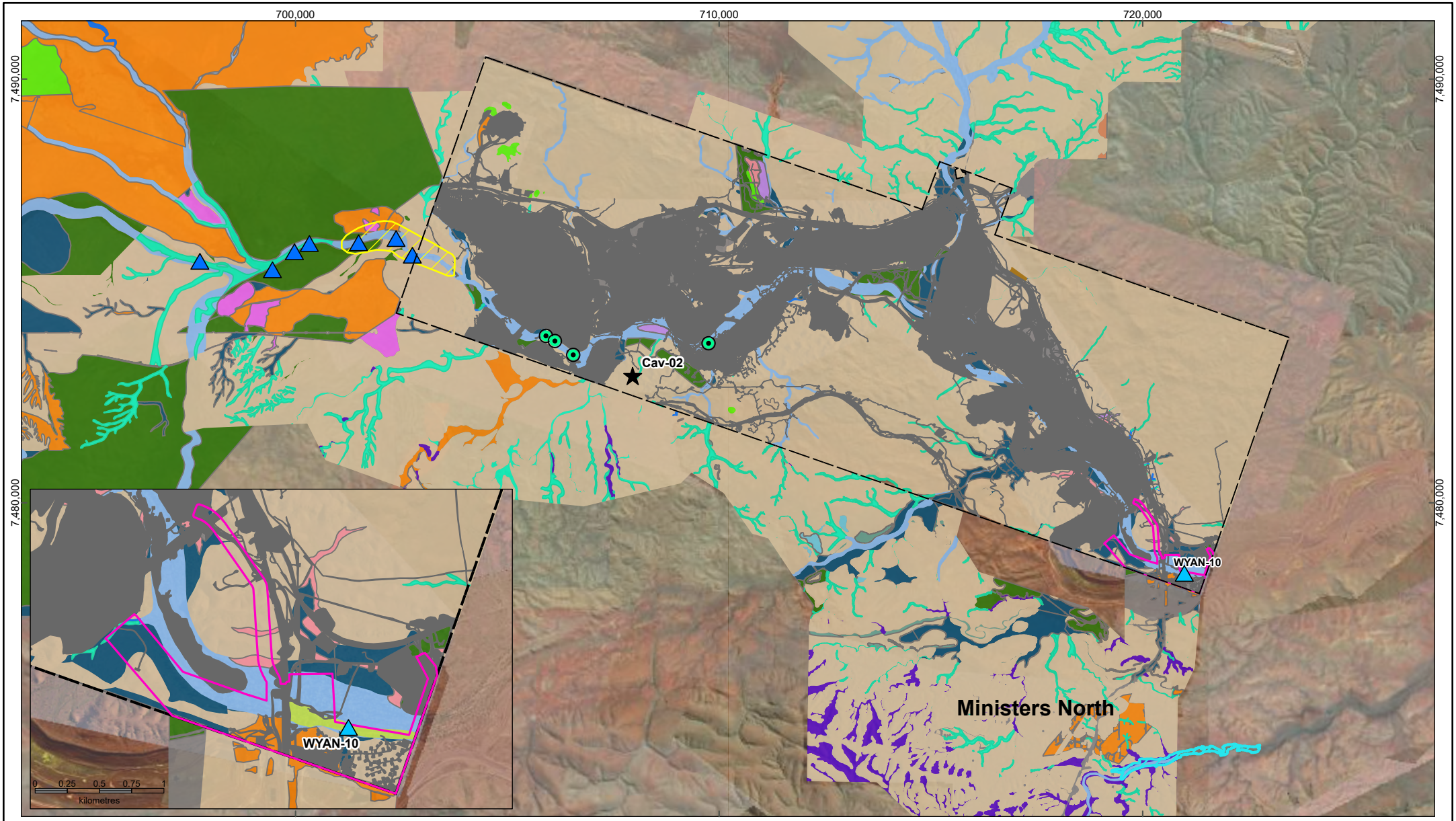
Surface water features

Three surface water pools were mapped within the Development Envelope during the recent fauna survey including two ephemeral pools and one artificial pool (Astron 2023a). The observed number of distinct pools within the Development Envelope has varied in reporting over biodiversity and water monitoring surveys due to seasonal and temporal fluctuations of the hydrology of the pools. In times of high flow in Marillana Creek all pools are connected by the waterway, as flows decline some depressions will retain water permanently or semi-permanently (refer to Section 7.3.2.2).

There are no natural pools present in the stretch of Marillana Creek to the north side of the Indicative Footprint or downstream of the Development Envelope. An artificial pool (WYAN-10) is located within the Indicative Footprint, as a result of continuous surplus water discharge from that location (Figure 9-4).

Cave features

One Category 4 cave has been recorded within the Development Envelope (Cav-02; Figure 9-4). This cave has been identified as a potential nocturnal roost for Ghost Bat; however, it is unknown if it is currently being used by the species as access during recent surveys was limited (GHD 2021). The cave occurs within Breakaway/Cliff habitat (Figure 9-4). Whilst this habitat type comprises rugged, incised rocky hills and ranges that have the capacity to form caves, no other caves have been recorded in this habitat type within the Development Envelope (Astron 2023a).



Development Envelope
Indicative Footprint
Existing Disturbance
Artificial discharge point
Marillana Creek Pools
Ghost Bat Cave
Indicative location of Flat Rocks
Yandicoogina Gorge

Habitat Feature
Surface Water Pool

Habitat Type
Basalt Outcrops
Breakaway/ Cliff
Boulders/ Rockpiles
Calcrete Plain
Cleared/ Disturbed
Drainage Area/ Floodplain
Gorge/ Gully
Hardpan Plain
Hillcrest/ Hillslope
Major Drainage Line
Medium Drainage Line
Minor Drainage Line
Mulga Woodland
Sand Plain
Sandy/Stony Plain
Stony Plain
Wetland
Undulating Low Hills

N
0 1 2 3 4
kilometres
GDA 1994 MGA ZONE 50

BHP

PUBLIC

MARILLANA CREEK (YANDI)
SIGNIFICANT AMENDMENT
FAUNA HABITAT TYPES
AND HABITAT FEATURES

WAIO PLANNING,TECHNICAL & ENVIRONMENT

SCALE @ A4:	1:120,000	PREPARED:	GEOMATICS	FIGURE:	9-4
DATE:	23/04/2025	REQUESTOR:	ENV APPROVALS		

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9.3.2.2 Regional fauna values

As described in Section 7.3.3, three areas of environmental significance occur in proximity to the Development Envelope: Flat Rocks and the Marillana Creek Pools, and Yandicoogina Gorge. These areas contain significant values for terrestrial and aquatic fauna and are summarised below.

Flat Rocks and the Marillana Creek Pools

Flat Rocks is an area within Marillana Creek that occurs in the western section of the Development Envelope and extends approximately 4 km outside of the Development Envelope to the west (Figure 9-4). Flat Rocks comprises areas of exposed bedrock, areas of riparian vegetation and GDV, and permanent, ephemeral and semi-permanent pools. This includes the Marillana Creek Pools which are a series of connected or disconnected refuge pools located along Upper Marillana Creek, located directly adjacent to and extending up to 5 km from the Development Envelope (Figure 9-3 and Figure 9-4; Section 7.3.2.2). These features are uncommon in the region and likely support an array of terrestrial and aquatic fauna including significant fauna (Biota 2013, 2022). Fauna habitats mapped within Flat Rocks and the Marillana Creek Pools area includes Wetlands and Major Drainage Line habitats, surrounded by Stony Plains, Undulating Low Hills and Hillcrest/Hillslope habitats (Figure 9-4; Biologic 2014 and 2018; Biota 2022). Wetland and Major Drainage Line habitats provide critical and supporting habitat for a number of significant fauna including Pilbara Olive Python, Northern Quoll, Pilbara Leaf-nosed Bat, Ghost Bat and Grey Falcon. The Pilbara Olive Python has been recently recorded within a pool within the Flat Rocks area, approximately 1.5 km west of the Development Envelope boundary (Biota 2022; Figure 9-5).

Yandicoogina Gorge

As described in Section 7.3.3.2, Yandicoogina Gorge, associated with Yandicoogina Creek, is located approximately 4 km south of the Development Envelope (Figure 9-4). Yandicoogina Gorge supports a GDE as well as a number of permanent and semi-permanent pools which provide high value habitat for terrestrial fauna in general as well as critical and/or supporting habitat for significant fauna species such as the Pilbara Olive Python, Northern Quoll, Pilbara Leaf-nosed Bat, Ghost Bat and Grey Falcon (Astron 2023b, 2024b) Recent surveys have mapped at least two fauna habitat types within the south western section of Yandicoogina Gorge, which are likely to extend east wards throughout the gorge: Major Drainage Line and Gorge/Gully (Biologic 2017).

Evidence of the Pilbara Olive Python has previously been recorded within Yandicoogina Gorge with a scat being recorded at a permanent water pool (Astron 2023b, 2024b; GHD 2021; Figure 9-5). In addition, at least four potentially suitable Ghost Bat caves have been recorded within Gorge/Gully habitat associated with Yandicoogina Creek (GHD 2021). Evidence of the Ghost Bat (scats) has also been recorded in caves in proximity to Yandicoogina Gorge (Figure 9-5) and it is likely that the species utilises the gorge for foraging (Astron 2023b, 2024b), with habitats present likely to represent critical habitat.

Yandicoogina Gorge also provides suitable habitat for a number of Priority listed species such as the Pilbara Flat-headed Blind Snake (*Anilios ganei*) which has previously been recorded in the GDE of the Gorge (GHD 2021), as well as providing habitat for Migratory birds, and aquatic fauna (see Section 9.3.2.6).

9.3.2.3 Vertebrate fauna

Database searches indicate that up to 370 vertebrate fauna species could possibly occur within the Development Envelope including 118 reptile species, 192 bird species, and 53 mammal species (including 10 introduced mammal species; Astron 2023a).

A total of 252 vertebrate fauna species have been recorded within the Development Envelope including five significant fauna (Astron 2023a; Section 9.3.2.4). The fauna assemblage recorded is considered typical of the Pilbara bioregion, and more specifically the Hamersley subregion. The number of species recorded is comparative to other fauna assessments in the subregion (Astron 2023a).

9.3.2.4 Significant vertebrate fauna

Overview

Five significant fauna species have been recorded within the Development Envelope including (Appendix 13; Figure 9-5):

- Pilbara Olive Python (*Liasis olivaceus barroni*) – Listed as Vulnerable under the Biodiversity Conservation Act 2016 (WA) (BC Act) and EPBC Act and is a MNES
- Northern Quoll (*Dasyurus hallucatus*) – Listed as Endangered under the BC Act and EPBC Act
- Common Sandpiper (*Actitis hypoleucos*) – Listed as Migratory under both the BC Act and EPBC Act and is a MNES
- Western Pebble-mound Mouse (*Pseudomys chapmani*) – Listed as Priority 4 by DBCA
- Peregrine Falcon[3] (*Falco peregrinus*) – listed as 'Other Specially Protected Fauna' under the BC Act.

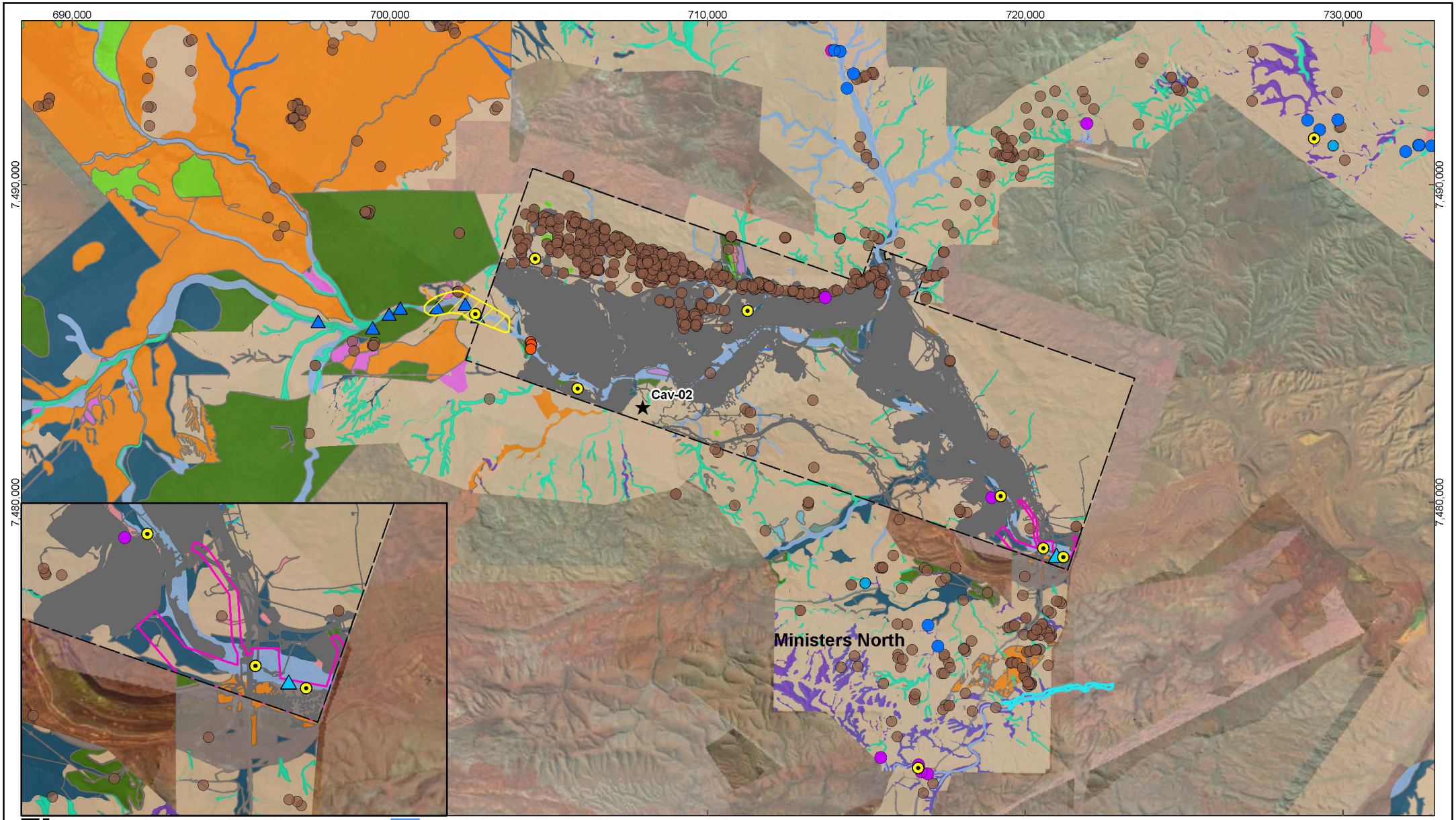
A further 11 significant fauna are considered to have a moderate likelihood of occurring within the Development Envelope due to the presence of suitable habitat and/or proximity of regional records (Astron 2023a; Appendix 13):

- Ghost Bat (*Macroderma gigas*) – Listed as Vulnerable under the BC Act and EPBC Act
- Pilbara Leaf-nosed Bat (*Rhinonicteris aurantius* [Pilbara form]) – listed as Vulnerable under the BC Act and EPBC Act
- Grey Falcon (*Falco hypoleucos*) – listed as Vulnerable under the BC Act
- Australian Painted Snipe (*Rostratula australis*) – Listed as Endangered under the BC Act and EPBC Act
- Common Greenshank (*Tringa nebularia*) – listed as Migratory under the BC Act and EPBC Act
- Glossy Ibis (*Plegadis falcinellus*) – listed as Migratory under the BC Act and EPBC Act
- Fork-tailed Swift (*Apus pacificus*) – listed as Migratory under the BC Act and EPBC Act
- Pilbara Barking Gecko (*Underwoodisaurus seorsus*) – listed as Priority 2 by DBCA
- Unpatterned Robust Slider (Robertson Range) (*Lerista macropisthopus remota*) – listed as Priority 2 by DBCA
- Brush-tailed Mulgara (*Dasycerus blythi*) – listed as Priority 4 by DBCA
- Letter-winged Kite (*Elanus scriptus*) – listed as Priority 4 by DBCA.

Recorded species and those with a moderate likelihood of occurring are described in detail below.

An additional 12 significant fauna species have a low likelihood of occurring within the Development Envelope due to a lack of nearby records and/or suitable habitat (Appendix 13; Astron 2023a). These species are not discussed further.

[3] Note that the Peregrine Falcon has not been shown on Figure 9-5 as the data is not spatially available due to the age of the record (i.e. 1995).



Development Envelope
Indicative Footprint
Existing Disturbance
Yandicoogina Gorge
Indicative location of Flat Rocks
Marillana Creek Pools
Artificial discharge point (WYAN-10)
Ghost Bat Cave

Habitat Type

Basalt Outcrops
Breakaway/ Cliff
Boulders/ Rockpiles
Calcrete Plain
Cleared/ Disturbed
Drainage Area/ Floodplain
Gorge/ Gully
Hardpan Plain
Hillcrest/ Hillslope
Major Drainage Line
Medium Drainage Line
Minor Drainage Line
Mulga Woodland
Sand Plain
Sandy/Stony Plain
Stony Plain
Wetland
Undulating Low Hills

Threatened fauna species records

Ghost Bat (*Microderma Gigas*) - Vulnerable
Northern Quoll (*Dasyurus hallucatus*) - Endangered
Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*) - Vulnerable
Pilbara Olive Python (*Liasis olivaceus barroni*) - Vulnerable
Common Sandpiper (*Actitis hypoleucos*) - Migratory

Priority Listed and Other Specially Protected Species Records

Western Pebble-mound Mouse (*Pseudomys chapmani*) - Priority 4
Peregrine Falcon (*Falco peregrinus*) - Other Specially Protected Fauna

N

0 1 2 3 4
kilometres

GDA 1994 MGA ZONE 50

BHP

PUBLIC

MARILLANA CREEK (YANDI) SIGNIFICANT AMENDMENT

SIGNIFICANT FAUNA SPECIES RECORDS

WAIO PLANNING, TECHNICAL & ENVIRONMENT

SCALE @A4:	1:160,000	PREPARED:	GEOMATICS	FIGURE:	9-5
DATE:	7/05/2025	REQUESTOR:	ENV APPROVALS		

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Significant fauna species recorded in the Development Envelope

Significant fauna species recorded in the Development Envelope and their occurrence (or likelihood of occurring) within the Indicative Footprint are described in detail below.

Pilbara Olive Python

The Pilbara Olive Python is restricted to ranges within the Pilbara region where it occurs as scattered populations. The species abundance is low and detection rates even lower due to its cryptic nature. There are at least 189 records of this species within the Pilbara region which include populations at Pannawonica, Millstream, Tom Price and the Burrup Peninsula (DCCEEW 2023c). It also occurs within the Rangelands (Western Australia) Natural Resource Management Region and part of the species' habitat is conserved within Karijini National Park (DCCEEW 2023c).

The Pilbara Olive Python is primarily nocturnal; however, is occasionally active during the day in warmer summer months. The species generally inhabits rocky areas including escarpments and deep gorges in proximity to water holes but may also inhabit caves and rock crevices away from water sources. Individuals occupy distinct home ranges up to 449 ha with males capable of travelling distances up to 4 km during the breeding season (June to August; DCCEEW 2023c).

There are six records of the Pilbara Olive Python within the Development Envelope, including three records in areas cleared for the Approved Proposal, two records within Major Drainage Line habitat within the Indicative Footprint and one record within Major Drainage Line habitat approximately 580 m north-west of the Indicative Footprint (Figure 9-6). Records include direct sightings and indirect evidence of skin sloughs and/or scats and indicate that a permanent population is present within the Development Envelope (Biologic 2011b; Ecologia 1995; Maunsell 2003). There are also multiple records in proximity to the Development Envelope, including 23 records within 40 km and four records within 15 km (Astron 2023a).

Suitable habitat for the Pilbara Olive Python within the Development Envelope comprises Wetland, Major and Medium Drainage Lines habitats, as well as Breakaway/Cliff habitats where in proximity to a water source (Astron 2023a). Wetland and Major Drainage Line habitat (including the artificial wetland associated with discharge outlet [WYAN-10]) provide critical foraging habitat for the species (Figure 9-6; Astron 2024b; noting that the recent survey report defines these habitats as supporting habitat, however, BHP has taken a more conservative approach and assigned these habitats as critical habitat, given that a resident population is likely to be present). Both of these habitat types are present within the Indicative Footprint (Figure 9-6). In addition, one section of Breakaway/Cliff habitat in the western section of the Development Envelope near Flat Rocks is also considered to represent critical habitat for the Pilbara Olive Python due to its proximity to a large wetland (Figure 9-6; Astron 2023a). Medium Drainage Lines and the remaining Breakaway/Cliff habitats provide supporting habitat for the species (Astron 2023a). All other fauna habitats within the Development Envelope and Indicative Footprint provide limited value to the Pilbara Olive Python (Astron 2023a).

Northern Quoll

The Northern Quoll was once distributed across northern Australia, almost continuously from the Pilbara, Western Australia, to Brisbane, Queensland; however, the species' distribution has since contracted and now includes four disjunct populations: the Pilbara (including Dolphin Island) and Kimberley (including islands) regions of WA, the Top End of the Northern Territory (including islands) and Queensland (TSSC 2005; Northover et. al. 2023).

Northern Quolls are relatively common in the northern part of the Pilbara (generally within 150 km of the coast) but are much less common in the south and south-eastern parts (Northover et. al. 2023). The species has a home-range size of up to 1,109 ha (11 km^2) for males and 443 ha (4.43 km^2) for females (King 1989). Whilst current population size estimates are not available, there are at least 3,935 known records of Northern Quoll within the Pilbara region (Dunlop 2017).

The species is both arboreal and terrestrial, inhabiting a wide variety of habitats including ironstone and sandstone ridges, scree slopes, granite boulders and outcrops, drainage lines, riverine habitats, dissected rocky escarpments, open forest of lowland savannah and woodland habitats. Pilbara Northern Quolls appear to depend on complex rocky habitat, which are generally favoured for foraging, sheltering and denning, and gullies and drainage lines for foraging and dispersal (Hill and Ward 2010).

The Northern Quoll has historically been recorded twice in the Development Envelope, neither of which occur within the Indicative Footprint (Figure 9-7). One record was a direct observation of an individual in the south-eastern section of the Development Envelope, and the other a deceased Northern Quoll on the main Yandi access road (Biologic 2011b; Figure 9-7). Both records are from pre-2016 and occurred in areas that have now been cleared as part of the Approved Proposal. Despite extensive survey effort within the Development Envelope, the species has not been recorded since (Astron 2023a). As such, a resident population of Northern Quoll is considered unlikely to occur within or in proximity to the proposed Development Envelope, with the closest known population present within ridgelines located approximately 13 km to the north (Astron 2023a). Major Drainage Line, Medium Drainage Line, Hillcrest/Hillslope, Breakaway/Cliff, Wetland, Sandy/Stony Plain, Stony Plain, Drainage Area/Floodplain, and Hardpan Plains habitats are likely to represent supporting habitat suitable for foraging and dispersal (Figure 9-7); however, given the lack of caves or shelter features suitable for denning, none of these habitats represent critical habitat for the species (Astron 2023a). Cleared/Disturbed areas and Undulating Low Hills habitat provide little to no habitat for the Northern Quoll.

Common Sandpiper

The Common Sandpiper is widespread, but uncommon, in Australia. The species arrives from Asia from July/August and departs around March. This species is usually solitary or occurs in very small groups and is often found in sheltered habitats used by other shorebirds including wetland habitats with steep shorelines, along mangrove-lined creeks, muddy areas with rocky outcrops, steep sided dams, and sewage ponds (Astron 2023).

The Common Sandpiper was recently recorded from an opportunistic sighting of two birds (one record) at Flat Rocks and seven records from three different motion cameras within the Development Envelope (Astron 2023a; Figure 9-5). It is possible that at least five of the seven records were the same two individuals (Astron 2023a). The species was also recorded in the Development Envelope in 2003 (Maunsell 2003). None of these records occur within the indicative Footprint; however, the species is considered likely to occur there given that the artificial Wetland and some of the Major Drainage Line habitat provide suitable habitat for this species. Neither of these habitats provide critical habitat given that the subregion doesn't support an ecologically significant proportion of the population of the species (DoE 2013).

Peregrine Falcon

There is one historical record of the Peregrine Falcon within the Development Envelope (Ecologia 1995; note this record is not spatially available due to age of record). This record occurred within areas cleared as part of the Approved Proposal and was previously assessed as part of the Approved Proposal under MS679 as amended by MS1039.

There are no additional records of the Peregrine Falcon within the Development Envelope or the Indicative Footprint; however, the species is considered to have a high likelihood of occurrence due to the proximity of nearby records (six records within 20 km) and the presence of suitable shelter and foraging habitat within the Major and Medium Drainage Line fauna habitats (Astron 2023a; note that critical and supporting habitat has not been defined for this species and so is not discussed in this context).

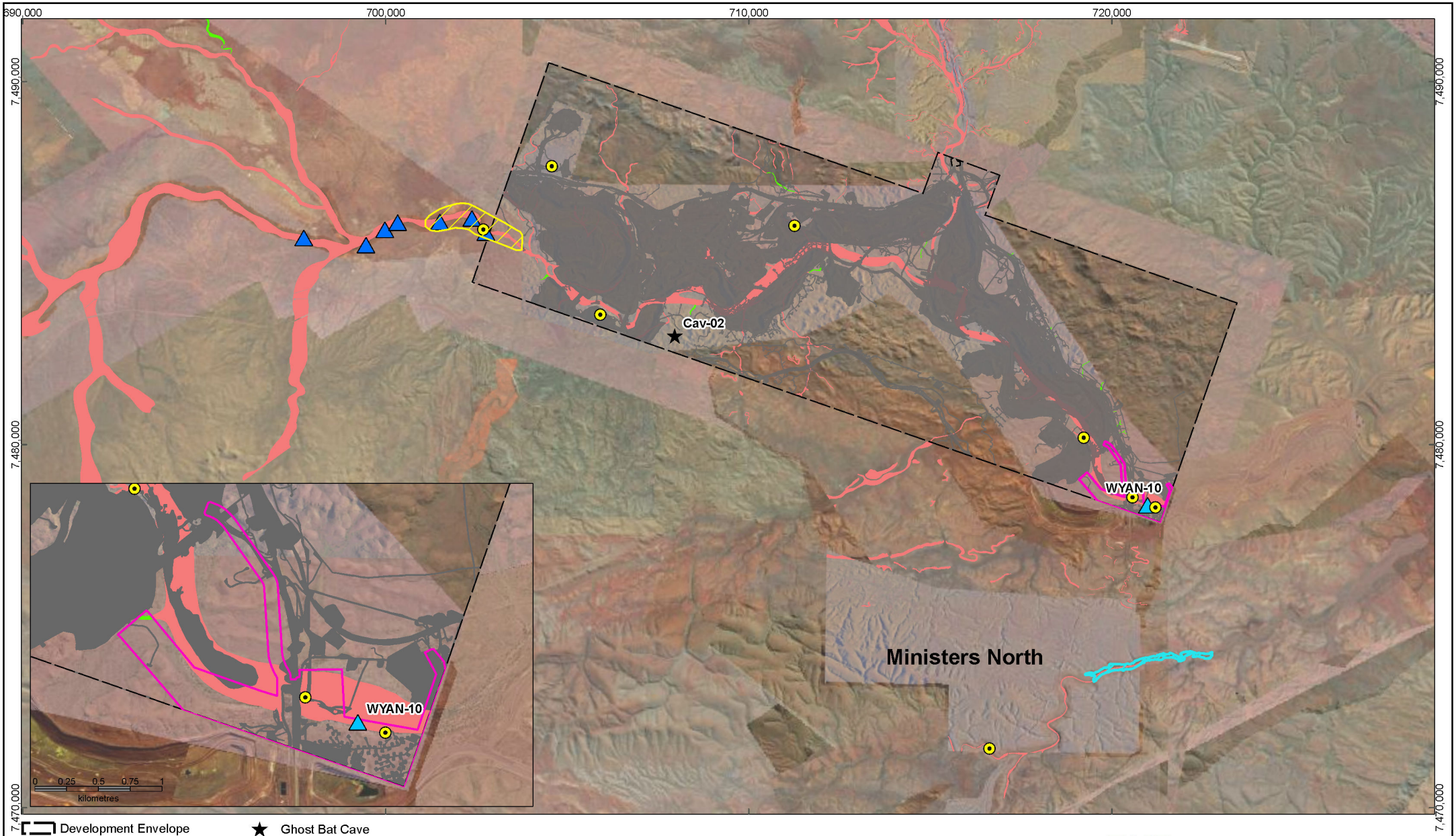
Western Pebble-mound Mouse

This species is native to WA where it is restricted to the non-coastal, central and eastern parts of the Pilbara. It generally occurs on the gentler slopes of rocky ranges where the ground is covered with a stony mantle and vegetated by hard spinifex, often with a sparse overstorey of eucalypts and scattered shrubs.

There are over 1,030 records of this species within the Development Envelope (Figure 9-5), with the species having been assessed as part of the Approved Proposal under MS679 (as amended by MS1039). Seven Western Pebble-mound Mouse mounds were recorded during the recent survey, including three active mounds, three recently inactive mounds, and one historical inactive mound (Astron 2023a; Table 9-4; Figure 9-5). No mounds have been recorded in the Indicative Footprint, despite recent survey effort (Astron 2023a; Figure 9-5). The Stony Plain, Undulating Low Hills and Hillcrest/Hillslope habitats provide suitable habitat for this species and are widespread throughout the Development Envelope (Astron 2023a).

Table 9-4: Terrestrial Fauna - Western Pebble-mound Mouse recent records

Mound ID	Mound status	Habitat type
WPMM01	Inactive	Undulating Low Hills
WPMM02	Inactive	Hillcrest/Hillslope
WPMM03	Inactive	Hillcrest/Hillslope
WPMM04	Active	Hillcrest/Hillslope
WPMM05	Inactive	Hillcrest/Hillslope
WPMM06	Active	Hillcrest/Hillslope
WPMM07	Active	Hillcrest/Hillslope



- Development Envelope
- Indicative Footprint
- Existing Disturbance
- Critical Habitat
- Supporting Habitat
- Indicative location of Flat Rocks
- Yandicoogina Gorge
- Ghost Bat Cave
- Artificial discharge point
- Marillana Creek Pools
- Pilbara Olive Python (*Liasis olivaceus barroni*) - Vulnerable

N

0 1 2 3 4
kilometres

GDA 1994 MGA ZONE 50

BHP

PUBLIC

MARILLANA CREEK (YANDI)
SIGNIFICANT AMENDMENT
PILBARA OLIVE PYTHON RECORDS
AND CRITICAL AND SUPPORTING HABITATS

WAIO PLANNING, TECHNICAL & ENVIRONMENT

SCALE @A4:	1:140,000	PREPARED:	GEOMATICS	FIGURE:	9-6
DATE:	24/04/2025	REQUESTOR:	ENV APPROVALS		

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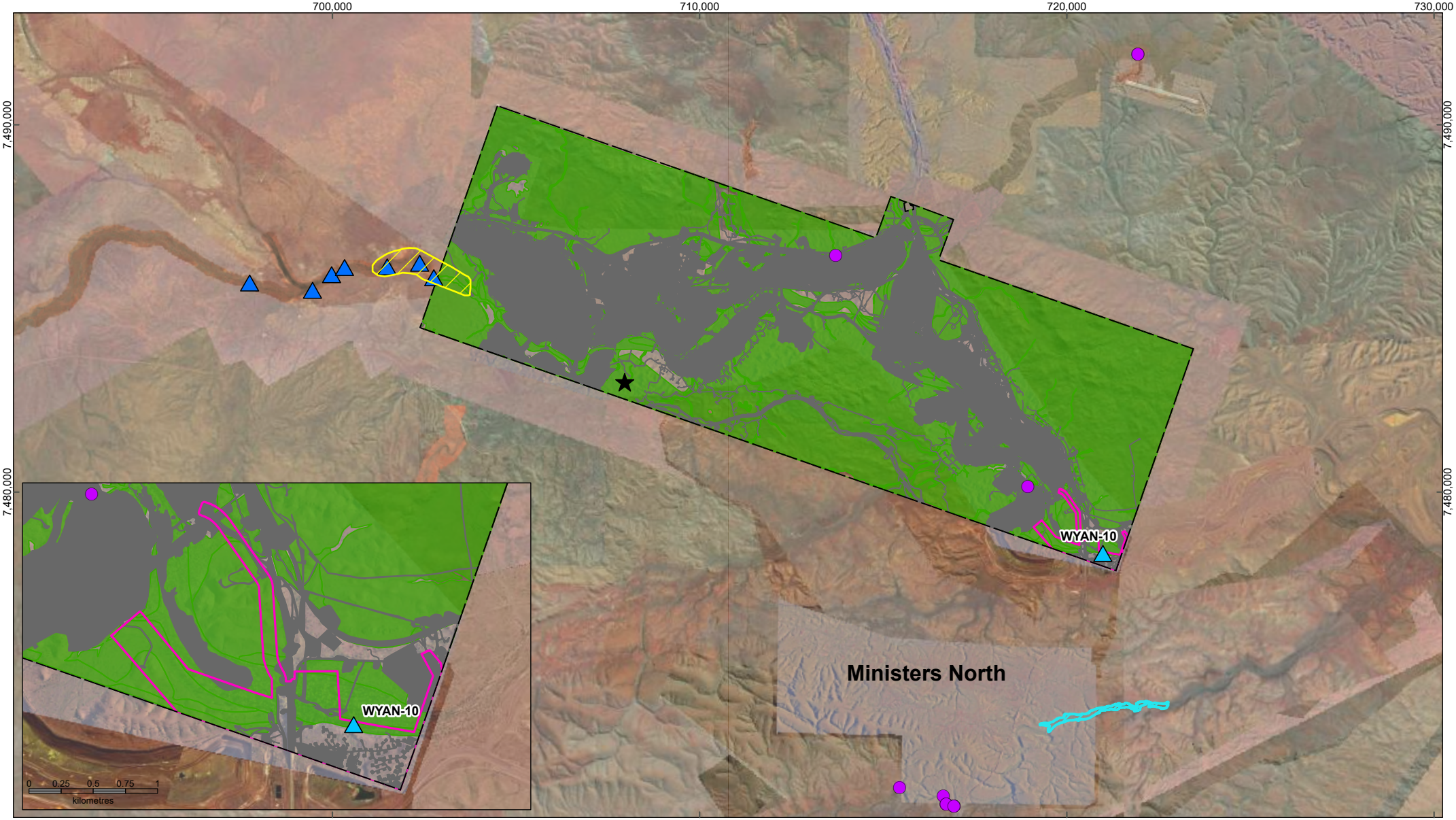

Development Envelope
Indicative Footprint
Existing Disturbance
Yandicoogina Gorge
Indicative location of Flat Rocks
Supporting Habitat

Northern Quoll (*Dasyurus hallucatus*) - Endangered
Ghost Bat Cave
Artificial discharge point
Marillana Creek Pools

N

0 1 2 3 4
kilometres

GDA 1994 MGA ZONE 50

BHP

PUBLIC

MARILLANA CREEK (YANDI)
SIGNIFICANT AMENDMENT
NORTHERN QUOLL RECORDS AND SUPPORTING HABITATS

WAIO PLANNING, TECHNICAL & ENVIRONMENT

SCALE @ A4:	1:140,000	PREPARED:	GEOMATICS	FIGURE:	9-7
DATE:	23/04/2025	REQUESTOR:	ENV APPROVALS		

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Significant species with a moderate likelihood of occurring within the Development Envelope

Significant fauna species that are considered to have a moderate likelihood of occurring in the Development Envelope, but which have not been recorded, are described in further detail below (Appendix 13; Astron 2023a).

Ghost Bat

The Ghost Bat formerly occurred throughout central, northern and southern Australia; however, its distribution has declined significantly. The species occurs in all four subregions of the Pilbara region of WA, with the population estimated to be between 1,300 and 2,000 individuals and in the Hamersley subregion, approximately 350 individuals (TSSC 2016a). The Pilbara population of Ghost Bat is genetically distinct and divergent and has been assumed to be an important population based on the definition in the EPBC Act Significant Impact Guidelines (DoE 2013).

Four categories of roosting habitat have been defined for the Ghost Bat, with maternity/diurnal roost caves with permanent occupancy (Category 1) and maternity/diurnal roost caves with regular occupancy (Category 2) being defined as critical roosting habitat (Bat Call 2021a). Diurnal roost caves with occasional occupancy (Category 3) may also represent critical habitat when located close to Category 2 caves as these form part of an 'apartment block' (when located in the same gorge/gully) that enables the long-distance movement of individuals across the landscape (Bat Call 2021a). Foraging habitat that occurs within 12 km of critical roosting habitat also represents critical habitat (Bat Call 2021a). Category 4 nocturnal roost caves with opportunistic usage are not considered critical roosting habitat for the Ghost Bat (Bat Call 2021a).

The Ghost Bat has not been recorded within the Development Envelope; however, there are over 100 regional Ghost Bat records within 5-30 km of the Development Envelope (Astron 2023a, 2024b; GHD 2021). This includes recent direct and indirect records of ghost bats at Caves CMN-02 and CMNY-05, both of which occur 3-4 km south of the Development Envelope (Table 9-5; Figure 9-5 and Figure 9-8). In addition, foraging and scat records exist 5-7 km to the north in association with cave CBKA-02, and approximately 10.3 km south in association with cave CMIN-03 (Table 9-5; Figure 9-5 and Figure 9-8). There is suitable foraging habitat present within the Major Drainage Line, Medium Drainage Line, Drainage Area/Floodplain, Stony/Sandy Plain, Stony Plain, Hillcrest/Hillslope, Wetland, and Hardpan Plains habitats within the Development Envelope and Indicative Footprint and a Category 4 cave (Cav-02) has been recorded within Breakaway/Cliff habitat within the Development Envelope (outside the Indicative Footprint; Astron 2023a, 2024b; GHD 2021; Figure 9-8). The cave could not be fully accessed at the time of survey and so it is unknown if it is currently being utilised by the species (GHD 2021); however, it is unlikely to represent critical roosting habitat (i.e. a Category 2 cave) due to only containing one shallow single chamber.

Whilst the Development Envelope is devoid of any critical roosting habitat, there is one potential Category 2 cave (i.e. critical roosting habitat) within 12 km of the Development Envelope; CMIN-03[4] (Table 9-5; Figure 9-8; Astron 2023b, 2024b; Biologic 2023b). Cave CMIN-03 is located approximately 10.3 km south-west of the Development Envelope and Indicative Footprint and is currently classed as a Category 2 cave, pending further investigations (see footnote[3]; Astron 2024b; Biologic 2023b; Table 9-5; Figure 9-8). Three caves, CMNY-05, CMN-02, and CMN-09, are located within a gully system in proximity to CMIN-03, and may form part of 'apartment block' (Bat Call WA 2021a; Astron 2024b). These caves likely represent important roosts that aid dispersal and long-distance movement across the landscape The remaining caves within the 12 km buffer are either isolated Category 3 caves, Category 4 caves or have yet to be categorised (Table 9-5; Figure 9-8).

Given the proximity of a Category 2 cave, foraging habitats within the Development Envelope that occur within 12 km of this cave are likely to represent critical foraging habitat for the Ghost Bat (Bat Call 2021a; Figure 9-8). Within the Indicative Footprint, critical foraging and dispersal habitat is present within the Wetland, Major Drainage Line, Medium

[4] More recent cave assessments and broader ghost bat surveys have identified a potential overstatement in the initial Category 2 (for ghost bat) rating of CMIN-03, with the status of this cave to potentially be downgraded to Category 3 (T. Betts pers. comm., November 2024, in Astron 2024b). If this cave is downgraded, then all reported critical ghost bat foraging habitat within the Indicative Footprint would need to be recategorised as supporting habitat (Astron 2024b).

Drainage Line, Drainage Area/ Floodplain, Stony Plain and Hillcrest/Hillslope habitats, as these all occur within 12 km of the Category 2 cave (Figure 9-8).

Table 9-5: Regional caves within 12 km of the Development Envelope

Habitat feature ID	Description	Habitat type	Distance from Development Envelope	Category	
				Pilbara Leaf-nosed Bat	Ghost Bat
CMIN-03	Ghost Bat scats recorded in 2011 No evidence of use recorded during recent monitoring surveys	Breakaway/Cliff	10.3 km south south-west	Category 4	Category 2[3]
CMN-01	Flat floor-slope, north-west facing and semi-exposed Potential Night Roost for Ghost Bat	Gorge/Gully	4.4 km south	Category 4	Category 4
CMN-02	Six ghost bats observed in 2023 50-100 ghost bat scats recorded in 2023-2024 Long-term monitoring equipment did not detect any evidence of breeding or usage as a maternity cave Likely used as a transitionary roost, locally important in the dispersal of ghost bat	Gorge/Gully	3.9 km south-west	Not suitable*	Category3
CMN-03	No evidence recorded Potential Pilbara Leaf-nosed Bat roost	Gorge/Gully	5.5 km south	Category 4	Not suitable*
CMN-04	Flat floor, south-facing, exposed No records	Gorge/Gully	7.6 km south	Category 4	Category 4
CMN-05	Flat floor, west facing, semi-exposed No records	Gorge/Gully	4.8 km south	Category 4	Category 4

Habitat feature ID	Description	Habitat type	Distance from Development Envelope	Category	
				Pilbara Leaf-nosed Bat	Ghost Bat
CMN-06	Incline floor-slope, south-west facing, semi exposed No records	Hillcrest/Hillslope	6.8 km south	Category 4	Category 4
CMN-07	Flat floor-slope, north-east facing, sheltered No records	Gorge/Gully	4.8 km south	Category 4	Category 4
CMN-08	Flat floor-slope, north-west facing and semi exposed Potential Night Roost for Ghost Bat	Gorge/Gully	4.4 km south	Category 4	Category 4
CMN-09	Incline floor-slope, west facing, sheltered No records	Gorge/Gully	4.2 km south	Category 4	Category 4
CMN-10	Flat floor-slope north-west facing, sheltered No records	Gorge/Gully	1.6 km south	Category 4	Not suitable*
CMN-11	Incline floor-slope, north facing, exposed No records	Gorge/Gully	1.6 km south	Category 4	Not suitable*
CMN-12	Incline floor-slope, west facing, exposed	Gorge/Gully	6.7 km south	Category 4	Not suitable*
MNY.01	Overhang, no records Potential feeding cave for Ghost Bat and Pilbara Leaf-nosed Bat	Major Drainage Line	3.2 km south-west	Category 4	Category 4
MNY.02	Overhang, no records Potential feeding cave for Ghost Bat and Pilbara Leaf-nosed Bat	Undulating Low Hills	2.3 km west south-west	Category 4	Category 4

Habitat feature ID	Description	Habitat type	Distance from Development Envelope	Category	
				Pilbara Leaf-nosed Bat	Ghost Bat
MNY.03	Overhang, no records Potential feeding cave for Ghost Bat and Pilbara Leaf-nosed Bat	Hillcrest/Hillslope	4.2 km west south-west	Category 4	Category 4
MNY.04	Potential feeding cave for Ghost Bat and Pilbara Leaf-nosed Bat	Gorge/Gully	4.4 km west south-west	Category 4	Category 4
CMNY.05	Incline floor-slope, south-east facing, semi exposed Potential feeding cave for Ghost Bat and Pilbara Leaf-nosed Bat 50-100 scats recently recorded	Gorge/Gully	3.6 km south-west	Category 4	Category 3
CMNY.06	Incline floor-slope, north-east facing, exposed Potential feeding cave for Ghost Bat and Pilbara Leaf-nosed Bat	Hillcrest/Hillslope	3.9 km south-west	Category 4	Category 4
CMIN-01	Potential feeding cave for Ghost Bat and Pilbara Leaf-nosed Bat	Gorge/Gully	5.7 km south	Category 4	Category 4
CMIN-02	Unlikely to be suitable; however, is currently under investigation	Hillcrest/Hillslope	1.5 km south	Not suitable*	Not suitable*
CBKA-01	Flat floor slope, north/west facing, sheltered No evidence of use	Gorge/Gully	1.4 km north	Category 4	Category 4
CBKA-02	One fresh scat recorded Deep dark cave with domed roof and relatively stable microclimate	Breakaway/Cliff	5.0 km north	Category 4	Category 3

Habitat feature ID	Description	Habitat type	Distance from Development Envelope	Category	
				Pilbara Leaf-nosed Bat	Ghost Bat
CBKA-03	Deep cave with high roof and relatively stable microclimate No recent records	Breakaway/Cliff	1.6 km north	Not suitable*	Category 3
CBKA-04	Can not be accessed due to proximity to rail Unlikely to be suitable for Ghost Bats	Breakaway/Cliff	1.6 km north	Not suitable*	Not suitable*
CMAR-25	Narrow, restricted entrance Flat floor slope, semi exposed	Hillcrest/Hillslope	10 km north	Not suitable*	Not suitable*
MARI-14	South facing, sheltered cavern No scats	Gorge/Gully	11 km north-east	Category 4	Category 4

Sources (Appendix 12): Astron 2023b, 2024b; Biologic 2023b, 2024e; GHD 2021

* cave is considered unsuitable for usage by either Pilbara Leaf-nosed Bats or Ghost Bats due to a restricted entrance or the dimensions of the cave. No evidence of usage has ever been recorded.

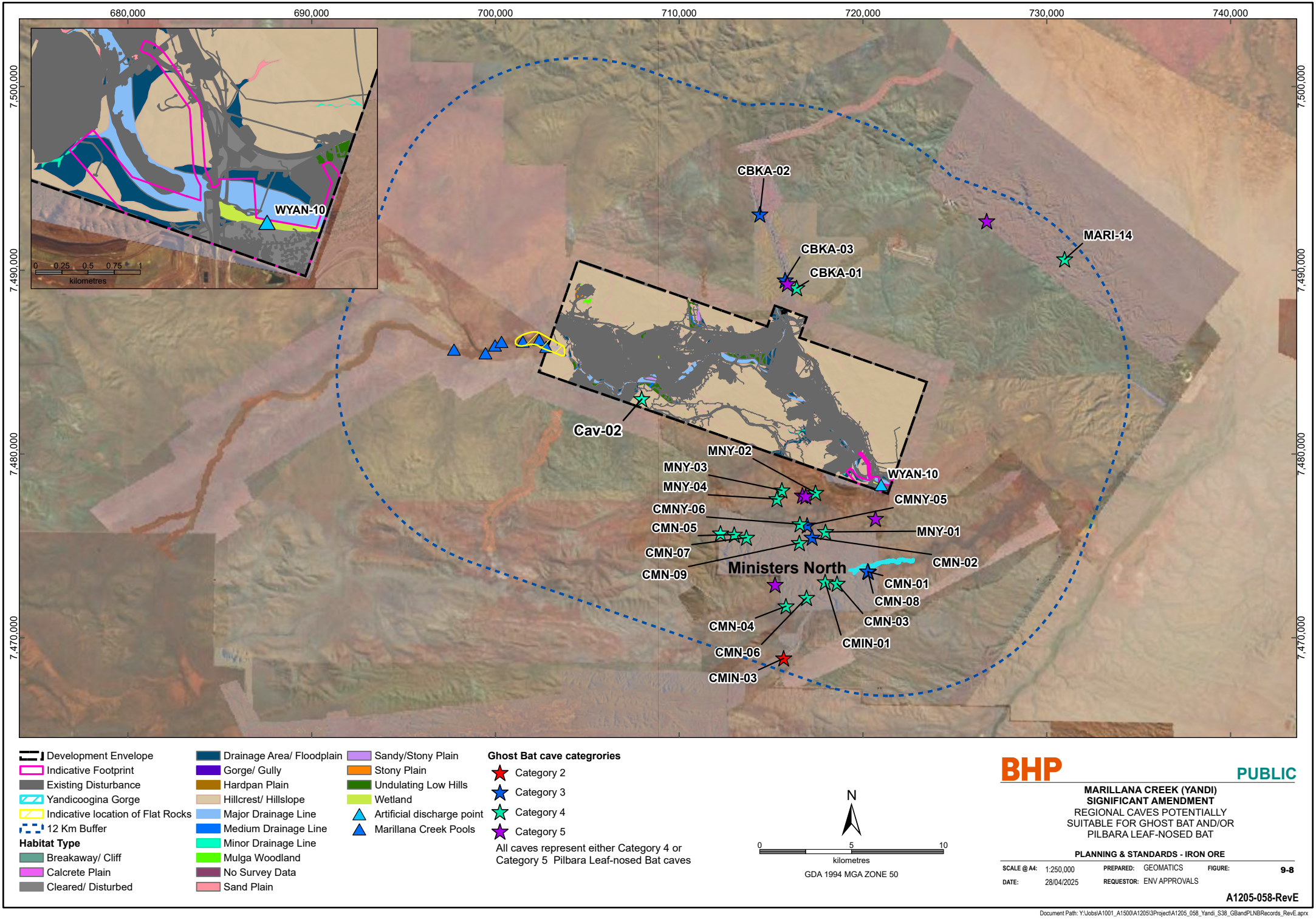
Pilbara Leaf-nosed Bat

The Pilbara Leaf-nosed Bat is a distinct form of the Orange Leaf-nosed Bat that is endemic to the Pilbara region of WA. The species occurs throughout the Pilbara and upper Gascoyne regions of WA where it comprises a single interbreeding population of national significance that is regarded as an 'important population' (TSSC 2016b; Bat Call 2021b).

The Pilbara Leaf-nosed Bat has not been recorded within the Development Envelope to date; however, there are over 1,200 records within 20 km of the Development Envelope (Astron 2023a). The closest record occurs approximately 5 km south of the Development Envelope; however, the majority of records occur approximately 17-20 km north of the Development Envelope where permanent roosts may occur (Astron 2023a).

Habitat critical to the survival of the Pilbara Leaf-nosed Bat is defined as maternity roosts (Category 1), non-permanent breeding roosts (Category 2) and semi-permanent/transitory diurnal roosts (Category 3) (TSSC 2016b); Bat Call 2021b). Nocturnal caves (Category 4) that are utilised at night for resting and/or feeding are not considered critical habitat but are important for the persistence of the species in a local area (Bat Call 2021b). Whilst there are a number of regional caves within 10 km of the Development Envelope, these are all Category 4 caves which do not represent critical roosting habitat (Table 9-5; Figure 9-8).

Foraging habitat within a 10 km (1,000 ha) radius of Category 1-3 caves, as well as permanent water sources within 8.7 km of known Category 1-3 roosts provide habitat critical to the survival of the species (Astron 2023a). In addition, Priority 1 foraging habitat (Gorges with pools) also provides critical habitat, regardless of distance from known roosts (TSSC 2016b); Bat Call 2021b). Based on these definitions, there is no critical roosting or critical foraging habitat for the Pilbara Leaf-nosed Bat present within the Development Envelope; however, most of the habitat types would provide supporting habitat given the species' capability of utilising a wide variety of habitat types (Astron 2024a). Within the Indicative Footprint, supporting habitat is present the Wetland, Major and Medium Drainage Lines, Drainage Area/Floodplain Hillcrest/Hillslope and Stony Plain habitats (Astron 2023a).



BHP

PUBLIC

MARILLANA CREEK (YANDI)
SIGNIFICANT AMENDMENT
REGIONAL CAVES POTENTIALLY SUITABLE FOR GHOST BAT AND/OR PILBARA LEAF-NOSED BAT

PLANNING & STANDARDS - IRON ORE

SCALE @ A4:	1:250,000	PREPARED:	GEOMATICS	FIGURE:	9-8
DATE:	28/04/2025	REQUESTOR:	ENV APPROVALS		

A1205-058-RevE

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Australian Painted Snipe

The Australian Painted Snipe is known to occur across Australia, with stronghold populations in the Riverina region of Victoria and New South Wales. Records do occur within Western Australia, with breeding activity recorded on the Swan Coastal Plain and north-west of WA; however, these locations generally occur closer to coastal areas, outside the Development Envelope (DCCEEW 2022a).

The species has not been recorded within the Development Envelope; however, regional records of the species occur within 40 km (Astron 2023a). Some marginally suitable habitat occurs in the Wetland and Medium and Major Drainage Line habitats within the Development Envelope, where the species may occasionally occur on a transient basis only given it is nomadic and resource dependant (GHD 2021; Astron 2023a).

Grey Falcon

The Grey Falcon is distributed throughout arid and semi-arid regions of Australia, including the Pilbara region of WA, where it is restricted to areas of high annual average temperatures and average rainfall of less than 500 mm. There are an estimated 500 Grey Falcon pairs throughout Australia, with at least 152 known records of the species in Western Australia (Birdlife 2024).

The Grey Falcon has not been recorded from the Development Envelope; however, there are four regional records including one within 20 km and three within 35 km of the Development Envelope. Major Drainage Line and Wetland habitats within the Development Envelope are considered critical habitat for the Grey Falcon due to the presence of tall Eucalyptus/Corymbia trees suitable for nesting, whereas Drainage Area/Floodplain, Hardpan Plains, Sandy/Stony Plain, Stony Plain, Medium Drainage Line and Undulating Low Hills habitats provide supporting habitat for the species (Astron 2023a).

Fork-tailed Swift

The Fork-tailed Swift is recorded sporadically within WA, with its distribution scattered along the coast of the south-west Pilbara and north throughout the Pilbara region and can also be found in the north and east of the Kimberley region (Astron 2023a). The Fork-tailed Swift has not been recorded within the Development Envelope but has a moderate likelihood of occurring due to its high mobility and wide range in distribution (Astron 2023a). While the species may sporadically fly over the Development Envelope, it would not be dependent on the terrestrial habitats within the Development Envelope, due to its extensive foraging range, aerial foraging habits and its non-breeding status within Australia (Astron 2023a).

Migratory waterbirds

The Glossy Ibis and Common Greenshank are both water birds that generally inhabit wetlands and freshwater marshes at the edges of lakes, rivers, saltmarshes, wet swamp areas, irrigation channels, and sewerage ponds.

Neither species has been recorded within the Development Envelope to date; however, regional records exist within 20-40 km (Astron 2023a). Suitable habitat for these species is present within the Wetland, Major Drainage Line and Medium Drainage Line fauna habitats, as well as the surface water pools recorded within the Development Envelope (Astron 2023a); however, none of these habitats are likely to represent critical habitat given that the subregion doesn't support an ecologically significant proportion of the population of either species (DoE 2013).

The Pilbara Barking Gecko

The Pilbara Barking Gecko is confined to the Hamersley Ranges from Tom Price to Newman where it occurs in rocky areas with spinifex and low tree cover; however, very little is known about the species ecology (Astron 2023a). There are 12 regional records of the species, all which are over 20 km from the Development Envelope. Suitable habitat for this species occurs in the Sandy/Stony Plain, Stony Plain and Undulating Low Hills habitats (Astron 2023a).

Unpatterned Robust Slider (Robertson Range)

The Unpatterned Robust Slider is found in Acacia shrublands and woodlands where it shelters in loose soil under leaf litter at the base of shrubs. The species is highly cryptic and difficult to detect without extensive survey/trapping effort (Astron 2023a). Three regional records occur over 20 km from the Development Envelope and suitable habitat occurs within the Major and Medium Drainage Lines and Drainage Area/Floodplain habitats (Astron 2023a).

Brush-tailed Mulgara

The Brush-tailed Mulgara mostly inhabits spinifex grasslands on sandplain or sand dune habitats but can be found in a range of habitat types including low open woodlands on ridge tops, cliffs, scree slopes, hills, and valley floors. Four regional records occur approximately 15 km from the Development Envelope, with suitable habitat being present within the Drainage Area/Floodplain and Sandy/Stony Plain habitats within the Development Envelope (Astron 2023a).

Letter-winged Kite

The Letter-winged Kite occurs in open country and grasslands in arid and semi-arid Australia, where there are tree-lined streams or water courses. There is one regional record of this species approximately 40 km from the Development Envelope, and suitable habitat occurs within the Major and Medium Drainage Line habitats (Astron 2023a). The species is considered to have a moderate likelihood of occurrence; however, it would likely only occur as a vagrant (GHD 2021).

9.3.2.5 SRE invertebrate fauna

The SRE status categories used for this assessment follow BHP's technical process instructions for SRE assessment methods (BHP 2022d; Bennelongia 2024a) as follows:

- **Confirmed SREs**: species with a thoroughly surveyed range <10,000 km^2.
- **Potential SRE**: species for which there is some evidence of short-range endemism (e.g. closely related to Confirmed SREs, occurrence in limited habitat, etc.) and the known range is <10,000 km^2, but sampling and/or taxonomy are not sufficiently robust to assign to the Confirmed SRE category. The Potential SRE category includes species that are likely to be SREs.
- **Uncertain**: specimens from SRE Groups with known ranges <10,000 km^2, including specimens that may be fragmentary or otherwise unidentifiable to species, for which more evidence is required to ascertain the species' true distribution. For example, a species collected only once, or a species collected multiple times from multiple different habitats, would be categorised as Uncertain; further sampling of that species would likely resolve its distribution, but in the absence of that sampling, its true distribution remains unknown and difficult to estimate. The Uncertain category includes species that are Data Deficient.
- **Not SRE** (=Widespread): species with known ranges >10,000 km^2.

Based on recent and historical SRE surveys, three Confirmed, 19 Potential and 25 Uncertain SREs have been recorded within the Development Envelope (Biologic 2013, Biologic 2015, Bennelongia 2024a). Of these, 13 Potential SREs and six Uncertain SREs are currently only known from the Development Envelope (Bennelongia 2024a; Table 9-6; Figure 9-9). Two of these (Uncertain[5] SREs) are known from the Indicative Footprint: *Beierolpium* 8/4 small

[5] Uncertain SRE species have been included in this assessment based on the Precautionary Principle; however, it should be noted that many of these are data deficient species which are likely to have wider distributions than is currently known based on habitat characteristics and/or species surrogates, and therefore may not actually represent SREs (Bennelongia 2024a).

`BPS505` and *Afrosternophorus* `BPS506`; however, both species have also been recorded elsewhere in the Development Envelope, outside the Indicative Footprint (Table 9-6; Figure 9-9).

None of the Confirmed, Potential and Uncertain SREs recorded within the Development Envelope are listed as Threatened under the EPBC or BC Act (Bennelongia 2024a).

Taxa could not be identified to species level due to being damaged or juvenile are likely to belong to one of the named taxa that either occur outside the Development Envelope or those which are described in detail below (Bennelongia 2024a), and as such are not discussed further. Widespread species or those identified as 'Not SREs' are not described further. A full list of the SRE taxa recorded is provided in Table 7 of Bennelongia 2024a, provided in Appendix 12.

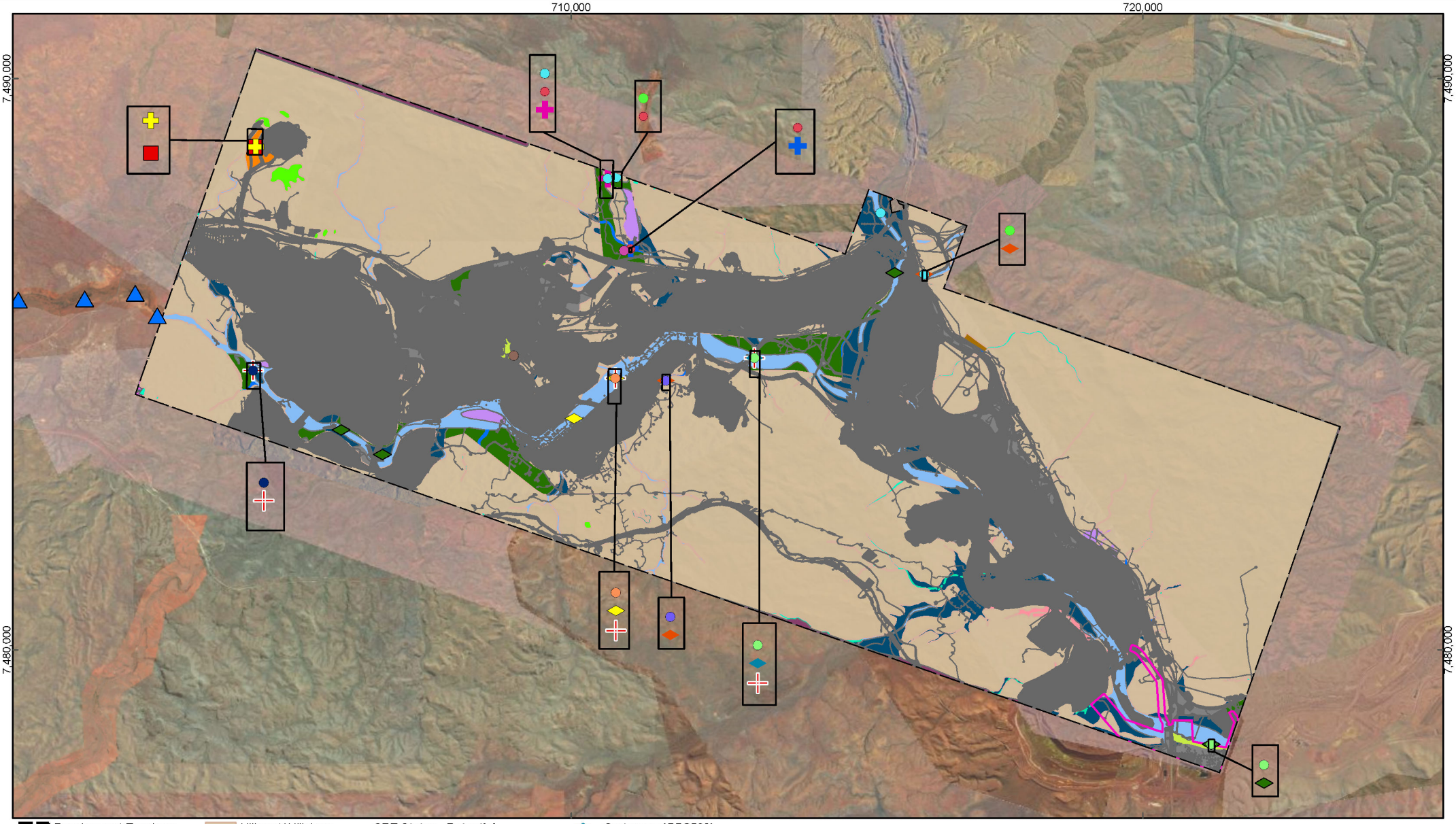
Table 9-6: Terrestrial Fauna - summary of SRE taxa only known from the Development Envelope

Order/taxa	SRE status	Habitats type	Location in relation to Indicative Footprint		Additional information
			Inside	Outside	
Conothele `BMYG220`	Potential	Hillcrest/ Hillslope	-	✓	One individual recorded from one site on a south-facing slope in Hillcrest/Hillslope habitat, outside the Indicative Footprint (Figure 9-9). This is a new species and is the only record known. It differed molecularly from its nearest matches by >13% which is over the threshold of 9.5% for most mygalomorph genera (Bennelongia 2024a). Phylogeny and habitat suggest the possibility that this animal may be an SRE, but its distribution remains unknown.
Austrochthonius `BPS507`	Uncertain	Minor Drainage, Gorge/ Gully, Hillcrest/ Hillslope	-	✓	Ten individuals collected from Minor Drainage, Gorge/ Gully, Hillcrest/ Hillslope habitat types, outside the Indicative Footprint (Figure 9-9). This is a potential new species and these are the only known records. Recorded from multiple sites and habitat types so the probability of being an SRE is relatively low; however, its distribution remains unknown.
Oratemnus `BPS502`	Potential	Major Drainage Line	-	✓	Four specimens of *Oratemnus* `BPS502` were collected from two sites within Major Drainage Line habitat in the central section of the Development Envelope (Figure 9-9). All records occur outside the Indicative Footprint. These are the only known records of this species and based on phylogeny and habitat, this species has been assigned as a Potential SRE and its distribution is unknown.
Oratemnus `BPS503`	Potential	Major Drainage Line	-	✓	Potential new species; recorded from one single site in Major Drainage Line in the central section of the Development Envelope, outside the Indicative Footprint (Figure 9-9). This is the only known record of these species and as such, its distribution remains unknown.
Cheliferidae `BPS504`	Potential	Major Drainage Line	-	✓	Potential new species recorded from one single site in Major Drainage Line in the central section of the Development Envelope (Figure 9-9). This is the only known record of this species and its distribution remains unknown.
Synsphyronus `BPS511`	Potential	Minor Drainage Line	-	✓	Potential new species recorded from one single site in Major Drainage Line in the central section of the Development Envelope, outside the Indicative Footprint (Figure 9-9). This is the only known record of this species and its distribution remains unknown.
Synsphyronus `paradoxus complex`	Uncertain	Major Drainage Line, Gorge/ Gully	-	✓	Twelve individuals collected from three sites in different habitat types outside the Indicative Footprint (Figure 9-9). Potential new species with these being the only known records. Sampled from multiple sites, so the probability of being an SRE is relatively low, but its distribution remains unknown.

Order/taxa	SRE status	Habitats type	Location in relation to Indicative Footprint		Additional information
			Inside	Outside	
Austrohorus `BPS508`	Uncertain	Major Drainage Line, Gorge/ Gully, Hillcrest/ Hillslope	-	✓	Twelve individuals collected from four sites in different habitat types outside the Indicative Footprint (Figure 9-9). Potential new species with these being the only records known. Sampled from multiple sites, so the probability of being an SRE is relatively low, but its distribution remains unknown.
Austrohorus `BPS509`	Potential	Gorge/ Gully	-	✓	*Austrohorus* `BPS509` was collected from a single site in Gorge/Gully habitat in the western section of the Development Envelope, outside the Indicative Footprint (Figure 9-9). This is the only known record of this species and its distribution remains unknown.
Beierolpium 8/2 `BPS521`	Uncertain	Hardpan Plain	-	✓	Singleton recorded from Hardpan Plain habitat outside the Indicative Footprint (Figure 9-9). Potential new species; this is the only record known. Members of this genus tend not to be SREs. However, distribution remains unknown.
Beierolpium 8/4 small `BPS505`	Uncertain	Major Drainage Line, Drainage Area/ Floodplain	✓	✓	Thirteen individuals recorded from four sites in Major Drainage Line and Drainage Area/Floodplain habitat types including one site inside the Indicative Footprint (Figure 9-9). Potential new species with these being the only records known. Sampled from multiple sites and members of the genus tend not to be SREs, so the probability of being an SRE is relatively low. However, distribution remains unknown.
Olpiidae gen 7/4 `BPS510`	Potential	Drainage Area/ Floodplain	-	✓	Five individuals of Olpiidae `BPS510` were collected from a single site in Drainage Area/Floodplain habitat within the Development Envelope, outside the Indicative Footprint (Figure 9-9). These are the only known records of this species and its distribution remains unknown; it is therefore considered a Potential SRE.
Afrosternophorus `BPS506`	Uncertain	Major Drainage Line	✓	✓	Two individuals recorded from two sites including one site inside the Indicative Footprint (Figure 9-9). Potential new species with these being the only records known. Sampled from two sites within an extensive habitat type, so the probability of being an SRE is relatively low, but its distribution remains unknown.
Xenolpium `PSE120`	Potential	Major Drainage Line	-	✓	Desktop record. Not collected during recent survey. Previously collected from Major Drainage Line habitat on Marillana Creek in a section that is now cleared outside the Indicative Footprint. Note that given this is an old database record it is not spatially available to show on Figure 9-9; however, it occurs in an area that has previously been cleared, outside the Indicative Footprint (Bennelongia 2024a).

Order/taxa	SRE status	Habitats type	Location in relation to Indicative Footprint		Additional information
			Inside	Outside	
Lychas `BSCO088` `pilbara1 group`	Potential	Drainage Area/ Floodplain	-	✓	Singleton recorded from Drainage Area/Floodplain habitat, outside the Indicative Footprint (Figure 9-9). Potential new species. Phylogeny and habitat suggest the possibility that this animal may be an SRE, but its distribution remains unknown.
Acanthodillo `BIS523`	Potential	Waterhole	-	✓	Singleton recorded from Wetland habitat outside the Indicative Footprint (Figure 9-9). Potential new species only known from within the Development Envelope; this is the only record known. Phylogeny and habitat suggest the possibility that this species may be an SRE, but its distribution remains unknown.
Acanthodillo `BIS524`	Potential	Stony Plain	-	✓	Singleton recorded from Stony Plain habitat, outside the Indicative Footprint (Figure 9-9). Potential new species only known from within the Development Envelope; this is the only record known. Phylogeny and habitat suggest the possibility that this species may be an SRE, but its distribution remains unknown.
Buddelundia `BIS521`	Potential	Hillcrest/ Hillslope, Stony Plain	-	✓	Three individuals recorded from Hillcrest/ Hillslope and Stony Plain habitats outside the Indicative Footprint (Figure 9-9). Potential new species; this is the only record known. Phylogeny and habitat suggest the possibility that this animal may be an SRE, but its distribution remains unknown.
Geophilidae sp. B01	Potential	Hillcrest/ Hillslope and Gorge/ Gully	-	✓	Two individuals recorded from Hillcrest/ Hillslope habitat, in the northern part of the Development Envelope (Bennelongia 2024a). Note that given this is a database record, it is not spatially available to show on Figure 9-9; however, it was recorded from the northern part of the Bennelongia survey area (2024a), outside the Indicative Footprint.

Source: Biologic 2013, Biologic 2015, Bennelongia 2024a



BHP

PUBLIC

MARILLANA CREEK (YANDI) SIGNIFICANT AMENDMENT

SRE INVERTEBRATE FAUNA SPECIES ONLY KNOWN FROM THE DEVELOPMENT ENVELOPE

WAIO PLANNING, TECHNICAL & ENVIRONMENT

SCALE @A4:	1:90,000	PREPARED:	GEOMATICS	FIGURE:	9-9
DATE:	6/05/2025	REQUESTOR:	ENV APPROVALS		

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9.3.2.6 Aquatic fauna

The aquatic fauna values within the Development Envelope and in regional areas that occur within the predicted groundwater drawdown area of the Combined Proposal including Flat Rocks, Marillana Creek Pools and Yandicoogina Gorge, are described below.

Development Envelope

A diverse aquatic fauna assemblage including vertebrates, microinvertebrates, hyporheos fauna and macroinvertebrates have been recorded within the artificial water feature (WYAN-10) within the Development Envelope (WRM 2015, 2018). The majority of invertebrate species recorded within the artificial water feature are common and widespread throughout the Pilbara; however, at least five stygal SREs have been recorded including the amphipods Paramelitdae sp. B, Paramelitdae sp. D and *Chydaekata* sp., the isopod *Pygolabis weeliwolli*, and the ostracod *Gomphodella* n. sp. 'BOS334' (WRM 2018). All recorded stygal SREs have distributions which extend outside the Development Envelope and predicted groundwater drawdown contours of the Proposal. As such, none of the stygal SREs or epigean species are considered to be locally restricted (WRM 2015, 2018).

Three freshwater fish species have been recorded within the artificial water feature within the Development Envelope including the Western Rainbowfish (*Melanotaenia australis*), Spangled Perch (*Leipotherapon unicolor*) and Pilbara Tandan (*Neosilurus* sp) (WRM 2018; 2015). All three species are common and widespread and have distributions that extend beyond the boundaries of the Development Envelope.

None of the aquatic fauna recorded within the Development Envelope are listed as Threatened under state or national legislation.

Marillana Creek Pools

A diverse range of aquatic fauna has been recorded within the Marillana Creek Pools including 488 native aquatic invertebrate taxa (across zooplankton, hyporheic, rehydrate and macroinvertebrate lists), two freshwater fish species (Spangled Perch and Pilbara Tandan) and two frog species (Biologic 2024b). Three of the pools in particular have a high ecological value for invertebrate fauna: MarC2, MarC4 and MarC5 (Biologic 2024b; Figure 9-3).

Zooplankton richness within the Marillana Creek Pools was found to be greater than other creeks included in recent studies (i.e. Munjina Creek, Yandicoogina Creek, Weeli Wolli Spring, Weeli Wolli Creek), although this difference was not statistically significant (Biologic 2024d). The hyporheic zone generally recorded a high richness of hyporheos and groundwater-dependent fauna, especially at MarC2, including several potentially restricted taxa. This highlights the strong connection to groundwater beneath Marillana Creek (Biologic 2024d). While most invertebrates recorded from the Marillana Creek Pools were common, widespread species, 24 species are of conservation interest as they are either new species, potentially restricted species or are listed on the IUCN Redlist (Table 9-7).

Table 9-7: Terrestrial Fauna - significant aquatic fauna recorded from Marillana Creek

Type	Species	Marillana Creek Pool	Reference site	Significance
Stygal mites	*Aspidiobates pilbara*	MarC2, MarC3 (surface waters)	-	Pilbara endemic known only from springs and permanent pools in good ecological condition
	Guineaxonopsis `sp. Biologic-ACAR013`	MarC2 and MarC4 (hyporheos)	-	Linear range of 1 km. Currently known only from Marillana Creek and Yandicoogina Creek. Further work may find it to be more widespread.
	Guineaxonopsis sp.	MarC1, MarC2, (hyporheos), MarC4 (hyporheos and surface waters)	-	Species identification unknown, may be uncommon, with a disjunct or restricted distribution in the Pilbara. May be one of the two Guineaxonopsis taxa known from Marillana Creek (see above)
	Rutacarus `sp. Biologic-ACAR007`	MarC4, MarC5 (hyporheos)	BENS	Known from Marillana Creek and Bens Oasis within Weeli Wolli Creek with a linear distance of 42.5 km.
	Rutacarus `sp. Biologic-ACAR022`	MarC4 (hyporheos)	-	This is the first record of this taxon.
	Rutacarus sp.	MarC2, MarC4, MarC5 (hyporheos)	BENS (hyporheos)	Species identification unknown, may be uncommon, with a disjunct or restricted distribution in the Pilbara
	Wandesia sp.	MarC1, MarC5 (hyporheos), MarC2 (surface waters)	MACREF2, WWS (hyporheos)	Species identification unknown, may be uncommon, with a disjunct or restricted distribution in the Pilbara
Ostracoda	*Gomphodella alexanderi*	MarC2 (hyporheos)	-	SRE known only from the hyporheos of Marillana Creek, Yandicoogina Creek, lower Weeli Wolli Creek, and groundwater bores at Yandi.
Harpacticoida	Bennelongia `sp. Biologic-OSTR026`	MarC1 (surface water)	-	Known only from Marillana Creek and Gingianna Pool.
	Canthocamptidae `sp. Biologic-HARP059	MarC2, MarC4 (hyporheos)	-	This is the first record of this taxon. Known linear distribution of 1 km.
	Elaphoidella sp.	MarC4 (hyporheos)	SS (hyporheos)	Undescribed and may be new to science

Type	Species	Marillana Creek Pool	Reference site	Significance
	Parastenocaris `sp. Biologic-HARP037`	MarC2 (hyporheos)	-	Currently known from only the Survey Area and Yandicoogina Creek.
	Parastenocaris sp.	MarC2, MarC5 (hyporheos)	SS (hyporheos)	Represents either a specimen new to science or additional records for known fauna.
	nr *Phyllognathopus* `sp. Biologic-HARP058`	MarC2 (hyporheos)	-	This is the first record of this taxon.
Stygal amphipods	*Chydaekat*a sp. MJ1-UM1	MarC4 (hyporheos)	-	Known to have a restricted range, recorded from upper Marillana Creek only
Syncarids	*Atopobathynella* `sp. Biologic-PBAT019`	MarC4 (hyporheos)	MACREF2 (hyporheos)	Previously recorded as Atopobathynella `sp. Biologic-PBAT042` and Atopobathynella `sp. Biologic-PBAT044`. Previously recorded from Turee Creek East sub catchment, the Weeli Wolli sub catchment and the Fortescue River catchment. Distribution is highly disjunct.
	Bathynellidae sp.	MarC2 (hyporheos)	-	Likely represents a new, undescribed species based on morphology
Clam shrimp	*Limnadopsis pilbarensis*	MarC4, MarC5, MarC6 (surface waters)	-	Pilbara endemic, relatively uncommon. Previously recorded from Burrup Rockhole, Beabea Creek, Ratty Spring (Pirraburdu Creek) and Glen Ross Creek.
Troglobitic symphyla	*Hanseniella* `sp. Biologic-SYMP055`	MarC4 (hyporheos)	-	Only known records of this taxon. Potential SRE.
	Hanseniella `sp. Biologic-SYMP069`	MarC6 (hyporheos)	MACREF2 (hyporheos)	Currently only known from Marillana Creek, with a linear distance of 3.7 km. Potential SRE.
Damselfly	*Austroagrion pindrina*	MarC2, MarC4 (surface waters)	MUNJS	Vulnerable, IUCN Red List.
	Eurysticta coolawanyah	MarC4, MarC5 (surface waters)	MACREF2, MACREF1, WWS, BENS, SS (surface waters)	Vulnerable, IUCN Red List
Dragonfly	*Hemicordulia koomina*	MarC1, MarC4, MarC5, MarC6 (surface waters)	BENS (surface waters)	Vulnerable, IUCN Red List
	Ictinogomphus dobsoni	MarC3 (surface waters)	MUNJS	Near Threatened, IUCN Red List
Beetle	*Haliplus fortescueensis*	MarC4 (surface waters)	-	Pilbara endemic with a restricted distribution

Source: Biologic 2024d

Yandicoogina Gorge

A diverse range of aquatic fauna has been recorded at the pools within Yandicoogina Gorge including 250 invertebrate taxa and three freshwater fish species (Western Rainbowfish, Pilbara Tandan and Spangled Perch; Biologic 2024c). Two sites (YC3 and YC4) are considered to be of high ecological value (Biologic 2024c). These sites generally recorded high macroinvertebrate diversity, high richness of hyporheos fauna, and high Pilbara endemic taxa richness. The percentage of stygobitic taxa recorded (19%) was considerably greater than that reported previously for Pilbara hyporheic zones (i.e. 5%), highlighting the strong groundwater connection across the pools at Yandicoogina Gorge.

While most aquatic invertebrates recorded from Yandicoogina Gorge pools were common, ubiquitous species, or are species known from multiple creeks or sub-catchments, 16 species are of conservation interest as they are either new species, are potentially restricted or are listed on the ICUN Redlist (Table 9-8).

In addition, three troglofauna taxa were recorded from the hyporheic zone including the pseudoscorpion Chthoniidae `sp. Biologic-PSEU083`, the dipluran Projapygidae `sp. Biologic-DIPL053`, and the symphylan *Hanseniella* `sp. Biologic-SYMP054` (Biologic 2023c). All troglofauna taxa were recorded in the wet season in 2022 from sites which do not always have an inundated hyporheic zone (i.e., YC6H, YC8H and YC9H). These locations would likely represent a humid, subterranean environment, that is not often inundated in comparison to the other sites sampled for hyporheos fauna within Yandicoogina Creek, which may provide temporary habitat for troglofauna (Biologic 2023c).

None of the invertebrate or vertebrate aquatic fauna recorded at Yandicoogina Gorge are listed under the EPBC Act or BC Act, or listed as Priority fauna by DBCA.

Table 9-8: Terrestrial Fauna - significant aquatic fauna recorded at Yandicoogina Gorge

Type	Species	Marillana Creek Pool	Significance
Stygal ostracods	*Meridiescandona marillanae* (`sp. Biologic-OSTR074`)	YC1, YC3, YC4 and YC4eH (hyporheos)	Known from Weeli Wolli Creek, Marillana Creek, Upper Fortescue.
	Gomphodella alexanderi (`sp. Biologic-OSTR012`)	WWDD3 (hyporheos)	Potential SRE restricted to Marillana Creek, Weeli Wolli Creek and Yandicoogina Creek.
	Gomphodella `sp. Biologic-OSTR077	YC7H (hyporheos)	A potential new species of ostracod currently not known from elsewhere
Stygal copepods	cf. Australocamptus `sp. Biologic-HARP064`	YC3 (hyporheos)	Potential SRE. First record of this OTU
	cf. Australocamptus sp.	YC2 (hyporheos)	Potential SRE.
	Kinnecaris `sp. Biologic-HARP037`	YC8H (hyporheos)	Potential SRE. Current known linear range 25 km
Stygal amphipods	Chydaekata `sp. E`	YC1, YC3, YC4 and YC8H (hyporheos)	Potential SRE known only from Weeli Wolli Creek, Marillana Creek and Yandicoogina Creek.
	Paramelitidae `sp. Biologic-AMPH023`	YC4eH, YC5H and YC8 (hyporheos)	SRE; known only from Yandicoogina Creek, Marillana Creek and lower Weeli Wolli Creek (downstream of the confluence with Marillana).
Syncarids	Bathynellidae sp. BES7547	YC9H (hyporheos)	A potentially new species of syncarid. Currently not known from elsewhere.

Type	Species	Marillana Creek Pool	Significance
	Atopobathynella `sp. Biologic-PBAT042`	YC1	A potential new species of syncarid. Is considered a Potential SRE (Data Deficient) that is currently not known from elsewhere.
	Bathynellidae `sp. Biologic-BATH019`	YC1 (hyporheos)	A potential new species of syncarid. Is considered a Potential SRE (Data Deficient) that is currently not known from elsewhere.
Isopoda	*Pygolabis* `sp. Biologic-ISOP035`	YC1 and YC3 (hyporheos)	Potential SRE. Currently known only from Yandicoogina Creek.
Water mite	*Wandesia* `sp. Biologic-ACAR009`	YC1 and YC3 (hyporheos)	Pilbara endemic known only from springs and permanent pools at Marillana Creek, Yandicoogina Creek, Weeli Wolli Creek and Karijini Nation Park.
Dragonflies and damselflies	*Ictinogomphus dobsoni*	YC4 (surface waters)	Near Threatened IUCN Red List.
	Hemicordulia koomina	YC4 (surface waters)	Vulnerable IUCN Red List.
	Austroagrion pindrina	YC3 (surface waters)	Vulnerable IUCN Red List.

Sources: Biologic 2024c and 2023d

9.4 Potential environmental impacts

BHP has considered the potential impacts outlined in the EPA's Environmental Factor Guideline - Terrestrial Fauna (EPA 2016c) and considers that those relevant to the Proposal are:

- loss of terrestrial fauna habitat and significant fauna individuals/records from clearing (direct)
- changes to and loss of fauna habitats from changes to groundwater regimes (indirect)
- changes to fauna habitats from changes to surface water regimes (indirect)
- disturbances to fauna from increased light, noise, vibration and dust (indirect)
- mortality or injury from vehicle strike and/or interactions with machinery/infrastructure (indirect)
- disturbances to fauna from invasive or introduced species (indirect).

Given the high level of fragmentation that already occurs within the Development Envelope, no additional fragmentation is expected to occur.

BHP has focused the discussion on potential direct and indirect impacts of the Proposal within the Indicative Footprint of the Development Envelope (see Table 2-4). Consideration of potential impacts to terrestrial fauna values extending beyond the boundaries of the Development Envelope (i.e. Flat Rocks) have been considered, where relevant and where the cause is likely to be attributed toward BHP activities alone. BHP has also outlined the combined effects which implementation of the Approved Proposal and the Proposal (i.e. the Combined Proposal) might have on the environment. Unless specified otherwise, the potential impacts discussed in this section are unmitigated (i.e. potential impacts before mitigation measures are applied, if required).

Cumulative impacts to Terrestrial Fauna are addressed in Section 16 and include a discussion of cumulative impacts outside the Development Envelope (where relevant and where causation is still unclear nor can be attributed to regional or a single mining operation or climate process, i.e. Yandicoogina Gorge).

9.4.1 Loss of fauna habitats and/or significant fauna individuals/records from clearing

9.4.1.1 Fauna habitats

Clearing of native vegetation will result in direct loss of habitat for vertebrate and SRE invertebrate fauna species within the Indicative Footprint of the Development Envelope.

Proposal

The Proposal will occur within an Indicative Footprint of 125 ha and will require clearing of no more than 95 ha of fauna habitat (Table 9-9). This includes clearing of up to 72 ha of critical and/or supporting habitat for significant fauna species including the Pilbara Olive Python, Northern Quoll, Pilbara Leaf-nosed Bat, Ghost Bat and Grey Falcon (Table 9-10). Table 9-9 identifies the extent of clearing for the Proposal on each habitat type mapped within the Development Envelope whereas Table 9-10 shows the breakdown of clearing critical and supporting habitat for significant fauna species as part of the Proposal.

Combined Proposal

It is not possible to assess the potential impacts of the Combined Proposal on each individual fauna habitat type within the Development Envelope as the majority of clearing for the Approved Proposal was undertaken prior to detailed fauna habitat mapping being undertaken (Biologic 2014 and 2018). However, the Combined Proposal will result in total clearing of 4,653 ha of fauna habitat within the Development Envelope (Table 9-9). This includes 4,558 ha approved for clearing under MS679, of which 4,492 ha has already been cleared for the Approved Proposal

and approximately 66 ha of clearing remains, and an additional 95 ha proposed to be cleared as part of this Proposal (Table 9-9).

Table 9-9: Terrestrial Fauna - potential impacts to fauna habitat types

Habitat type	Current extent of habitat present within Development Envelope (ha)	Area to be cleared in Indicative Footprint for the Proposal (ha)	% to be cleared from the Development Envelope for the Proposal	% remaining in Development Envelope after proposed clearing	Critical habitat	Supporting habitat
Wetland	11.8	7.1	60.07	39.93	Yes	Yes
Major Drainage Line	433.3	17.6	4.07	95.93	Yes	Yes
Breakaway/Cliff	9.7	0.0	0.00	100	Yes	Yes
Hardpan Plain	3.7	0.0	0.00	100	Yes	Yes
Medium Drainage Line	11.5	0.3	2.54	97.39	Yes	Yes
Mulga Woodland	24.2	0.0	0.00	100	Yes	No
Drainage Area/ Floodplain	345.5	25.4	7.35	92.65	Yes	Yes
Sandy/Stony Plain	38.3	0.0	0.00	100	Yes	Yes
Undulating Low Hills	221.8	0.02	0.00	100	No	Yes
Stony Plain	13.0	0.1	0.77	99.23	Yes	Yes
Hillcrest/Hillslope	7,093.4	21.2	0.30	99.70	Yes	Yes
Minor Drainage Line	49.0	0.1	0.20	99.80	No	No
Calcrete Plain	1.8	0.0	0.00	100	No	No
Sand Plain	15.7	0.0	0.00	100	No	No
No Survey Data*	72.6	0.2	0.27	99.73		
Cleared/disturbed**	135.9	22.4	16.48	83.52		
Total fauna habitats	**8,481.2**	**94.4**	**1.11**	**98.89**		
Cleared (Approved Proposal; MS 679)***	4,492	30.21	0.67	99.33		
Other clearing****	184.56	0.13	0.07	99.93		
Total cleared areas	**4,676.56**	**30.34**	**0.65**	**99.35**		
Total area (fauna habitats + cleared areas)	**13,157.42**	**124.7**	**0.95**	**99.05**		

[1] represents the % of the current extent present in the Development Envelope to be cleared.
* These are periphery areas of the Development Envelope that have minimal or no survey information available due to survey boundary misalignment and age of surveys, with mining commencing at Yandi in 1991. Collectively, these areas account for <1% of the Development Envelope.
** cleared/disturbed areas do not include the Approved Proposal.
*** note that an additional 66 ha remains to be cleared under MS679.**** Other clearing relates to non-BHP clearing.

Table 9-10: Terrestrial Fauna – clearing of critical and supporting habitat for significant fauna as part of the Proposal

Fauna habitat type	Area to be cleared in Indicative Footprint for the Proposal (ha)	Pilbara Olive Python		Ghost Bat[1]		Grey Falcon		Northern Quoll		Pilbara Leaf-nosed Bat	
		Critical habitat*	Supporting habitat	Critical habitat	Supporting habitat	Critical habitat	Supporting	Critical habitat	Supporting	Critical habitat	Supporting
Wetland	7.1	✓		✓					✓		✓
Major Drainage Line	17.6	✓		✓		✓			✓		✓
Medium Drainage Line	0.3		✓	✓			✓		✓		✓
Drainage Area/ Floodplain	25.4			✓		✓			✓		✓
Stony Plain	0.1			✓					✓		✓
Hillcrest/Hillslope	21.2			✓					✓		✓
Undulating Low Hills	0.02						✓				
Total critical or supporting habitat to be cleared	**71.7**	**24.7**	**0.3**	**71.7**	**0**	**43.0**	**0.3**	**0**	**71.7**	**0**	**71.7**

1 note that all suitable foraging and dispersal habitat for the Ghost Bat has been defined as critical habitat due to a Category 2 cave (CMIN-03) occurring within 12 km; however, this cave is currently under review and may have its category downgraded. If this cave is downgraded, then all the habitats would be downgraded to supporting habitat as no other Category 2 caves occur within the 12 km radius (see Section 9.3.2.4; Biologic 2024b).

9.4.1.2 Habitat features

In addition to the broad fauna habitat types, the Proposal has the potential to impact habitat features such as surface water pools. Whilst there is one cave within the Development Envelope, there are no caves within the Indicative Footprint, with the closest known cave approximately 9 km west of the Indicative Footprint. As such, no direct or indirect impacts to any caves are expected.

Proposal

There is one artificial water pool within the Indicative Footprint associated with the discharge point (Figure 9-4). The Proposal is not expected to impact on this pool, or any of the natural surface water pools within the wider Development Envelope. As such, there is no change to the impacts to water features to that assessed for the Approved Proposal.

Combined Proposal

There is no change to the impacts to surface water features to that assessed for the Approved Proposal.

9.4.1.3 Significant fauna individuals/records

The main impact of clearing to significant fauna species is from the loss of critical and/or supporting habitat (see Section 9.4.1.1 and Table 9-10); however, clearing activities also have the potential to result in the direct loss of some vertebrate and SRE invertebrate fauna records including individuals that may be present within the Indicative Footprint either from interactions with clearing machinery causing mortality or injury, or from the displacement of individuals into nearby territories. Whilst many native fauna species are highly mobile and capable of moving larger distances, many species have poor dispersal abilities. Many fauna species will not move out of the way of large machinery or vehicles, but will retreat or hide in the direct line of clearing, such as the Western Pebble-mound Mouse which nests in underground burrows where they may retreat and hide, or are slow-moving, such as the Pilbara Olive Python, and may not be able to get out of the way of clearing machinery. Displacing individuals into nearby territories can leave the displaced individuals, as well as the resident individuals exposed to increased predation and competition for resources.

Proposal

As described in Section 9.3.2.3, five significant vertebrate fauna species have been recorded in the Development Envelope (Table 9-11:). Of these, two significant species are known to occur within the Indicative Footprint: Pilbara Olive Python and Western Pebble-mound Mouse. There are two historical records of the Pilbara Olive Python, recorded from indirect evidence (skin sloughs and scats) in 2010 within the Indicative Footprint; however, the species has not been recorded since. Critical and supporting habitat for the Pilbara Olive Python occurs in the Indicative Footprint, and so it is possible that the species could be present during clearing activities. Based on the Indicative Footprint, the Proposal will clear 1.1% of known Pilbara Olive Python records in the Pilbara (Table 9-11:).

Based on recent survey effort, there are no Western Pebble-mound Mouse mounds within the Indicative Footprint and so no mounds will be impacted by clearing activities associated with the Proposal. Whilst individual mice could occur within the Indicative Footprint during clearing, given the existing level of disturbance and activity, this is considered unlikely.

As described in Section 9.3.2.4, two Uncertain SRE species only known from the Development Envelope occur within the Indicative Footprint: *Afrosternophorus* `BPS506` and *Beierolpium* 8/4 small `BPS505' (Table 9-6; Figure 9-9). Based on the Indicative Footprint, the Proposal will clear 50% of known records of *Afrosternophorus* `BPS506` and 25% of known records of *Beierolpium* 8/4 small `BPS505' (Table 9-11); however, both species are also known from locations outside the area proposed for clearing and occur in widespread habitat types that extend beyond the areas proposed for clearing.

Combined Proposal

The combined effect of clearing for the Combined Proposal will be direct impacts to 2.7% of known records of the Pilbara Olive Python, 0.1% of known records of the Northern Quoll and 3% of known records of the Western Pebble-mound Mouse (Table 9-11). All three species were previously assessed for the Approved Proposal. Additional impacts to significant fauna species associated with clearing activities will be limited to the Proposal, which is described above.

The combined effect of the Combined Proposal on individual SRE invertebrate species will not be greater than that described above for the Proposal, given that additional clearing is limited to the Proposal (noting that Uncertain SRE species that occur within the Indicative Footprint, also occur in areas outside the proposed impact areas).

Table 9-11: Terrestrial Fauna - potential impacts to significant fauna records

Species	Known records within Pilbara[1]	Records within Development Envelope	% of known Pilbara[1] records within Development Envelope	Records within Approved Proposal	Records in Indicative Footprint	% of known records (Proposal alone)	% of known records (Combined Proposal)
Threatened fauna							
Pilbara Olive Python (*Liasis olivaceus barroni*)	187	6	3%	3	2	1.1	2.7
Northern Quoll (*Dasyurus hallucatus*)	1,719	2	0.1	2	0	0	0.1
Migratory fauna							
Common Sandpiper (*Actitis hypoleucos*)[2]	-	8	-	0	0	0	0
Priority fauna							
Western Pebble-mound Mouse (*Pseudomys chapmani*)	3,684	1,039	28	112	0	0	3
Other specially protected fauna							
Peregrine Falcon (*Falco peregrinus*)	29	1	3.5	0	0	0	0
SRE invertebrate fauna[2]							
Afrosternophorus `BPS506`	0	2	100	0	1	50%	50%
Beierolpium 8/4 small `BPS505'	0	4	100	0	1	25%	25%

1 Records are based on the BHP database current as at the time of writing, comprising of BHP survey data and publicly available data. Records indicate location rather than number of individuals. Multiple individuals may be present at a single record.

2 Regional records not available. Calculations are based on number of known records within the Development Envelope.

9.4.2 Changes to or loss of fauna habitats from changes to groundwater regimes

As discussed in Section 7.4.2, the Proposal requires the abstraction of groundwater to enable below water table mining, in addition to what is authorised for the Approved Proposal. Groundwater abstraction has the potential to lower groundwater levels which can subsequently alter the health or structure of fauna habitats by causing a decline in vegetation health, particularly to fauna habitats containing GDV, or by lowering water levels in groundwater dependant surface water pools. Groundwater dependant surface water pools occur within the Flat Rocks area within and extending beyond the Development Envelope (see Section 7.3.3.1 and Section 9.3.2.6), whilst known and potential areas of GDV (see Section 8.3.2.1) also occur within, and extending beyond, the Development Envelope. Groundwater dependant surface water pools are associated with Major Drainage Line fauna habitat, whereas GDV is associated with the Wetland, Major Drainage Line, and Drainage Area/Floodplain fauna habitats. These habitats provide critical and/or supporting habitat for a number of significant fauna species including Pilbara Olive Python, Northern Quoll, Ghost Bat, Pilbara Leaf-nosed Bat and Grey Falcon (Section 9.3.2.1 and Section 9.3.2.4) whilst the groundwater dependant surface water pools also provide habitat for a high diversity of aquatic fauna, including new and potentially restricted species (see Section 9.3.2.6).

Proposal

There are no groundwater dependant surface water pools present within the drawdown contours of the Proposal and so no impacts to surface water pools or aquatic fauna as a result of groundwater drawdown from the Proposal alone are expected to occur (see Section 7.4.2.1).

Indirect impacts to GDV, and associated terrestrial fauna habitats, from changes to groundwater levels have the potential to occur as there is approximately 3.6 ha of vegetation likely to contain GDV within the 0-20 m drawdown contours of the Proposal (Figure 8-13 in Section 8.4.2). This includes Artificial Wetland, Major Drainage Line and Drainage Area/Floodplain habitat which provide critical or supporting habitat for significant fauna including the Pilbara Olive Python, Northern Quoll, Ghost Bat, Pilbara Leaf-nosed Bat and Grey Falcon.

Combined Proposal

The Combined Proposal has the potential to result in the degradation or loss of terrestrial and aquatic fauna habitats associated with GDV and/or groundwater dependant surface water pools within, and extending beyond, the Development Envelope (i.e. Flat Rocks and the Marillana Creek Pools) based on the predicted extent of groundwater drawdown (refer to Section 7.6.2). As described in Section 7.4.2.1, the predicted unmitigated impacts to environmental receptors by 2029 are as follows:

- Drawdown in the CID adjacent to Flat Rocks and MARC5 pool is estimated to be approximately 15 m. Measured groundwater levels at Flat Rocks estimate current drawdown is approximately 12 m; this represents a decline in groundwater levels by a further 3 m.
- Drawdown in the CID is estimated to propagate 10 km west of the Development Envelope and potentially impact groundwater levels in MARC2 where the CID discharges directly into the pool. For pools MarC3 and MarC4, drawdown of 1-2 m in the Basement is predicted (noting the CID does not underly these pools). The presence of these pools is unlikely to be impacted by dewatering as the main mechanism for supplying water to the pools is surface water flow in Marillana Creek.

Dewatering for the Approved Proposal at W0 and W1 has already lowered groundwater levels in the CID aquifer upgradient and off tenement at Flat Rocks (refer to Section 7.4.2.1 and Section 8.6.2). As a result, a decline in GDV health (and associated terrestrial fauna habitats) has historically and recently been observed within the central and western portions of the Development Envelope, and continues to be observed off-tenure at Flat Rocks. Monitoring during 2020-2022 within the Development Envelope demonstrated that tree health had improved for the most part; however, more recent monitoring (2023-2024) has recorded some recent potential tree deaths (6 trees) within the western section of the Development Envelope (see Section 8.4.2). BHP considers that drier than usual conditions

are at least partially responsible for these observations including below average rainfall and lack of streamflow along Marillana Creek, and will continue monitoring these areas in accordance with the Ministerial conditions (see Section 8.4.2; Appendix 3). Historical impacts to riparian vegetation and GDV within the Development Envelope have been accounted for within the land disturbance reporting total for MS679, where a total of 30 ha of riparian vegetation was reported to have died (FY2020 AER; BHP 2020a; see Section 8.4.1.1). However, a decline in the health of GDV (and the associated fauna habitats) continues to be observed at Flat Rocks where approximately 2 ha of GDV has recently died (Section 8.4.2).

In addition, aquatic ecosystem monitoring indicates that surface water levels within some of the Marillana Creek Pools appear to be declining over time (Biologic 2024d). The cause of these observations is likely due to low streamflow in Marillana Creek and declining groundwater levels, likely due to a combination of reduced rainfall, reduced streamflow and dewatering activities.

In response to the above-mentioned observations, BHP has commenced mitigation actions in an attempt to recover groundwater levels in the western section of the Development Envelope and off-tenure at Flat Rocks. This mitigation included a dewatering reduction trial that commenced in 2022 and ceasing dewatering at W0 altogether in 2023 (refer to Section 7.5.2.2). BHP is currently investigating water level recovery in the W0 pit to support upgradient water levels, off tenure reinjection and an investigation into the feasibility of a low permeability barrier to slow groundwater flow into the W1 Pit and force water to mound within the CID channel upstream within the Flat Rocks area (refer to Section 7.5.2.2).

Groundwater drawdown associated with the Combined Proposal, if not managed effectively, has the potential to result in further decline or loss of GDV and the associated terrestrial fauna habitats, and a decline in groundwater dependant surface water pool levels which includes critical and supporting habitat for significant terrestrial fauna and habitat for significant aquatic fauna including new and potentially restricted species within the Development Envelope and off-tenure at Flat Rocks. Whilst groundwater abstraction associated with the Approved Proposal has reduced in recent times the Development Envelope, the Combined Proposal is predicted to result in an additional 3 m drawdown of groundwater within the Flat Rocks area. This will reduce levels from 12 m currently to 15 m (described in detail in Section 7.6.2).

9.4.3 Changes to fauna habitats from changes to surface water regimes

The excavation of pits, construction of infrastructure, and dewatering and the subsequent discharge of surplus water, all have the potential to alter surface water regimes which can result in degraded or modified fauna habitats including habitats for both terrestrial and aquatic fauna. Altered surface water regimes may include changes to water quality, quantity, flow rates, physical or biological attributes and/or the formation of pit lakes.

Proposal

Dewatering for the Proposal will result in the discharge of surplus water into Marillana Creek, in addition to discharge already being undertaken for the Approved Proposal along the same creek line (Section 7.4.1.1). Surplus water discharge is authorised at two locations along Marillana Creek at MCSW040 (WYAN-10; main discharge; see Figure 8-13 and Figure 9-4) and MCSW031 (supplementary, located towards the centre of the Development Envelope).

Discharge to Lower Marillana Creek is currently approved under EP Act licence L6168/1991/11 and has been operating for approximately 15 years. Discharges from the Approved Proposal have created a short section of permanent flow which has resulted in changes to the composition of riparian vegetation and creating a Wetland (artificial) habitat which provides critical and supporting habitat for significant terrestrial fauna (Section 9.3.2.1) and which supports a high diversity of aquatic fauna (Section 9.3.2.6).

The proposed discharge rate for the Approved Proposal is a maximum of 26 ML/day and will be via the existing infrastructure at MCSW040 (WYAN-10; main discharge) for which the impacts were assessed and approved under

MS 679. The proposed discharge rate for surplus water from the Proposal is within the licence requirements as described in Section 7.4.1.

Wetting front limits have not previously been set for this location, however the maximum recorded was 9 km in 2008, and more recently 2.5 km in 2023 (Section 7.5.5). Monitoring of the vegetation downstream of the discharge location, within the Development Envelope, has shown no significant negative impacts on riparian vegetation health associated with surplus water discharge since 2009; however, there is anecdotal evidence from Traditional Owners that riparian vegetation (and the associated fauna habitats) further downstream and off BHP tenure, has declined in heath and composition since discharge volumes and the wetting front have decreased. The surface discharge from the Proposal will increase the flow of water along Marillana Creek, increasing the wetting front up to 9 km. It is not anticipated that flows will increase past the existing 9 km wetting front due to the Proposal.

In addition, the installation of infrastructure including pits, flood bunds and road creek crossings will result in changes to surface water catchments, with the reduction to the Marillana Creek catchment estimated to be approximately 0.01% (2,050 km^2; described further in Section 7.4.1.2).

Combined Proposal

Changes to surface water regimes associated with the Combined Proposal are described in Section 7.4.1. Overall, given that ongoing monitoring of vegetation downstream of the discharge point has shown no negative impacts on vegetation health, no additional changes to fauna habitats from the Combined Proposal are anticipated to occur.

As discussed in Section 7.3.2.2, most of the 15,000,000 tpa of mine dewater (41.1 ML/day) for the Approved Proposal has been historically utilised as part of the mine operations for purposes such as dust suppression and wash down/cleaning. Since 2018, dewatering volumes have declined as the dewatering objective moves from drawing down water levels to maintaining water levels. In FY 2023, total surplus water generated from mine dewatering discharged into Marillana Creek north of the proposed E8 pit (at the discharge point to also be utilised for the Proposal) was 6,732 ML, well within the allowable licensed rate. The discharge of this water is continuous through the year and has created a permanent pool and an associated wetting front. As of June 2023, the wetting front extends downstream approximately 2.5 km from the discharge point to beyond the boundary of the Development Envelope with an associated discharge of approximately 10 ML/day. As described above, the proposed discharge rate for the Proposal (26 ML/day) includes the remaining discharge required for the Approved Proposal, and a maximum discharge of approximately 9,576,983 kL/annum is expected over the life of the Combined Proposal.

9.4.4 Disturbances to fauna due to increased light, noise, vibrations and dust emissions

An increase in noise, light, vibrations and dust emissions resulting from construction and operation of the Proposal has the potential to disturb fauna by altering behaviour including abandonment of an area including dens or burrows, whilst exposure to artificial light can interfere with activities governed by the length of the day including reproduction, dormancy, foraging and migration. High airborne particulate levels (dust) have the potential to irritate the eyes or interfere with vision and affect the ability of individuals to capture prey.

The impacts of increased dust emissions, noise, light, vibrations and dust are likely to be species specific. Potential impacts associated with increased dust, noise and vibrations are likely to be greatest for Pilbara Olive Python and Western Pebble-mound Mouse, whereas artificial light can disorient flying birds (particularly during migration where it can cause them to divert from efficient migratory routes or collide with infrastructure) or alter the foraging behaviour of nocturnal species such as the Northern Quoll, Ghost Bat, and/or the Pilbara Leaf-nosed Bat.

Proposal

The Proposal will result in an increase in light, noise, vibrations and dust; however, given it is located within existing operational areas, any potential impacts on fauna are expected to be minimal.

Combined Proposal

The Combined Proposal will comprise operational mining areas with existing impacts on fauna from mining activities associated with the Approved Proposal as well as mining activities associated with the Proposal. The combined effect will result in an increase to these potential impacts due to the increase in noise, light; however, is not considered to be significantly greater than that assessed for the Approved Proposal given that the Proposal occurs in an area with existing disturbance. The majority of significant species recorded in the proposed Development Envelope are present in low densities and therefore, should disturbances occur, the potential impacts would be limited to individuals only and would not be expected to impact a population.

9.4.5 Mortality or injury from vehicle strike or interactions with machinery / infrastructure

The Proposal will result in an increase in vehicle and machinery activity which has the potential to increase the risk of injury or mortality of fauna from vehicle strike or collisions with machinery or infrastructure during construction and operation of the Proposal. This risk is greater for species that are attracted to roads for basking or foraging activities, or at night when nocturnal fauna actively forage. The use of barbed wire fencing may result in fauna becoming entangled, resulting in injury or mortality.

Proposal

The Proposal will result in an increase in vehicle and machinery activity; however, given it is located within existing operational areas, any additional potential impacts on fauna are expected to be minimal. The Proposal will not result in an increase in the use of barbed wire fencing.

Combined Proposal

The combined effect will result in an increase in risk of vehicle strike or interactions with machinery/infrastructure; however, is not considered to be significantly greater than that previously assessed for the Approved Proposal.

9.4.6 Impact to fauna from invasive or introduced species

Construction and mining activities have the potential to introduce and spread invasive weed species that can potentially alter the condition fauna habitats through changes in the vegetation composition. Habitat clearing can also enhance the ability of feral predators to move through the landscape and prey on native fauna. The displacement of fauna into adjacent territories inhabited by other individuals can result in increased predation and competition for food resources, shelter and breeding sites until equilibrium in the surrounding areas is reached. Construction and operation of mining activities can also introduce and attract feral predators. Introduced fauna species may affect native fauna through direct predation, competition for food and shelter, habitat destruction and the spread of diseases.

Proposal

The Proposal is located within and adjacent to existing operational areas and would therefore not be expected to result in a significant increase in invasive or introduced species.

Combined Proposal

The combined effect to fauna from invasive or introduced species is not expected to be greater than that assessed for the Approved Proposal given the level of existing disturbance within the Development Envelope.

9.5 Mitigation

BHP considers that there are potentially significant impacts to Terrestrial Fauna requiring targeted management measures, specifically in relation to local fauna habitats and significant fauna specifically Pilbara Olive Python, Ghost Bat and Grey Falcon. The proposed mitigation (including standard management practices) for the Proposal is discussed below, including how BHP has used the results of targeted surveys to inform the mitigation hierarchy.

BHP proposes to implement the Yandi Biodiversity Environmental Management Plan (BEMP) (BHP 2025a) to meet the EPA objective for Terrestrial Fauna. The BEMP details the avoidance and mitigation measures for fauna as described below. The BEMP includes the avoidance and minimisation measures currently implemented for the Approved Proposal, as well as revised avoidance and minimisation measures to be implemented for the Combined Proposal, if approved (see Appendix 10).

9.5.1 Avoid

The Combined Proposal has been designed to avoid impacts to significant fauna and/or habitats as far as practical. Key infrastructure components will be installed in historically cleared areas where possible to avoid impacts to fauna. This includes the avoidance of Western Pebble-mound Mouse mounds and Pilbara Olive Python records, where possible.

9.5.2 Minimise

As part of the Combined Proposal, BHP proposes to continue to manage potential impacts to Terrestrial Fauna under the revised BEMP (BHP 2025a) (Appendix 10) as well as implementing standard management practices to minimise impacts associated with increased noise, dust, vibration, light, weeds and feral fauna. Management measures to minimise impacts include (but are not limited to):

- clearing for the Proposal will be limited to a maximum extent of 95 ha of native vegetation to minimise impacts to fauna habitats
- fauna spotters may be utilised where clearing is to be undertaken in critical fauna habitat where recent records of species of significant fauna have been identified
- construction will be mostly undertaken during day-light hours which will minimise impacts to nocturnal fauna species
- the use of barbed wire fencing will be avoided as far as practicable to avoid the potential impact to bats from entanglement in fencing
- if barbed wire fencing is required, reflectors will be installed where appropriate
- all sightings and events involving significant fauna will be identified and captured in WAIOs Event Management System
- appropriate speed limits will be imposed on access roads and construction areas to minimise the risk of vehicle strike or fauna interactions with machinery
- excessive dust will be minimised as far as practical to minimise degradation of fauna habitats
- the Proposal will be operated within the existing groundwater licence limits for surplus water discharge
- the presence of domestic pets or animals on site will be prohibited
- standard hygiene practices will be implemented to minimise introduction and spread of weeds including annual weed control (if required) and vehicle hygiene measures when entering/leaving construction areas.

In addition, BHP propose to develop a Flat Rock Springs Tree Restoration Program in collaboration with DBCA, Kings Park Science and the Banjima People (Elliott and Stevens 2025). Restoration of degraded riparian and GDV will assist in restoring the associated fauna habitats in these areas.

Indirect impacts associated with habitat degradation caused by groundwater drawdown will be monitored and managed in accordance with the updated MCWRMP (Appendix 6). BHP proposes further mitigation measures to

address declining surface water levels and tree health and the subsequent decline in terrestrial and aquatic fauna habitats at Flat Rocks (Section 7.5.2.4) including:

- Manage water level recovery in W0 to support upgradient water levels, off-tenure injection in the CID at a location upstream of Flat Rocks (currently being investigated and will require approvals under the EP Act and RiWI Act prior to proceeding)
- Investigation into the feasibility of a low permeability barrier to slow groundwater flow into W1 Pit and force water to mound within the CID channel upstream.

9.5.3 Rehabilitate

Rehabilitation and closure at the Yandi Hub will continue to be managed through the Yandi MCP (BHP 2025b) (Appendix 5). The Yandi MCP covers the Approved Proposal and has been updated to include this Proposal.

Management approaches relating to rehabilitation of terrestrial fauna values for the Proposal include:

- undertaking progressive rehabilitation
- constructing fauna habitats into rehabilitated areas at closure, where practicable
- supplementary replanting (where required).

9.5.4 Other statutory decision-making processes

BHP's view is that there is no other statutory decision-making process to mitigate the potential environmental impacts of the Proposal on Terrestrial Fauna, considering the EPA's Taking decision making processes into account in EIA: Interim Guidance (EPA 2021b).

9.6 Assessment and significance of residual impacts

9.6.1 Loss of fauna habitat and/or significant fauna individuals/records from clearing

The Proposal includes some flexibility to modify the final location of elements of the Proposal within the Indicative Footprint; however, no more than 95 ha of fauna habitat will be cleared (as an authorised extent limit) additional to what has previously been cleared as part of the Approved Proposal (4,492 ha).

9.6.1.1 Fauna habitats

Based on the Indicative Footprint, no more than 95 ha of fauna habitat will be cleared for the Proposal which represents 1.11% of the current extent of fauna habitats present within the Development Envelope (Table 9-9). This includes clearing up to 72 ha of critical or supporting habitat for significant fauna species including the Pilbara Olive Python, Ghost Bat, Northern Quoll, Pilbara Leaf-nosed Bat and Grey Falcon. When considering the Combined Proposal, clearing of up to 4,653 ha is not expected to significantly affect the regional availability of any of the fauna habitats present within the Development Envelope given that the habitats to be cleared are widespread and extend beyond the boundaries of the Development Envelope. Offsets for clearing under the Approved Proposal have previously been provided and are described in further detail in Section 14.

Impacts of habitat clearing to significant fauna recorded or considered to have a moderate likelihood of occurring within the Development Envelope are described below. Significant residual impacts to recorded species such as the Pilbara Olive Python and Northern Quoll are anticipated due to the loss of critical and/or supporting habitat and will require offsets (Section 14). Significant residual impacts to species not recorded but considered to have a moderate likelihood of occurring within the Development Envelope such as the Ghost Bat, Pilbara Leaf-nosed Bat and Grey

Falcon are also anticipated due to the loss of critical and/or supporting habitat that requires an offset (refer to Section 14).

Pilbara Olive Python

Based on the Indicative Footprint, the Proposal will result in the direct removal of approximately 25 ha of suitable habitat for the Pilbara Olive Python. This includes 24.7 ha of critical habitat (Wetland and Major Drainage Line) and 0.3 ha of supporting habitat (Medium Drainage Line) for the Pilbara Olive Python. Clearing of critical and supporting habitat is anticipated to represent a significant residual impact to the Pilbara Olive Python that will require an offset (see Section 14).

Northern Quoll

Based on the Indicative Footprint, the Proposal will result in the direct removal of up to 72 ha of supporting habitat for the Northern Quoll within the Wetland, Major Drainage Line, Medium Drainage Line, Drainage Area/ Floodplain, Stony Plain and Hillcrest/Hillslope habitats. Clearing of supporting habitat is anticipated to represent a significant residual impact to the Northern Quoll that will require an offset (see Section 14).

Common Sandpiper

Based on the Indicative Footprint, the Proposal will result in the direct removal of approximately 24.7 ha of suitable habitat within the Major Drainage Line and Wetland habitat. Clearing of suitable habitat for this Proposal or the Combined Proposal is not considered to represent a significant residual impact for this species given that the species is only an occasional visitor and given the extent of suitable habitat remaining within the Development Envelope (i.e. 420.4 ha).

Western Pebble-mound Mouse

Based on the Indicative Footprint, the Proposal will result in the direct removal of approximately 21.3 ha of suitable habitat for the species including Stony Plain, Undulating Low Hills and Hillcrest/Hillslope habitats (Table 9-9). A further 7,327 ha of suitable habitat will remain throughout the Development Envelope, with all three habitats being widespread and common throughout the wider Pilbara region.

Peregrine Falcon

Based on the Indicative Footprint, the Proposal will result in the direct removal of approximately 17.6 ha of suitable habitat within the Major Drainage Line habitat (Table 9-9). However, given that the species which is capable of utilising a variety of habitats and only one historical record is known from the Development Envelope, this is not considered to represent a significant residual impact.

Ghost Bat

The Ghost Bat has not been recorded within the Development Envelope. However, the Proposal will result in the direct loss of a total of 72 ha of critical habitat within the Wetland, Major Drainage Line, Medium Drainage Line, Drainage Area/ Floodplain, Stony Plain and Hillcrest/Hillslope habitats present within the Indicative Footprint (refer Table 9-5 in Section 9.3.2.4). Clearing of critical habitat is anticipated to represent a significant residual impact to the Ghost Bat that requires an offset (Section 14).

Pilbara Leaf-nosed Bat

The Pilbara Leaf-nosed Bat has not been recorded from the Development Envelope and no critical habitat for this species is present within the Indicative Footprint; however, the Proposal will result in clearing approximately 72 ha of supporting habitat within the Wetland, Major and Medium Drainage Lines, Drainage Area/Floodplain, Stony Plain and Hillcrest/Hillslope habitats present within the Indicative Footprint. Clearing of supporting habitat is anticipated to represent a significant residual impact for this species that requires an offset (Section 14).

Grey Falcon

The Grey Falcon has not been recorded from the Development Envelope and there are no potential direct impacts to this species based on occurrence of known records. However, the Proposal will result in the clearing approximately 43 ha of critical habitat within the Major Drainage and Drainage Area/Floodplain habitats and 0.3 ha of supporting habitat within Medium Drainage Line and Undulating Low Hills habitats. Clearing of critical and supporting habitat is anticipated to represent a significant residual impact to the Grey Falcon that requires an offset (Section 14).

Australian Painted Snipe

The Australian Painted Snipe has not been recorded from the Development Envelope and there is no critical habitat present for the species (refer to Section 9.3.2.4). The Proposal will result in the direct removal of approximately 25 ha of suitable habitat within the Wetland and Major and Medium Drainage Line habitats; however, this is unlikely to represent a significant impact given that this species is likely to only be an occasional visitor.

Migratory waterbirds

Neither the Common Greenshank or the Glossy Ibis have been recorded from the Development Envelope and there is no critical habitat present for either species (refer to Section 9.3.2.4). The Proposal will result in clearing approximately 25 ha of suitable habitat for these species including Wetland, and Major and Medium Drainage Line habitats; however, this is unlikely to be significant for either species given the small extent proposed for clearing and extent that will remain throughout the Development Envelope and wider region.

Fork-tailed Swift

The Fork-tailed Swift has not been recorded within the Development Envelope but has a moderate likelihood of occurring due to its high mobility and wide range in distribution. While the species may sporadically fly over the Development Envelope, it would not be dependent on any of the fauna habitats within the Development Envelope given that it exclusively forages in the air. Due to its extensive foraging range, aerial foraging habits and its non-breeding status within Australia, it is considered that there will be no significant residual impact to this species from either the Proposal or Combined Proposal.

Priority listed species

A total of 43.4 ha of suitable habitat for Priority listed species (Pilbara Barking Gecko, Unpatterned Robust Slider, (Robertson Range), Brush-tailed Mulgara and Letter-winged Kite) will be directly removed as a result of the Proposal. None of these species have been recorded within the Development Envelope, despite numerous surveys over multiple years. At least 818 ha of suitable habitat will remain throughout the Development Envelope. No significant residual impacts to these species are expected to occur as a result of the Proposal.

SRE invertebrate fauna

Two Uncertain SREs have been recorded within the Indicative Footprint where they may be subject to impacts associated with clearing: *Beierolpium* 8/4 small `BPS505` and *Afrosternophorus* `BPS506' (Table 9-11; Figure 9-9). However, neither species is restricted to the Indicative Footprint with both species also being known from sites outside the proposed areas of impact (Figure 9-9). Whilst both species are currently only known from the Development Envelope, both were recorded in widespread, extensive habitat types (i.e. Major Drainage Line and/or Drainage Area/Floodplain habitat) and are considered likely to have wider distributions than currently known (Bennelongia 2024a). Approximately 415.7 ha of Major Drainage Line habitat and 338.15 ha of Drainage Area/Floodplain habitats will persist throughout the Development Envelope and continue to provide suitable habitat for these species. Based on the above, impacts to these two Uncertain SRE species associated with clearing for the Proposal alone or the Combined Proposal are unlikely to be significant.

The remaining 17 Potential and Uncertain SRE species only known from the Development Envelope were recorded outside the Indicative Footprint and outside the existing disturbance areas (Table 9-6 and Figure 9-9 in Section

9.3.2.5). In addition, these species are considered unlikely to be restricted to the Development Envelope as they either occur in widespread habitats that extend beyond the boundaries of the Development Envelope, or they were recorded from multiple sites/habitat types, indicating that they are not restricted by habitat type (Bennelongia 2024a). As such, there are no anticipated significant residual impacts to these 17 Potential and Uncertain SRE species only known from the Development Envelope as a result of the Combined Proposal.

9.6.1.2 Habitat features

As discussed in Section 9.4.1.2, there are no predicted impacts to water features additional to those already assessed for the Approved Proposal and therefore, no significant impacts to terrestrial or aquatic fauna habitat features as a result of clearing for the Proposal or the Combined Proposal.

9.6.1.3 Significant fauna individuals/records

Clearing of significant fauna records for the Proposal is not considered to be significant, given that the records to be cleared represent less than 1% of known records in the Pilbara and comprise indirect observations such as scats, tracks or skin sloughs rather than stationary individuals, dens, burrows or mounds.

Clearing activities for the Proposal have the potential to cause mortality or injury to individuals of significant fauna that may be present within the Indicative Footprint during clearing; however, given that all the significant fauna recorded or with a moderate likelihood of occurring are mobile and/or present at low densities (if at all), any incidents would be restricted to individuals and unlikely to impact any significant species at a population level. Clearing will be clearly demarcated in the field and restricted to that necessary for implementation of the Proposal (BHP 2025a; Appendix 10). Overall, impacts to significant fauna individuals or records as a result of the Proposal are not expected to be significant. When considering the Combined Proposal, additional impacts to significant species individuals or records are confined to clearing activities associated with the Proposal alone (described above) and unlikely to be significant.

9.6.2 Changes to and loss of fauna habitats from changes to groundwater regimes

Dewatering in the E8 pit for the Proposal will not increase the total volume of authorised dewatering across the Development Envelope, and no increase to the existing licence to take groundwater (GWL89501) is proposed; however, dewatering for the Proposal alone will introduce groundwater drawdown to the south-eastern portion of the Development Envelope for the first time. Whilst there are no groundwater dependant water pools present within the groundwater drawdown contours of the Proposal, there is Wetland and Major Drainage Line fauna habitat that contain GDV within the 3.6 ha that falls within the 0-20 m drawdown contours of the Proposal (Figure 8-13). These habitats provide critical and supporting habitat for significant fauna that have the potential to be degraded by declining groundwater levels due to them containing GDV (see Section 8.4.2), Whilst historical monitoring has shown a decline in GDV and tree health in some areas of the Development Envelope, recent monitoring has shown positive trends for the health of riparian vegetation and GDV along Marillana Creek (excluding the impacts from recent fires and below average rainfall), particularly in and around the artificial discharge point within the Indicative Footprint (refer to Section 8.4.2). Whilst it is possible that some of the fauna habitats associated with GDV may experience a decline in condition due to groundwater drawdown; the proposed surplus water discharge along Marillana Creek is predicted to counterbalance the drawdown and maintain groundwater levels within this area (refer to Section 8.6.2). The Proposal alone is therefore not expected to result in a significant change or loss of terrestrial or aquatic fauna habitat associated with changes to groundwater regimes.

Dewatering for the Combined Proposal will introduce groundwater drawdown to the south-eastern portion of the Development Envelope for the first time, as well as continue to drawdown groundwater in areas west of the Development Envelope boundary, where an additional 3 m of drawdown is predicted to occur in and around the Flat Rocks area (refer to Section 7.4.2.1). As described in Section 9.4.3, approximately 2 ha of riparian vegetation/GDV has recently died at Flat Rocks as a result of dewatering for the Approved Proposal (described in detail in Section 7.4.2.1 and Section 8.6.2). This has subsequently resulted in the degradation of the Major Drainage Line fauna

habitat associated with this area. Major Drainage Line habitat is critical and supporting habitat for significant fauna such as the Pilbara Olive Python, Northern Quoll, Ghost Bat, Pilbara Leaf-nosed Bat and Grey Falcon. In addition, ongoing aquatic ecosystem monitoring undertaken across the Marillana Creek Pools has detected a decline in surface water pool levels and a reduction in aquatic species richness since 2020 (Biologic 2024d). The cause of these observations is likely due to low streamflow in Marillana Creek and declining groundwater levels. Below median streamflow has been recorded at DWER's Marillana Creek Flat Rocks Gauging Station (708001) for most years between 2015 and 2024, with 2023 being the lowest year on record. The gauging station is located between MarC5 and MarC6 and provides a good representation of streamflow in the pools. There are no groundwater bores associated with the pools; however, regional groundwater bores have shown a gradual decline for a number of years due to a combination of reduced rainfall, reduced streamflow and dewatering activities. As outlined in Section 7.3.7, dewatering drawdown due to Yandi Operations has caused drawdown in the pools closest to the development envelope (MARC5 & 6) between 2011 and 2022 with slight recovery noted from 2022 to early 2025, with the degree of impact from dewatering reducing with distance to the west.

In response to the above-mentioned observations, BHP has commenced mitigation actions aimed at recovering groundwater levels in the area including a dewatering trial and ceasing dewatering at W0. Ceasing dewatering at W0 has resulted in a water level recovery of over 18 m at the tenure boundary and has been effective in stopping the decline of groundwater off tenure at Flat Rocks. Water levels at the HYW0002M monitoring bore have begun to recover and are currently 3 m below pre-development groundwater levels. BHP is proposing additional mitigation measures to further abate historical and potential additional groundwater drawdown and subsequent decline in GDV / fauna habitat health and surface water pools levels including off-tenure injection in the CID at a location upstream of Flat Rocks and investigation into the feasibility of a possible low permeability barrier to slow groundwater flow into the W1 Pit and force water to mound within the CID channel upstream (if required; see Section 7.5.2.2). BHP will also undertake rehabilitation/replanting at a later date, once groundwater levels have recovered to suitable levels. Through these mitigation actions, no further drawdown due to dewatering for the Combined Proposal is expected at Flat Rocks and the MarC5 Pool, whilst groundwater levels near MarC1, MarC2, MarC3, and MarC4 pools will be returned and maintained within 3-4 m of pre-mining groundwater levels consistent with trigger and threshold values in the MCWRMP (see Section 7.6.2.1). Given that no further decline in GDV, or the associated fauna habitats, or surface water pool levels is anticipated, and that groundwater levels will be recovered and maintained at pools MarC1, MarC2, MarC3 and MarC4, no significant residual impacts to terrestrial or aquatic fauna as a result of groundwater drawdown associated with the Combined Proposal are expected. However, the decline and loss of approximately 2 ha of GDV (and associated fauna habitats) that has been observed at Flat Rocks to date is recognised as a significant residual impact as this represents critical and/or supporting habitat for significant fauna which will require an offset (refer to Section 14). BHP also acknowledges the historical and potential future impacts are considered significant to the Banjima People and further assessment regarding culturally significant impacts are described in Chapter 11 – Social Surroundings.

9.6.3 Changes to fauna habitats from changes to surface water regimes

Impacts associated with changes to surface water regimes are described in detail in Section 7.6.1. Discharge to Lower Marillana Creek will occur at the existing discharge location in use at the Yandi mine which has shown no significant negative impacts on terrestrial and/or aquatic fauna habitats within the Development Envelope from surplus water discharge since its establishment in 2009 (Astron 2024a); however, there is anecdotal evidence that riparian vegetation (and the associated fauna habitats) downstream and off BHP tenure, has declined in health and composition since discharge volumes and the wetting front have decreased in recent years. The Proposal is not anticipated to result in any further decline of riparian vegetation, and the associated fauna habitats, from discharge as the proposed discharge rate for the Proposal will be within the licence requirements (L6168/1991/11) and there will be no changes to the existing maximum wetting front reached (9 km), Discharge for the Proposal may assist in restoring fauna habitats associated with GDV/riparian vegetation downstream and off BHP tenure due to increasing the wetting front from the recently observed 2.5 km. The potential for future decline in health of riparian vegetation and fauna habitats following cessation of discharge for the Yandi mine is addressed in the Yandi mine Closure Plan

(BHP 2025b) and includes reference to the potential opportunity to support the riparian vegetation downstream of the discharge location which is currently being explored with Traditional Owners, and if feasible, will be incorporated into future updates to the Yandi mine Closure Plan (BHP 2025b).

Overall, impacts to terrestrial and/or aquatic fauna associated with altered surface water regimes are not expected to be significant given that the reduction in surface water availability from loss of catchment is low and within the natural variation of seasonal runoff, that there will be no increase in the allowed discharge to Marillana Creek from the Proposal.

9.6.4 Disturbances to fauna due to increased light, noise, vibrations and dust emissions

Whilst disturbances associated with an increase in light, noise vibrations and dust are expected as a result of the Proposal, these will be highly localised. Given that the Proposal is located within existing operational areas, impacts are not expected to be greater than is already present for the Approved Proposal. Therefore, the potential impact on fauna due to increased light, noise, vibrations and dust emissions is expected to be minimal.

9.6.5 Mortality or injury from vehicle strike or interactions with machinery / infrastructure

Mortality or injury of native fauna individuals due to an increased risk of vehicle strike or interactions with machinery/infrastructure will be unavoidable; however, management measures will be implemented to reduce this risk, particularly to significant fauna species. The majority of significant species recorded in the proposed Development Envelope are present in low densities and are highly mobile and capable of moving to adjacent habitats which extend throughout the Development Envelope. Any potential impacts associated with vehicle strike or interactions with machinery/infrastructure would be limited to individuals only and unlikely to impact a population. Clearing activities will be restricted to daylight hours, and speed limits imposed on all tracks and roads to reduce the likelihood of vehicle strike. In the event of fauna mortality and injury, the impact would likely be limited to an individual and unlikely to impact populations. As a result, the potential impacts on significant fauna due to clearing activities or interactions with vehicles, machinery and earthworks are unlikely to be significant.

9.6.6 Impact to fauna from invasive or introduced species

The Proposal may result in the spread of weeds or feral fauna into areas of proposed new disturbance (mainly via vehicle movement); however, five species of feral fauna and 28 weed species are already known to occur within the Development Envelope. The Proposal is unlikely to increase the incidence of feral fauna or weed species, given that it occurs adjacent to operational areas and given the management measures proposed. BHP has strict hygiene and waste control measures in place as part of the Approved Proposal which will continue to be implemented for the Proposal. As such, impacts associated with invasive or introduced species is expected to be minimal and unlikely to be significant.

9.6.7 Significant residual impacts

Following the application of the mitigation hierarchy (Section 9.5) and the Residual Impact Significance Model in the WA Offsets Guidelines (Government of Western Australia 2014), BHP considers that there will be significant residual impacts to Terrestrial Fauna associated with clearing and degradation of critical and supporting habitat for significant fauna in the Pilbara bioregion. The detailed assessment of offsets is discussed in Section 14, including how the proposed offset/s will counterbalance the significant residual impact on Terrestrial Fauna values. For the other impacts assessed, BHP considers that the residual impacts are not significant. However, BHP acknowledge the potential impacts of the Combined Proposal, and those that have occurred as part of the Approved Proposal are considered significant to the Banjima People, discussed further in Section 11.

Potential residual impacts to terrestrial fauna values at Yandicoogina Gorge may be due to climate variability, or a combination of climate variability and groundwater drawdown from regional cumulative dewatering by both BHP and third-party operators and are addressed in Section 16.3.

See Section 9.7 for the discussion on the outcomes relating to the identified residual impacts and BHP's proposed assurance (regulation) and monitoring, where required, for Terrestrial Fauna.

9.7 Environmental outcomes

Table 9-12 summarises the environmental outcomes, proposed assurance (regulation) and proposed monitoring (if required) for each residual impact for Terrestrial Fauna. Detail of the proposed monitoring is set out in the Part IV environmental management plans and other relevant statutory decision-making documents discussed in Section 9.5. Table 9-12 demonstrates how the proposed environmental outcomes for the Combined Proposal, together with the proposed regulation and monitoring, are consistent with the EPA's objective for Terrestrial Fauna (Section 9.1).

As required by the EPA's ERD Instructions, for Significant Amendments, BHP has included information about the existing implementation conditions for the Approved Proposal (Appendix 2). BHP considers that the EPA should inquire into the Approved Proposal implementation conditions (relating to Terrestrial Fauna), as provided for under s40AA(3), as part of the assessment of the Proposal under s40 and in the EPA's assessment report required under s44, for the following reasons:

- to contemporise the conditions to reflect the contemporary condition setting approach (in recommended conditions in EPA Reports and MS since early 2023).

As provided for as an option in the EPA's ERD Instructions, BHP has proposed conditions (including outcome-based conditions) for the EPA's consideration, in Appendix 3.

Table 9-12: Terrestrial Fauna - environmental outcomes, proposed regulation and monitoring of the Proposal

Residual impact	Environmental outcome	Proposed regulation (Condition[1] or other statutory decision-making process)	Proposed Monitoring	Consistency with EPA objective
Clearing a total of 72 ha of critical habitat that includes (significant): • Pilbara Olive Python (25 ha) • Ghost Bat (72 ha) • Grey Falcon (43 ha).	Clearing of no more than 72 ha of critical foraging and dispersal habitat in the Pilbara bioregion	**Condition A1-1:** The proponent must ensure that the proposal is implemented in such a manner that the following limitation or maximum extents / capacities / ranges are not exceeded including: • Clearing of no more than 4,653 hectares of vegetation. **Condition B3-2:** The proponent must implement the Yandi Biodiversity Environmental Management Plan (BEMP; Rev 2, BHP 2025a). **Condition B7**: Offsets: • Offsets via contribution to PEOF. **Condition B6**: Decommissioning and Rehabilitation • Implement the MCP (BHP 2025b).	Standard management practices: • internal land disturbance approval process to manage ground disturbance • annual land disturbance reporting against approved limits/extents. **Condition B3-2:** The proponent must implement the Yandi Biodiversity Environmental Management Plan (BEMP; Rev 2, BHP 2025a). **Condition B7:** Offsets: • Impact Reconciliation Procedure and Impact Reconciliation Report. **Condition B6**: Decommissioning and Rehabilitation • Implement monitoring outlined in the MCP (BHP 2025b). Additional management practices are outlined in the BEMP.	The potential significant residual impact of the proposed clearing to critical habitat for the Pilbara Olive Python, Ghost Bat and Grey Falcon can be counterbalanced by offsets via contribution to PEOF, so that the environmental outcome is consistent with EPA's objective.
Clearing up to 72 ha of supporting habitat for (significant): • Northern Quoll (72 ha) • Pilbara Leaf-nosed Bat (72 ha) • Pilbara Olive Python (0.3 ha) • Grey Falcon (0.3 ha).	Clearing of no more than 72 ha of supporting foraging and dispersal habitat in the Pilbara bioregion			The potential significant residual impact of the proposed clearing of supporting habitat for the Northern Quoll, Pilbara Leaf-nosed Bat, Pilbara Olive Python and Grey Falcon can be counterbalanced by offsets via contribution to PEOF, so that the environmental outcome is consistent with EPA's objective.
Clearing two historical records of Pilbara Olive Python which represents 1.1% of known species records within the Pilbara bioregion	The viability of the Pilbara Olive Python population known from the Development Envelope will be maintained.	**Condition A1-1:** The proponent must ensure that the proposal is implemented in such a manner that the following limitation or maximum extents /	Standard management practices: • internal land disturbance approval process to manage ground disturbance • annual land disturbance reporting against approved limits/extents.	The biological diversity and ecological integrity of significant fauna values will be maintained, which is consistent with the EPA's objective for Terrestrial Fauna (Section 9.1)

Residual impact	Environmental outcome	Proposed regulation (Condition[1] or other statutory decision-making process)	Proposed Monitoring	Consistency with EPA objective
Clearing records of two Uncertain SRE species that are only known from the Development Envelope: *Afrosternophorus* `BPS506' and *Beierolpium* 8/4 small `BPS505 (not significant)	The viability of Afrosternophorus `BPS506' and Beierolpium 8/4 small `BPS505 will be maintained given that both species occur in widespread habitat types and are also known from locations outside those to be impacted. The viability of the SRE fauna assemblages known from within the Development Envelope will be maintained.	capacities / ranges are not exceeded, including: • Clearing of no more than 4,653 hectares of vegetation.		
Decline in condition/health of terrestrial and aquatic fauna habitat within the Marillana Creek Pools[2]	No further decline in aquatic fauna habitat at Flat Rocks and MARC5 Pool attributable to drawdown associated with the Combined Proposal.	**Condition B1: Inland Waters** • Implement the Marillana Creek Water Resource Management Plan (BHP 2025c) **Condition B6: Rehabilitation and Decommissioning** • Implement the MCP (BHP 2025b)	**Condition B1: Inland Waters** • Implement the Marillana Creek Water Resource Management Plan (BHP 2025c) **Condition B6**: The proponent must implement monitoring outlined in the MCP (BHP 2025b).	Subject to regulation (EP Act Part V), the environmental outcome is likely to be consistent with the EPA objective for Terrestrial Fauna (Section 9.1)
Loss of 2 ha of critical and supporting habitat associated with riparian vegetation/GDV at Flat Rocks from the Approved Proposal[3]	No further decline in the health or condition of terrestrial fauna habitats at Flat Rocks attributable to drawdown associated with the Combined Proposal.	**Condition B1-1:** The proponent must ensure the implementation of the proposal achieves the following environmental outcomes: (2) no significant changes to the health, extent or diversity of riparian vegetation communities within the development	**Condition B1-1:** The proponent must implement the Marillana Creek Water Resource Management Plan (BHP 2025c) **Condition B6**: The proponent must implement monitoring outlined in the MCP (BHP 2025b).	The biological diversity and ecological integrity of significant fauna values at Flat Rocks will be maintained, which is consistent with the EPA's objective for Terrestrial Fauna (Section 9.1)

Residual impact	Environmental outcome	Proposed regulation (Condition[1] or other statutory decision-making process)	Proposed Monitoring	Consistency with EPA objective
		envelope as a result of changes to groundwater regimes or groundwater quality associated with the implementation of the proposal **Condition B1-2** The proponent must: **(**1) implement the Marillana Creek Water Resource Management Plan (BHP 2025c), with the purpose of ensuring the riparian vegetation communities and habitat environmental outcomes in condition B1-1 (1) and B1-1 (2) are achieved, monitored, substantiated and satisfy the requirements of conditions C2 and condition C3; and (2) implement the Marillana Creek Diversion Management Plan (MCDMP; Rev 0), with the purpose of ensuring the environmental outcomes in condition B1-1 (3) are achieved, monitored, substantiated.	Additional management practices are outlined in the MCWRMP (BHP 2025c)	The significant residual impact of the loss of 2 ha of critical/supporting habitat associated with riparian vegetation within the Development Envelope and off-tenure at Flat Rocks from the Approved Proposal can be counterbalanced by offsets, so that the environmental outcome is consistent with EPA's objective for Terrestrial Fauna (Section 9.1)

1 See Appendix 3 for proposed implementation conditions for the Combined Proposal

2 this is a potential residual impact of the Combined Proposal

3 this is a residual impact of the Approved Proposal

10 Subterranean fauna

10.1 EPA Environmental factor and objective

The EPA's objective for the Subterranean Fauna factor is:

> *To protect subterranean fauna so that biological diversity and ecological integrity are maintained.*

In the context of this objective, ecological integrity is '*the composition, structure, function and processes of ecosystems, and the natural range of variation of these elements*' (EPA 2016e).

10.2 Relevant policy and guidance

BHP assessed this environmental factor considering the following relevant EPA policies and guidance, as outlined in Table 10-1.

Table 10-1: Subterranean Fauna - policy and guidance

EPA (and other State and Commonwealth) policy and guidance	Consideration of EPA policy and guidance
Statement of environmental principles, factors, objectives and aims of EIA (EPA 2023a)	• Identified the relevant environmental factor and objectives to guide the EIA process • Followed the aims of the EIA process • Considered cumulative effects when assessing potential impacts on subterranean fauna • Applied the mitigation hierarchy for subterranean fauna.
Environmental Factor Guideline - Subterranean Fauna factor (EPA 2016e)	• Identified the EPA's objective for subterranean fauna • Applied the relevant considerations for environmental impact assessment • Identified the values of subterranean fauna, and their significance • Identified activities that can impact on subterranean fauna • Considered the links with other environmental factors.
Technical guidance – Subterranean fauna surveys for environmental impact assessment (EPA 2021c)	• Surveys described in Section 10.3.1 were undertaken in accordance with the guidance.

10.3 Receiving environment

10.3.1 Studies and surveys

Subterranean fauna studies began at Yandi in 2005 as part of the Regional Subterranean Fauna Study Monitoring Program (Biota 2006). Since that time, over 11 sampling rounds have been completed and three consolidated survey reports provided as part of the monitoring program (Appendix 14).

Recent subterranean fauna surveys have recently been undertaken in areas associated with the proposed mine pit locations of the Proposal, in areas of groundwater drawdown associated with either the Proposal alone and/or the Combined Proposal and areas outside the proposed impacts (Table 10-2; Bennelongia 2024b, c, 2025). In addition

to the sampling work, 3D habitat modelling and habitat assessment work was recently undertaken to determine the suitability, extent, and connectivity of subterranean habitats within and beyond the Indicative Footprint of the Proposal (Biologic 2024d; Table 10-2). Subterranean fauna surveys were also recently undertaken at Ministers North (Bennelongia 2024c), part of which occurs within the area of predicted groundwater drawdown associated with the Combined Proposal (Figure 10-1). All historical and recent surveys have been completed in accordance with the EPA guidance in place at the time of survey. Collectively, the recent and historical surveys have been used to support the assessment of subterranean fauna for the Proposal. BHP has provided the associated survey reports in Appendix 15 and the survey data as part of the IBSA data package (see Appendix 9).

The recent baseline subterranean fauna sampling survey at Yandi included three sampling phases undertaken at least three months apart, with at least one phase undertaken during the wet season, in accordance with the EPA guidance (EPA 2021c; Bennelongia 2024b). During the survey, a total of 60 troglofauna samples and 59 stygofauna samples were collected (Bennelongia 2024b). Stygofauna sampling included 10 drill holes in the Proposal's direct impact area (i.e. the groundwater drawdown contours), 17 drill holes outside the Proposal's groundwater contours and one site outside the Development Envelope, at Upper Marillana (Figure 10-1 and Table 10-3) Troglofauna sampling included 12 drill holes within the Proposal's direct impact area (i.e. the proposed eastern pit) and 25 drillholes in indirect impact areas or outside the impact areas of the Proposal (Figure 10-2 and Table 10-3).

During the targeted subterranean fauna survey, a further 39 stygofauna samples and 27 troglofauna samples were collected from areas inside and outside the proposed impact areas (Bennelongia 2025). Sampling methods used in the recent surveys included a combination of troglofauna leaf-litter traps, troglofauna net scrapes and stygofauna net hauls (Bennelongia 2024b, 2025; Appendix 15).

During the Ministers North surveys, a total of 75 stygofauna samples were collected from 75 drill holes, all of which occur within the groundwater drawdown contours of the Combined Proposal (Figure 10-1; Bennelongia 2024c).

Collectively, there are 145 stygofauna sample sites within the predicted drawdown contours of the Combined Proposal which includes 14 sample sites within the Proposal's drawdown contours, as well as a further 17 regional sample sites located within 5 km of the Proposal, outside the Proposal's impact areas (Table 10-3). For troglofauna, there are 16 sample sites located within the additional impact areas of the Combined Proposal, a further 37 sample sites within the Development Envelope but outside the direct impact areas, and at least 205 regional sample sites within 5 km of the Proposal (Table 10-3).

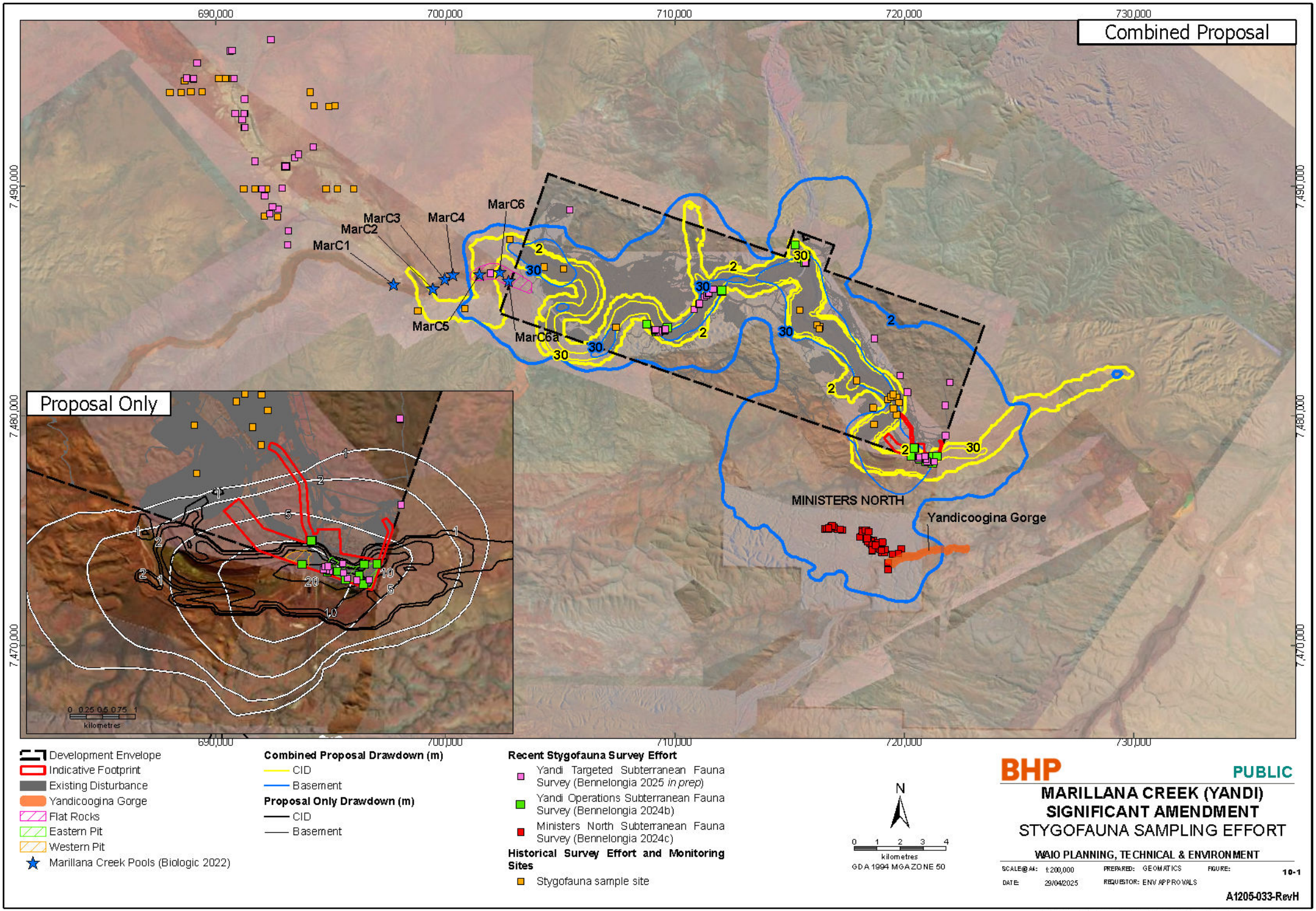
Table 10-2: Subterranean Fauna - recent studies and surveys

Title	Survey date/s	Summary	Appendix
Yandi Operations Subterranean Fauna Survey Report Bennelongia 2024b	Round 1 9-11 May 2022 Round 2: 13-15 September 2022 Round 3: 7-9 March 2023	Detailed subterranean fauna survey for both stygofauna and troglofauna The survey included a three-phase survey, undertaken at least three months apart, with at least one phase undertaken during the wet season in accordance with EPA guidance (EPA 2021c). Sampling methods included traps, haul nets and scraping, with 35 species of stygofauna and 33 species of troglofauna recorded.	Appendix 15
Ministers North Subterranean Fauna Survey Bennelongia 2024c	Round April to June 2023 Round 2: July to October 2023	Detailed and targeted subterranean fauna survey to document species and communities within the Ministers North tenement, located approximately 3.4 km south of the Yandi Development Envelope and within the Yandi drawdown area. The survey included three	Appendix 15

Title	Survey date/s	Summary	Appendix
	Round 3: November 2023-February 2024	phases, and used traps, haul nets and scraping methods, with six species of stygofauna and 47 species of troglofauna recorded.	
Jugari East 8 Subterranean Fauna Habitat Modelling Biologic 2024d	N/A	Subterranean fauna habitat assessment (based on 2D information and 3D habitat modelling) to determine the suitability, extent, and connectivity of subterranean habitats within and beyond the Development Envelope.	Appendix 15
Yandi Targeted Subterranean Fauna Survey Report Bennelongia 2025	March to May 2024	Follow up, targeted subterranean fauna survey work within the Development Envelope and regional areas targeting two stygofauna species, *Elaphoidella* `BHA342` and *Parastenocaris* `BHA343`, and five troglofauna species *Hanseniella* sp. indet., *Hesperanillus* `BCO247`, *Cryptops* `BSCOL091`, and Haplodesmidae `BDI080` and Trigoniulidae `BDI079`.	Appendix 15

Table 10-3: Subterranean fauna - summary of subterranean fauna sampling effort at Yandi

Area	Stygofauna sampling effort	Troglofauna sampling effort
	Number of sample sites	Number of sample sites
Development Envelope	59	53
E8 Proposal drawdown contours (stygofauna) / E8 Proposed new mine pits (troglofauna)	14	16
Combined Proposal drawdown contours (stygofauna only)	145	-
Regional sites within 5 km of Development Envelope (outside Proposal impact areas)	17	205



BHP

PUBLIC

MARILLANA CREEK (YANDI) SIGNIFICANT AMENDMENT

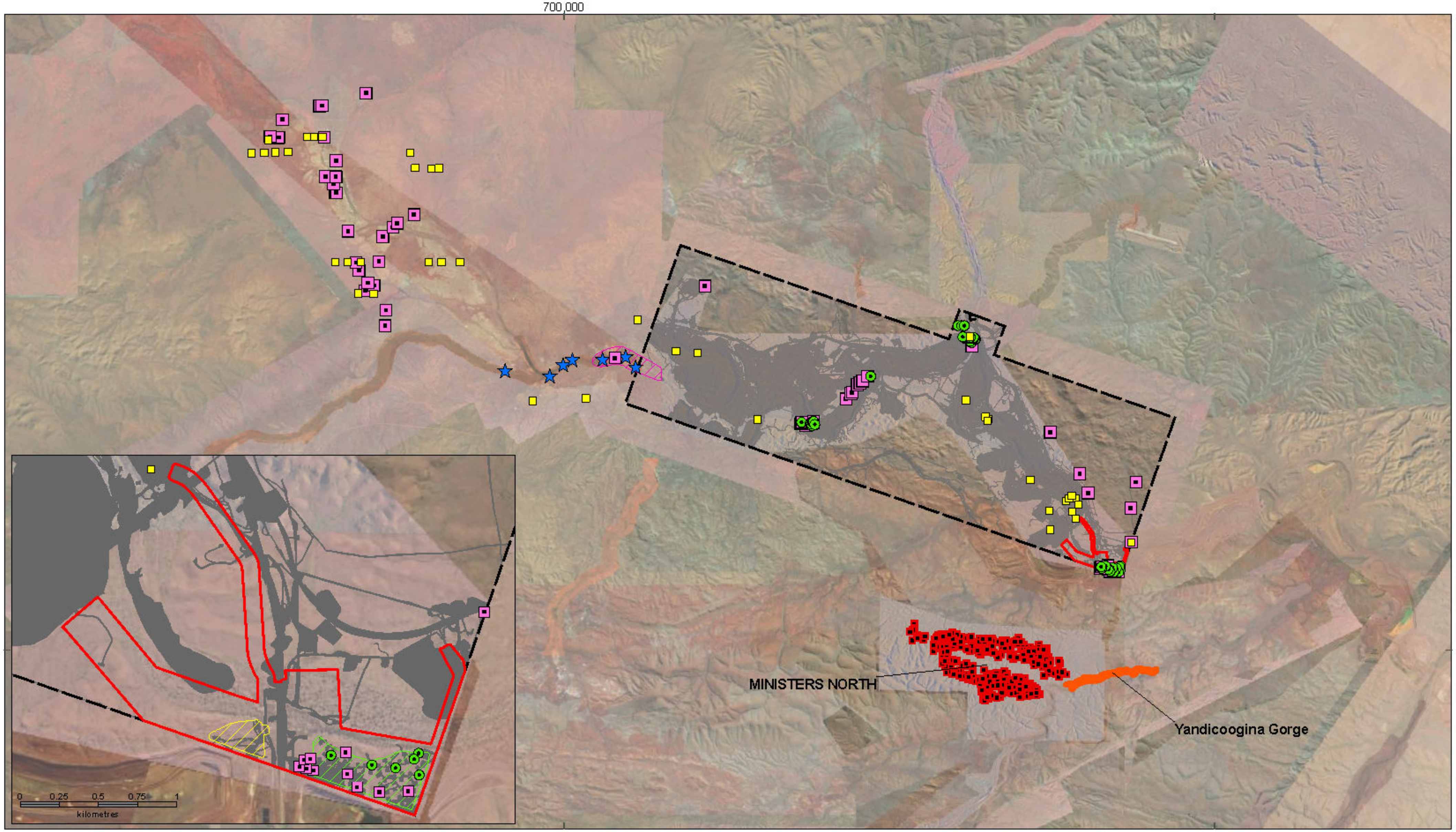
STYGOFAUNA SAMPLING EFFORT

WAIO PLANNING, TECHNICAL & ENVIRONMENT

SCALE@A4:	1:200,000	PREPARED:	GEOMATICS	FIGURE:	10-1
DATE:	29/04/2025	REQUESTOR:	ENV APPROVALS		

A1205-033-RevH

Document Path: Y:\Jobs\WA1001_A1500\A1205\3 Project\A1205_033_E_Yandi_S38_Sub Fauna Survey_RevDraft



Development Envelope
Indicative Footprint
Existing Disturbance
Yandicoogina Gorge
Flat Rocks
Eastern Pit
Western Pit
Marillana Creek Pools (Biologic 2022)

Recent Troglofauna Survey Effort

Yandi Targeted Subterranean Fauna Survey (Bennelongia 2025 *in prep*)

Yandi Operations Subterranean Fauna Survey (Bennelongia 2024b)

Ministers North Subterranean Fauna Survey (Bennelongia 2024c)

Historical Survey Effort and Monitoring Sites

Troglofauna sample site

N

0 2 4 6 8
kilometres

GDA 1994 MGA ZONE 50

BHP

PUBLIC

MARILLANA CREEK (YANDI) SIGNIFICANT AMENDMENT

TROGLOFAUNA SAMPLING EFFORT

WAIO PLANNING, TECHNICAL & ENVIRONMENT

SCALE @ A4:	1:200,000	PREPARED:	GEOMATICS	FIGURE:	10-2
DATE:	29/04/2025	REQUESTOR:	ENV APPROVALS		

A1205-097-RevD

10.3.2 Environmental values

10.3.2.1 Subterranean fauna habitats

Overview

The types of geology known to support stygofauna include calcretes; alluvial formations, particularly when associated with alluvial or paleochannel aquifers; fractured rock aquifers, and karst limestone; whereas troglofauna are likely to be present in karst limestone, CID, BIF, alluvium/colluviums in valley-fill areas, and weathered or fractured sandstone (EPA 2016e).

The Development Envelope lies entirely within the Hamersley Province which has a long geological history, broadly comprising Archaean and Proterozoic metamorphic and sedimentary rocks with much younger (Tertiary) sedimentary deposits (Golder Associates 2015). The Tertiary deposits infill older erosion features such as broad valleys with clays and calcretes of groundwater derived origin, or narrow channel-fill deposits including iron-rich CIDs in remnants of the main drainage lines (Golder Associates 2015). Surface geology comprises primarily exposed rock, with alluvium and colluvium along drainage lines (Figure 10-3).

The Yandicoogina Palaeovalley overlaps several areas of the Development Envelope and connects to the north-east with the much larger Robe Palaeovalley, which is a globally significant subterranean fauna hotspot (Figure 10-3; Bennelongia 2024; Bell *et al*. 2012; Clark et. al 2021). Stygofauna and troglofauna records are often associated with palaeovalleys, with stygofauna generally occurring more central in the valley and troglofauna on the slopes (Bennelongia 2024b).

The hydrogeology of the Development Envelope can be broadly classified into three hydrogeological units, as described in Section 7, including (BHP 2022b):

- The shallow alluvial aquifer associated with Marillana Creek. A hydraulic connection exists between the Marillana alluvium and the CID aquifer where the two units interface and cross; elsewhere, hydraulic connectivity is limited.
- The Marillana Formation which is a strip aquifer extending over 85 km in length and is the main aquifer within the Development Envelope. The aquifer incorporates the CID paleochannel orebody, is heterogeneous, and contains zones of higher permeability associated with secondary porosity features such as cavities and zones of lower permeability within the Lower CID and Basal Clay/Conglomerate. Marginal sediments have low permeability but can still transmit groundwater where cavities exist.
- The Weeli Wolli Formation which is a fractured-rock aquifer along the basement of the Marillana/Yandicoogina system and which is considered lower yielding for subterranean fauna compared to the CID and alluvial aquifer.

Based on the surface geology, hydrogeology and occurrence of the Yandicoogina Palaeovalley, the subterranean habitats throughout the Development Envelope are likely to provide suitable habitat for troglofauna and stygofauna, and are likely to extend beyond the boundaries of the Development Envelope (Bell *et al*. 2012; Bennelongia 2024b; Figure 10-3).

Groundwater quality within the Development Envelope ranges from fresh to brackish (414 S/cm – 1,767 S/cm) and depth to groundwater across the Development Envelope generally ranges between 10 and 63 mbgl; however, the alluvium within Marillana Creek will sustain groundwater levels either just below or at surface during seasonal wet periods. Depth to groundwater is recognised as a potential constraint to stygofauna abundance and diversity and across the Pilbara region where groundwater habitats deeper than 30 mbgl have typically recorded fewer stygofauna species or lower stygofauna abundance, than shallower groundwater habitats (Halse 2018a in Bennelongia 2024b). Aquifers with higher transmissivity are more likely to host stygofauna than aquifers with lower transmissivity, and whilst stygofauna stygofauna mostly occur in fresh to hyposaline water, some species can tolerate higher salinities

(Bennelongia 2024b). Given that depth to groundwater throughout the Development Envelope is relatively shallow, salinity is fresh, and transmissivity is high, subterranean habitats within the Development Envelope are considered highly suitable for stygofauna, with the CID and the superficial alluvial systems of Marillana Creek known to support a diverse stygofauna community (Bennelongia 2022; 2015).

Habitat modelling

A subterranean fauna habitat assessment (based on two-dimensional (2D) information and three dimensional (3D) modelling) was recently undertaken to gain an understanding of the suitability, extent, and connectivity of subterranean fauna habitats within and surrounding the Indicative Footprint (herein referred to as the subterranean fauna study area; Biologic 2024d; Appendix 15).

The 2D habitat assessment and categorisation of geological mapping is the first step in assessing subterranean fauna habitats and was based on bedrock and regolith mapping, as well as integrating linear structural mapping, geological cross sections, diamond cores and water bore schematics, and subterranean fauna sampling results (where available). This information contributes toward developing the 3D habitat model (as discussed further below). Interpretations of drill hole logging, hydrological bore schematics and downhole geophysical data and visual examination of diamond core photos are used to categorize the geological members and sub-units for potential habitat suitability for subterranean fauna (i.e. High, Medium, Low, Uncertain; Table 10-4). This information is uploaded into the 3D model for display using colour coding for each of above categories.

The 2D habitat assessment shows that the bedrock geology, which underlies the Marillana Formation CID, within the subterranean fauna study area comprises the Weeli Wolli Formation and ranges between 180 and 600 m in thickness. This formation is generally not considered to provide suitable habitat for subterranean fauna (Table 10-4), but this may be due to the lack of sampling within this geology. Where fresh/unweathered or in units featuring shale and dolerite, the Weeli Wolli Formation is likely to be relatively impermeable and probably low suitability for subterranean fauna; however, in areas of cherty or shaly BIF, some areas may provide some suitable habitat if sufficiently weathered/fractured (Table 10-4). Conversely, the CID and detritals are expected to form highly suitable subterranean fauna habitats within the subterranean fauna study area, especially where secondary weathering and fracturing of CID provide frequent and well-developed cavities, vugs, and pore spaces (Figure 10-3; Table 10-4). The CID is confined to the central palaeochannel of Marillana Creek where it forms a series of low mesas (Perring & Hronsky 2019 in Biologic 2024d). Beyond the subterranean fauna study area to the west, the CID is overlain by calcrete of the Oakover Formation, which is also likely to be highly weathered and which provides suitable habitat in the wider surrounding local area. Quaternary detrital deposits associated with the present-day drainage lines and floodplains of Marillana Creek overlie the CID and infill the paleochannel beside the mesas (Figure 10-3; Table 10-4). These deposits are likely to provide additional suitable habitats for subterranean habitat where sufficient pore spaces occur between variably textured material.

The 3D habitat model was created based on a combination of the three geological models provided by BHP WAIO for East 8, East 7, and East 3, 4, 5, 6 using Leapfrog® Geo 2022.1.1 software (Leapfrog). The 3D model was then refined using various information sources and parameters to specifically investigate the suitability, extent, and connectivity of habitats for subterranean fauna. 3D modelling in Leapfrog provides a rich visual platform for creating realistic models and detailed conceptualisations of the extent and connectivity of subterranean fauna habitats. However, constraints and limitations do exist (Biologic 2024d). Given that mining began prior to subterranean fauna being considered in EIA, no detailed or baseline survey information was available prior to mining or dewatering. In addition, extrapolation of the habitat model in the area between East 7 and East 8 was based on best available data but remains conceptual in areas where drilling has not been undertaken to date. A full description of the methodology, constraints and limitations is provided in Appendix 15 (Biologic 2024d).

The 3D habitat model shows that suitable troglofauna habitat is hosted within the fractured/weathered CID of the Marillana Formation and alluvial/ colluvial detritals associated with Marillana Creek and surrounding floodplains (Biologic 2024d). Groundwater hosted within the CID forms the primary stygofauna habitat, while the fractured/weathered parts of the Weeli Wolli Formation may also provide deeper habitat in some areas within the

palaeochannel. Following historic mining and dewatering, the alluvial detritals are unlikely to occur BWT and so provide suitable habitat for troglofauna, but may also provide some temporary stygofauna habitat following sporadic flood events.

The CID at East 7 has been subject to mining, but relatively thin areas of the Lower CID unit (M2; high suitability habitat) immediately surrounding the pit (up to 20 m thick) remain intact. Localised medium suitability habitats within the detritals and weathered Weeli Wolli Formation also remain intact surrounding the East 7 pit. At East 8, the Marillana Formation CID is currently intact and forms a thick, uninterrupted layer of highly suitable habitat. This is interpreted as continuous throughout the current extent of CID owing to a lack of potential barriers. Alluvial habitats surround the CID and extend out into the Marillana Creek floodplain. The modelling of the alluvial habitats in this area is based on more limited drilling information than the CID, but the available drilling logs, cores and geophysics interpretations indicated that the alluvials are likely to represent medium suitability habitat, with localised variability depending on sediment texture. Sampling data (Bennelongia 2024b) confirmed the occurrence of stygofauna and troglofauna from high suitability CID habitat as well as medium suitability alluvial habitats at the E8 proposed pits and along the Marillana Creek in the immediate vicinity of E8. At East 3,4,5,6, the Marillana Formation CIDs have been largely removed through historic mining, but a thin layer (up to 15 m) of CID remains intact around the pit shells and under the benches. Further potential stygofauna habitat may occur in and around East 8 at depth where the CID transitions to basement (Weeli Wolli Formation). Drill core analysis in the East 8 proposed pit areas showed some weathering/fracturing in these units which suggested some potentially habitable lithologies beneath the CID. Overall, the current extent of suitable subterranean fauna habitat throughout the study area is well-connected and continuous, with no major habitat barriers.

Table 10-4: Subterranean Fauna - habitat suitability of stratigraphic units

Stratigraphic unit (2D geology map code)	BHP Code	Description	Habitat potential[6]	Subterranean fauna habitat suitability assessment
Detritals & CID				
Quaternary Detritals	SZ, A	Surface Scree and Alluvials (Talus and Colluvium)	Low – Med-High	Deposits that may provide some AWT or BWT habitat, locally variable based on texture – clay, silt, sand, gravel.
Tertiary (Pliocene) Detritals	CID	Channel Iron Deposit – undifferentiated and non-denatured	High	Void spaces expected to occur frequently throughout the CID (e.g. secondary weathering, vugs, fractures, porosity). Typically forms highly suitable subterranean fauna habitat.
	DCID	Denatured Channel Iron Deposit – undifferentiated and non-denatured	High	
	HCID	Hardcapped Channel Iron Deposit – undifferentiated and non-denatured	High	
	TO	Oakover Formation	High	Calcrete formation. Void spaces expected to occur frequently (e.g. secondary weathering, vugs, fractures, porosity).
	M4W	Marillana Formation, Lower Member (MFLM) – Eastern CID – Weathered	High	Void spaces expected to occur frequently throughout the CID (e.g. secondary weathering,

[6] High potential habitat – observed cavity; obvious/ well-defined/ interconnected voids, vugs and microcavities; open fractures (penetrated by water); obvious signs of secondary/ hydrated weathering.

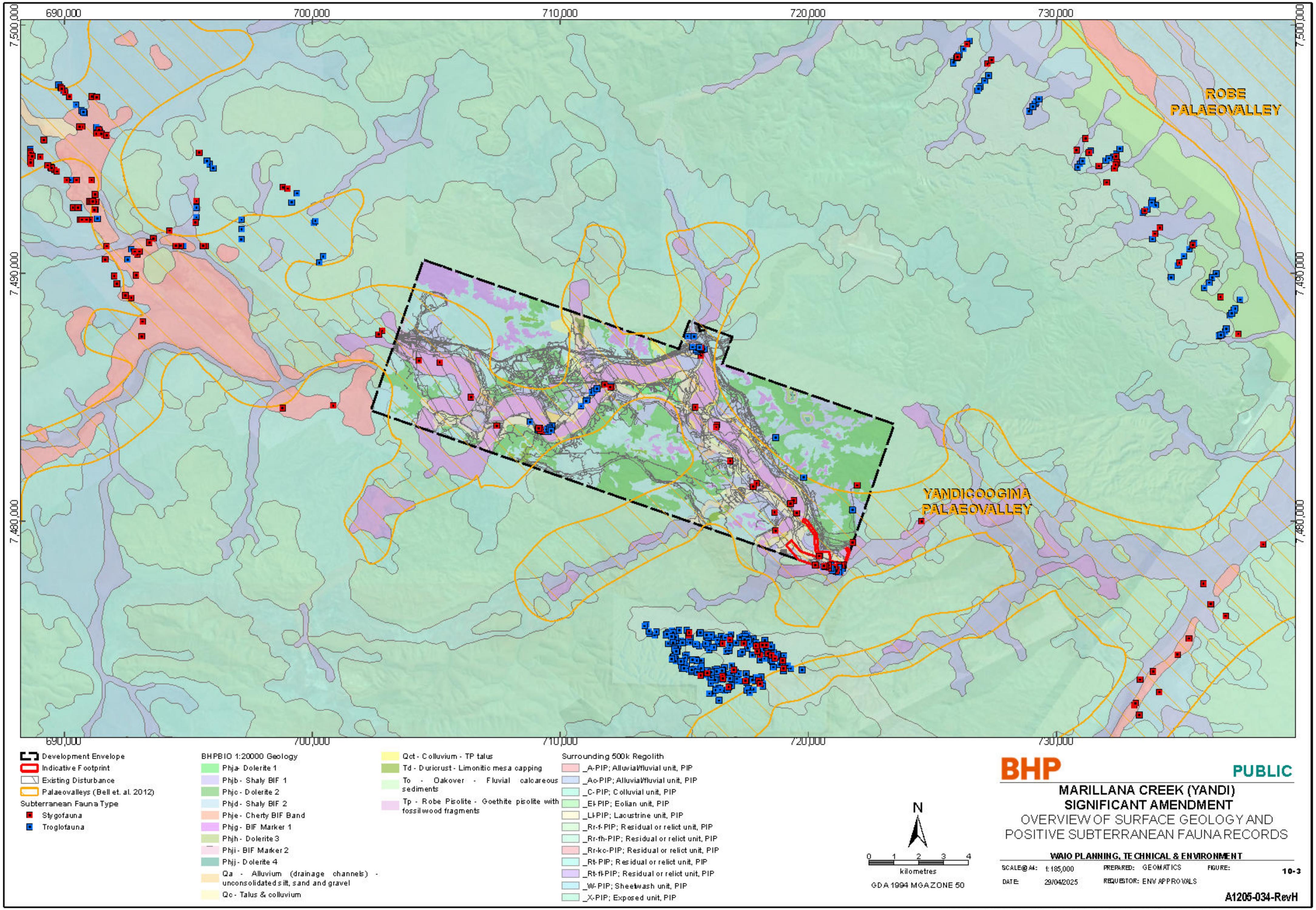
Medium potential habitat – partially weathered rock, calcareous detritals, or pisolite without well-developed cavities; smaller, less obvious or partly open fractures; singular or poorly developed voids/ vugs; gravels and gravelly detritals; cavity fill; fault contacts.

Low potential habitat – fresh rock lacking cavities, fractures, vugs, evidence of weathering; rock freshly fractured during drilling (no signs of weathering/ water penetration); fresh clay, silt, and fine textured detritals; fresh or crumbly shale, black shale, dolerite.

Uncertain – rock intervals that cannot be confidently placed in the above categories.

Stratigraphic unit (2D geology map code)	BHP Code	Description	Habitat potential[6]	Subterranean fauna habitat suitability assessment
	M4	MFLM Eastern CID	High	vugs, fractures, porosity). Typically forms highly suitable subterranean fauna habitat.
Tertiary (Oligocene – Miocene) Detritals	EK	MFLM Eastern Clay	Low	Clay layer within the CID. Impermeable barrier for subterranean fauna.
	M3SA	Marillana Formation, Barimunya Member (MFBM) – Upper CID High Silica, High Alumina	High	Void spaces expected to occur frequently throughout the CID (e.g. secondary weathering, vugs, fractures, porosity). Typically forms highly suitable subterranean fauna habitat.
	M3W	MFBM – Weathered	High	
	M3HA	M3 – High Alumina	High	Void spaces expected to occur frequently throughout the CID (e.g. secondary weathering, vugs, fractures, porosity). Typically forms highly suitable subterranean fauna habitat.
	M3	MFBM – Upper CID	High	
	M3MN	MFBM – Upper CID – Northern Marginal Zone	High	
	M3MS	MFBM – Upper CID – Southern Marginal Zone	High	
	M2	MFBM – Lower CID	High	Void spaces expected to occur frequently throughout the CID (e.g. secondary weathering, vugs, fractures, porosity). Typically forms highly suitable subterranean fauna habitat.
	M2U	MFBM – Lower CID	High	
Tertiary (Oligocene – Miocene) Detritals	M1	MFBM – Lower CID	High	
	OK	MFBM – Ochreous clay	Low-Med	A variable basal ocherous clay unit, subject to various degrees of weathering.
	BK	Marillana Formation, Munjina Member (MFMM) – Basal Clay	Low-Med	A basal clay unit creating a barrier for subterranean fauna with sparse areas of connectivity.
	BG	MFMM – Basal Conglomerate	Low – Med-High	Commonly a conglomerate with varied weathering and occasional voids and vugs.
Bedrock				
Intrusives	HE, K	Dolerite Dykes/ Sills	Low	Either fresh or weathered completely to clay.
Hamersley Province	HJ, WW	Weeli Wolli Formation interbedded shale and BIF	Low – Med-High	Fresh and weathered units can be fractured which is favourable for subterranean fauna and tend to be within close proximity to the palaeochannel. Deeper units are fresh and impermeable.
Unknown	UN, FILL, B	Unknown, Surface Landform Fill – mine waste dumps, bunds etc	Unknown	Mining operational waste product e.g. waste dumps, bunds/barriers.

Source: Biologic 2024d



690,000
700,000
710,000
720,000
730,000
7,500,000
7,490,000
7,480,000
ROBE PALAEOVALLEY
YANDICOOGINA PALAEOVALLEY
Development Envelope
Indicative Footprint
Existing Disturbance
Palaeovalleys (Bell et. al. 2012)
Subterranean Fauna Type
Stygofauna
Troglofauna
BHPBIO 1:20000 Geology
Phja- Dolerite 1
Phjb - Shaly BIF 1
Phjc - Dolerite 2
Phjd - Shaly BIF 2
Phje - Cherty BIF Band
Phjg - BIF Marker 1
Phjh - Dolerite 3
Phji - BIF Marker 2
Phjj - Dolerite 4
Qa - Alluvium (drainage channels) - unconsolidated silt, sand and gravel
Qc - Talus & colluvium
Qct - Colluvium - TP talus
Td - Duricrust - Limonitic mesa capping
To - Oakover - Fluvial calcareous sediments
Tp - Robe Pisolite - Goethite pisolite with fossil wood fragments
Surrounding 500k Regolith
_A-PIP; Alluvial/fluvial unit, PIP
_Ac-PIP; Alluvial/fluvial unit, PIP
_C-PIP; Colluvial unit, PIP
_El-PIP; Eolian unit, PIP
_Ll-PIP; Lacustrine unit, PIP
_Rr-f-PIP; Residual or relict unit, PIP
_Rr-fh-PIP; Residual or relict unit, PIP
_Rr-kc-PIP; Residual or relict unit, PIP
_Rt-PIP; Residual or relict unit, PIP
_Rt-fl-PIP; Residual or relict unit, PIP
_W-PIP; Sheetwash unit, PIP
_X-PIP; Exposed unit, PIP
N
0 1 2 3 4
kilometres
GDA 1994 MGA ZONE 50
BHP
PUBLIC
MARILLANA CREEK (YANDI)
SIGNIFICANT AMENDMENT
OVERVIEW OF SURFACE GEOLOGY AND POSITIVE SUBTERRANEAN FAUNA RECORDS
WAIO PLANNING, TECHNICAL & ENVIRONMENT
SCALE@ A4: 1:185,000
PREPARED: GEOMATICS
FIGURE: 10-3
DATE: 29/04/2025
REQUESTOR: ENV APPROVALS
A1205-034-RevH

10.3.2.2 Stygofauna

At least 56 stygofauna taxa have been recorded in and around the Development Envelope and groundwater drawdown area of the Combined Proposal including specimens that could not be identified to species level (Table 10-5; Bennelongia 2024b, c, 2025; Appendix 15). Copepods are the most diverse and abundant stygofauna group (at least 12 species and 597 specimens) at Yandi; however, amphipods, annelids, ostracods, syncarids, roundworms, and one species of isopod have also been collected (Table 10-5; Bennelongia 2024b).

Of the stygofauna species recorded, a total of six species are currently known only from the groundwater drawdown area of either the Proposal alone and/or the Combined Proposal including *Dussartcyclops* 2222 `BCY095`, *Pilbaranella* `BSY372`, *Candonopsis* `BOS1831`, *Elaphoidella* sp. S02, Haplotaxidae sp. S01and Darwinulidae sp. (Bennelongia 2024b; Table 10-5; Figure 10-4 and Figure 10-5). Two species recorded within the drawdown contours of the Proposal in 2023 have since been located outside these areas and as such, are not considered further: *Elaphoidella* `BHA342` and *Parastenocaris* `BHA343` (Table 10-5; Biologic 2024d and Bennelongia 2025). The remaining stygofauna species are either widespread or have linear ranges that extend outside the groundwater drawdown areas (Table 10-5). These species are not considered further.

At Ministers North, a total of 117 stygofauna specimens belonging to six species were collected from 11 different holes during recent field surveys (Bennelongia 2024c). All six species were collected from the groundwater drawdown area of the Combined Proposal (Table 10-5). None of the stygofauna species recorded during the Ministers North survey are restricted species and the stygofauna assemblage at Ministers North is considered relatively depauperate, which is considered likely to be due to deep groundwater depths (i.e. over 40 m; Bennelongia 2024c).

None of the stygofauna taxa, nor the communities recorded within the groundwater drawdown impact area are listed or recognised as conservation priorities under state or federal legislation; however, the stygofauna assemblage within the Yandi Hub is considered to be relatively rich (Bennelongia 2024b).

Table 10-5: Subterranean Fauna - stygofauna species recorded within the Yandi groundwater drawdown area

Identification	Known from outside Yandi drawdown area	Comments
Nematoda		
Nematoda spp.	Yes	Species likely to be widespread, not included in environmental impact assessment. Not considered further.
Aphaneura		
Aeolosoma sp. 1 (PSS)	Yes	Widespread in northern Western Australia. Not considered further.
Oligochaeta		
Enchytraeidae `2 bundle` s.l. (long thin 2 per seg)	Yes	Widespread in Western Australia. Probably amphibious. Not considered further.
Enchytraeidae `2 bundle` s.l. (short sclero 4 per seg)	Yes	Widespread in Western Australia. Probably amphibious. Not considered further.
Enchytraeidae `3 bundle` s.l. (short sclero)	Yes	Widespread in Western Australia. Probably amphibious. Not considered further.
Enchytraeidae 'E06'	Yes	Also known from Ministers North. Not considered further.
Enchytraeidae 'OB3‘	Yes	Also known from Ministers North. Not considered further.
Haplotaxidae sp. S1	No	Historically recorded from one site at Yandi. Currently only known from Yandi Development Envelope.
Naididae sp. N02	No	Historically recorded. Currently only known from Yandi Development Envelope; however, taxa from this family are described as common and widespread and not of significance. Not considered further.
Naididae sp. N07	No	Historically recorded. Currently only known from Yandi Development Envelope; however, taxa from this family are described as common and widespread and not of significance. Not considered further.
Phreodrilidae sp. AP DVC s.l.	Yes	Widespread in Western Australia. Not considered further.
Phreodrilidae sp. AP SVC s.l.	Yes	Widespread in Western Australia. Not considered further.
Pristina longiseta	Yes	Cosmopolitan. Not considered further.
Tubificidae `stygo type 1A`	Yes	Widespread in Western Australia. Not considered further.
Tubificidae `stygo type 5`	Yes	Widespread in Western Australia. Not considered further.
Copepoda		
Canthocamptidae sp. B01	Yes	Known distribution of ca. 110 km^2; linear distribution 17 km. Not considered further.

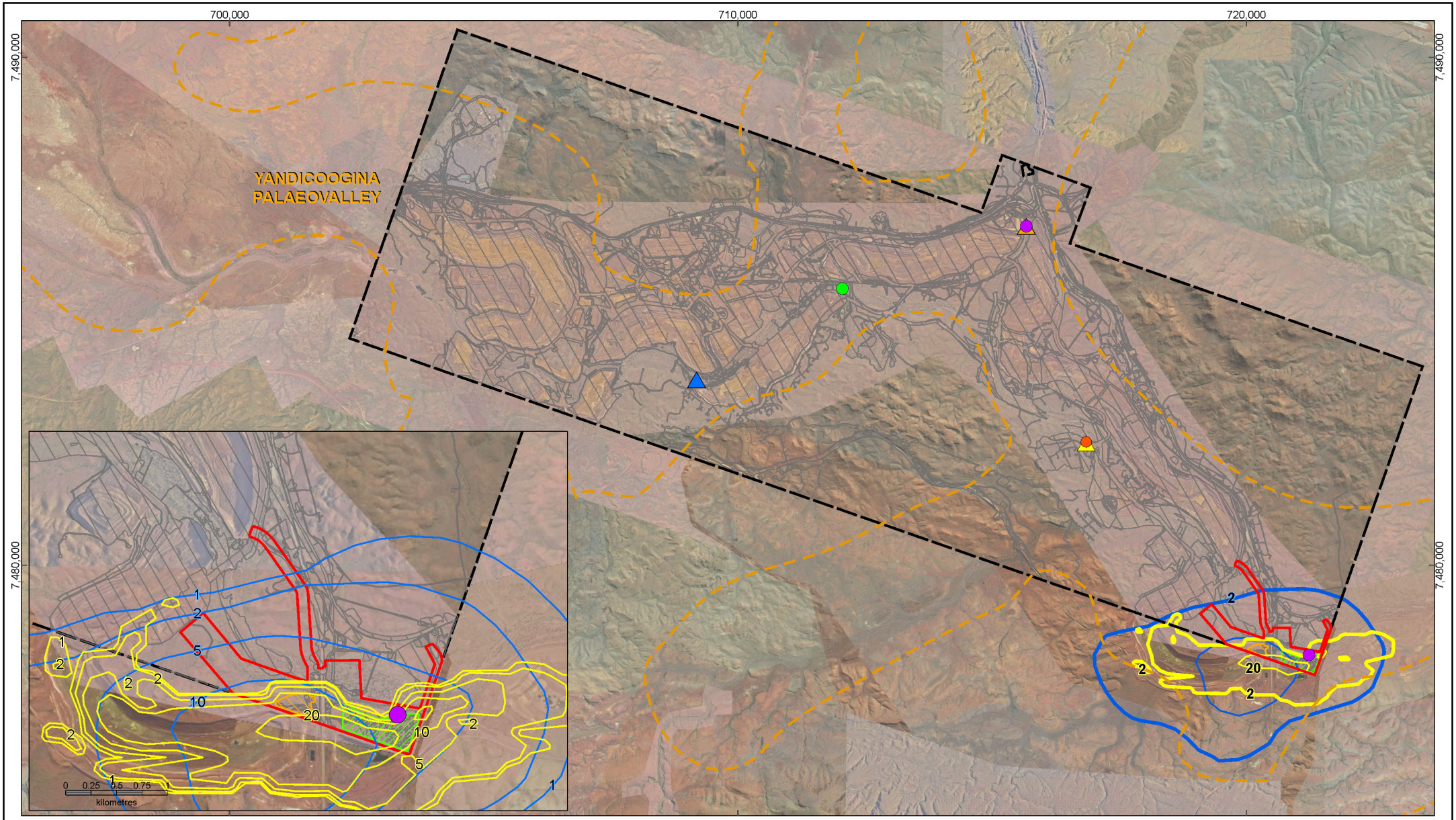
Identification	Known from outside Yandi drawdown area	Comments
Canthocamptidae sp. B02	Yes	Known distribution of 10,000 km^2; linear distribution 230 km. Morphologically identifiable, but referred for sequencing because of minor morphological divergence and to provide a referent for future samples. Sequencing unsuccessful. Morphological identification retained. Not considered further.
Cyclopidae sp.	Yes	One species recorded. Very juvenile so could not be identified to species level; however is most likely a member of any of the cyclopoid copepod species collected in the area. Not considered further.
Diacyclops `BCY059` (humphreysi s.l.)	Yes	Known distribution of 670 km^2; linear distribution 50 km. Not considered further.
Diacyclops cockingi	Yes	Widespread in Pilbara. Not considered further.
Diacyclops humphreysi	Yes	Widespread in Pilbara. Not considered further.
Diacyclops sobeprolatus	Yes	Widespread in Pilbara. Not considered further.
Diacyclops sp.	Yes	Three juveniles collected. Likely belong to *D.* `BCY059` (humphreysi s.l.) or *D. Cockingi*.
Dussartcyclops 2222 `BCY095`	No	Known linear distribution 10 km. Known only from the Yandi Development Envelope.
Elaphoidella `BHA342`	Yes	cf. *Australocamptus* `sp. Biologic-HARP064`. Known from Yandicoogina Creek, outside the drawdown area (Biologic 2024d). Not considered further.
Elaphoidella sp. S2	No	Recorded from one site within the Development Envelope in 2008. Currently not known from elsewhere.
Microcyclops varicans	Yes	Cosmopolitan. Not considered further.
Parastenocaris `BHA343`	Yes	New species and B code. Assigned based on morphological divergence. Also known from Upper Marillana (Bennelongia 2025). Not considered further.
Parastenocaris jane	Yes	Widespread in Pilbara. Not considered further.
Parastenocaris `sp. Biologic-HARP037`	Yes	A singleton copepod recorded at Marillana Creek Pool MarC2. Currently not known from elsewhere; however, additional morphological and molecular work will likely increase the known distribution of this taxa in the future.
Pescecyclops sp. B01 (nr pilbaricus)	Yes	Widespread in Pilbara. Not considered further.
Thermocyclops aberrans	Yes	Widespread in northern Western Australia. Not considered further.
Ostracoda		
Candonopsis `BOS1831`	No	New species and B code. Assigned based on morphological and molecular divergence. Known only from the Yandi Development Envelope.
Darwinulidae sp.	Unknown	Higher order, but a discrete species as it is the only darwinulid in the survey.
Deminutiocandona murrayi	Yes	Widespread in Pilbara. Not considered further.

Identification	Known from outside Yandi drawdown area	Comments
Limnocythere dorsosicula	Yes	Widespread in Australia. Not considered further.
Meridiescandona `BOS1739`	Yes	New species, recorded in the Development Envelope, north of the Indicative Footprint. Also known from Upper Marillana with a linear range of 35 km. Not considered further.
Meridiescandona facies (PSS) s.l.	Yes	Known linear distribution over 50 km. Also known from Lower Weeli Wolli catchment including Yandicoogina and Iron Valley. Not considered further.
Meridiescandona lucerna	Yes	Known distribution of ca. 10,300 km^2; linear distribution 280 km.Two specimens sequenced, supporting morphological identification. Not considered further.
Meridiescandona marillanae	Yes	Lower Weeli Wolli, Marillana catchments. Locally widespread (33.7 km). Also known from Yandicoongina and Weel Wolli Creek. Not considered further.
Notacandona `BOS1900`	Yes	New species collected at six different locations, all located to the north west of the Development Envelope. Has a known linear range of 7 km. Not considered further.
Notacandona boultoni	Yes	Known distribution of ca. 820 km^2; linear distribution 47 km. Not considered further.
Syncarida		
Atopobathynella sp. B07	Yes	Known distribution of ca. 220 km^2; linear distribution 28 km. Sequencing of two specimens supported morphological identification. Not considered further.
Billibathynella `BSY187-DNA`	Yes	Known distribution of ca. 300 km^2; linear distribution 46 km. Not considered further.
Pilbaranella `BSY372`	No	New species and B code. Assigned based on morphology and molecular divergence (two specimens sequenced). Known only from the Development Envelope.
Pilbaranella sp.	Yes	Cryptic species difficult to ID through morphology. Likely to be *P. `BSY372`* which was collected 7km away within the same drainage system. Not considered further.
Amphipoda		
Neoniphargidae sp. B03	Yes	44 specimens recorded from three sites outside the Development Envelope. Linear range of 3 km. Not considered further.
Chydaekata sp.	Yes	Likely to be Chydaekata sp. MJ1-UM1. Not considered further.
Chydaekata sp. MJ1-UM1	Yes	Known distribution of ca. 60 km^2; linear distribution 28 km. Molecular analysis of one specimen matched it with this pre-existing species code; the identification of all specimens was updated from Chydaekata sp. to C. sp. MJ1-UM1. Not considered further.
Maarrka weeliwollii	Yes	Known distribution of ca. 3,400 km^2; linear distribution 90 km. Also known from Yandicoogina and Iron Valley. Not considered further.
nr *Billibathynella* sp. B02 (=Parabathynellidae sp. S03)	Yes	Known from the Weeli Wolli and Coondewanna catchments. Not considered further.
Paramelitidae Genus 2 sp. B02	Yes	Known distribution of ca. 4,000 km^2; linear distribution 85 km. Not considered further.
Paramelitidae sp. B16	Yes	Known distribution of ca. 900 km^2; linear distribution 67 km. Also known from Iron Vallley. Not considered further.
Paramelitidae sp. B26 (Helix-AMP018)	Yes	Molecular analysis indicates species is likely Paramelitidae sp. B16 which has a known linear distribution of 53 km. Not considered further.

Identification	Known from outside Yandi drawdown area	Comments
Isopoda		
Pygolabis sp. B06 (=BIOTA yandi sp. 1)	Yes	Recorded outside the Development Envelope. Linear distribution of 130 km. Not considered further.
Pygolabis weeliwolli	Yes	Known distribution of ca. 10,700 km^2; linear distribution 265 km. Also known from Yandicoogina and Iron Valley. Not considered further.

Source: Bennelongia 2024b, c, 2025; Biologic 2024d

Species highlighted in blue are currently not known from outside the groundwater drawdown area of the Combined Proposal



Development Envelope
Indicative Footprint
Existing Disturbance
Palaeovalleys (Bell et. al. 2012)
Eastern Pit
Western Pit

Grounwater Drawdown Contours (m)

Basement
CID

Species only known from the Development Envelope

Dussartcyclops 2222 - `BCY095`
Candonopsis - `BOS1831`
Pilbaranella - `BSY372`
Darwinulidae sp.
Elaphoidella sp. S2
Haplotaxidae sp. S1

N

0 1 2 3 4
kilometres
GDA 1994 MGA ZONE 50

BHP

PUBLIC

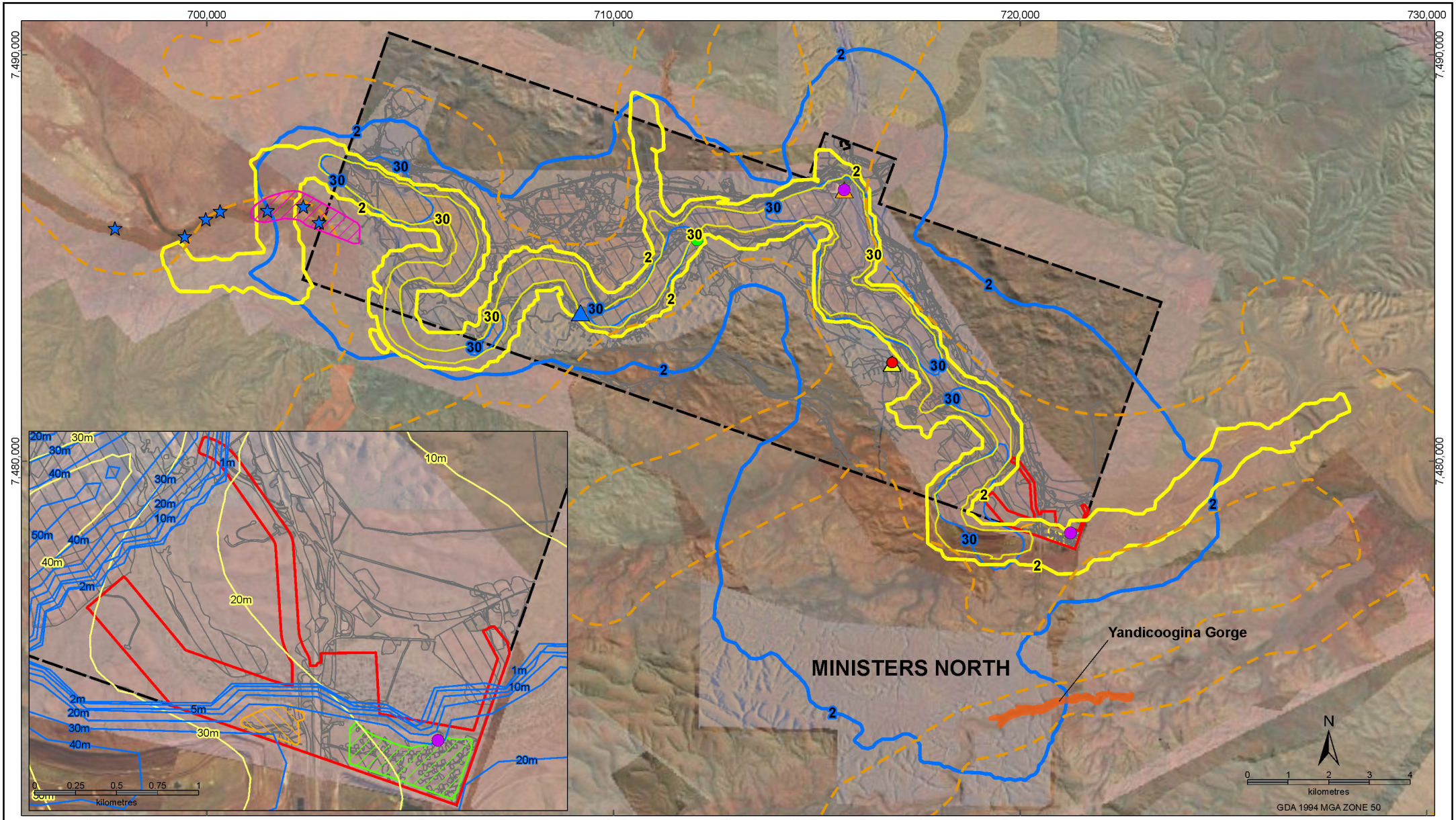
MARILLANA CREEK (YANDI)
SIGNIFICANT AMENDMENT
POTENTIALLY RESTRICTED STYGOFAUNA AND THE E8 PROPOSAL GROUNDWATER DRAWDOWN CONTOURS (M)

WAIO PLANNING, TECHNICAL & ENVIRONMENT

SCALE @A4:	1:100,000	PREPARED:	GEOMATICS	FIGURE:	10-4
DATE:	29/04/2025	REQUESTOR:	ENV APPROVALS		

A1205-071-RevH

Document Path: \\bgisfileprdwaio\premiumafs\2depts\Heritage_Data\Jobs\A1001_A1500\A1205\3Project\A1205_071_E_Yandi_S38_RestrictedStygofauna_RevD.aprx



- Development Envelope
- Indicative Footprint
- Existing Disturbance
- Palaeovalleys (Bell et. al. 2012)
- Eastern Pit
- Western Pit
- Yandicoogina Gorge
- Flat Rocks
- Marillana Creek Pools (Biologic 2022)

Groundwater Drawdown Contours (m)

- CID
- Basement

Species only known from the Development Envelope

- *Candonopsis* - `BOS1831`
- *Dussartcyclops* 2222 - `BCY095`
- *Pilbaranella* - `BSY372`
- Darwinulidae sp.
- *Elaphoidella sp. S2*
- *Haplotaxidae sp. S1*

BHP

PUBLIC

MARILLANA CREEK (YANDI)
SIGNIFICANT AMENDMENT
POTENTIALLY RESTRICTED STYGOFAUNA SPECIES AND THE COMBINED PROPOSAL GROUNDWATER DRAWDOWN CONTOURS (M)

WAIO PLANNING, TECHNICAL & ENVIRONMENT

SCALE @ A4:	1:125,000	PREPARED:	GEOMATICS	FIGURE:	10-5
DATE:	29/04/2025	REQUESTOR:	ENV APPROVALS		

A1205-036-RevH

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10.3.2.3 Troglofauna

At least 35 troglofauna taxa are known from the Development Envelope (Table 10-6). This includes 194 specimens attributable to 33 troglofauna taxa recorded during the recent survey (Bennelongia 2024b, 2025). Myriapoda (millipedes) are the most abundant troglofauna group at Yandi (five species; 42 specimens), but araneomorph spiders, beetles, centipedes, cockroaches, diplurans, dipterans, hemipterans, pauropods, pseudoscorpions, schizomids, silverfishes, and symphylans have also been collected. None of the troglofauna taxa, nor the communities recorded in the Development Envelope, are listed or recognised as conservation priorities under state or federal legislation (Bennelongia 2024b, 2025).

A total of 15 troglofauna species are currently known only from the Development Envelope, five of which are currently only known from the proposed pits of the Proposal (Table 10-6; Figure 10-6; Bennelongia 2024b). The remaining species are either widespread or are known from outside the Development Envelope and are not considered further (Table 10-6).

Troglofauna were not considered as a key environmental factor for the Approved Proposal and so none of the potentially restricted troglofauna species have previously been assessed.

Table 10-6: Subterranean fauna - troglofauna recorded within the Development Envelope

Identification	Known from outside the Development	Comments
Araneae		
Anapistula sp.	Yes	Three specimens recorded from two separate drill holes: one within the proposed pits of the Proposal and one in the Development Envelope, outside the proposed pits. Could not be identified to species level morphologically; species status unclear but may be *Anapistula* sp. S01, *Anapistula* B02 or *Anapistula* `BAR147`, all of which have been recorded at Ministers North.
Prethopalpus sp. B27	Yes	Collected in this survey and from Lambs Creek. Known linear range 21 km. Identified morphologically as *Prethopalpus* sp.; sequencing matched the specimen with P. sp. B27.
Prethopalpus `BAR146`	Yes	Known linear distribution of 11.5 km.
Schizomida		
Draculoides 'sp. Koodaideri/Yandi'	No	Database records located from two sites 110 m apart within the proposed eastern pit of the Proposal. Many species of Draculoides in the Pilbara have been described and most have restricted ranges. There is uncertainty about how this species aligns with more recent identifications. The distribution of this species remains unknown.
Draculoides `SCH030`/`SCH107-DNA`	Yes	Known linear range 11.5 km.
Draculoides `SCH071`	Yes	Matched genetically with WAM species. Known linear range 16 km.
Draculoides sp.	Likely	Mostly juvenile, probably belonging to other species listed here. Two adult females in too poor condition for sequencing.
Pseudoscorpion		
Indohya `BPS274`	No	New species and B code. Distribution unknown. Recorded from a scrape sample at a single site located within the proposed eastern pit of the Proposal.
Lagynochthonius `BPS601`	No	Two individuals recorded from a drillhole within the existing operational area. Currently only known from the Development Envelope.
Chilopoda		

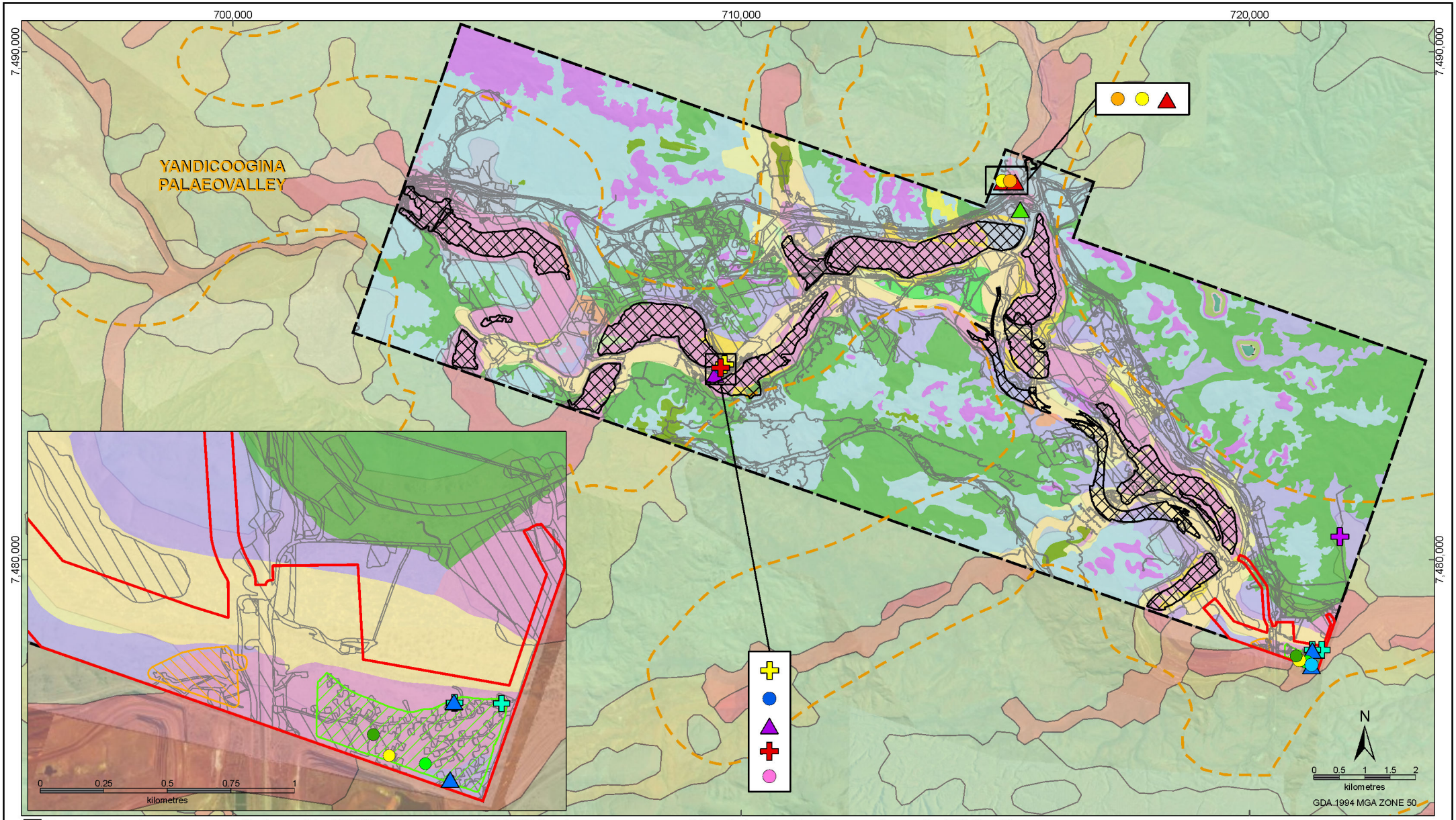
Identification	Known from outside the Development	Comments
Cryptops `BSCOL091`	No	New species and B code. Known linear range 300 m. Both specimens sequenced, supporting common identity. Recorded from proposed eastern pit of the Proposal.
Cryptops 'BSC111'	No	Morphology and sequencing species is not C. 'BSCOL091'. Treated as new species and assigned B code.
Diplopoda		
Haplodesmidae `Helix-DIHAP001`	Yes	Was Haplodesmidae `BDI080`. No longer restricted. Also matches WAM record of Haplodesmidae sp. DNA02
Lophoturus madecassus	Yes	Cosmopolitan circumtropical species
Trigoniulidae `BDI075`	No	New species and B code. Known linear range 11 km. Molecular analysis of two specimens supported recognition of new species.
Trigoniulidae `BDI079`	No	New species and B code. Distribution unknown. Genetics supported recognition of new species.
Pauropoda		
Decapauropus tenuis	Yes	Known distribution of ca. 4,500 km^2; known linear range 100 km.
Pauropoda sp.	Yes	Specimen too small (and juvenile) for either morphological or molecular identification. Probably one of other species listed.
Pauropodidae `BPU076`	Yes	Collected during this survey and from Marillana. Known linear range 26 km.
Pauropodidae `BPU114`	No	New species and B code. Distribution unknown.
Pauropodidae sp. B14	Yes	Known distribution of ca. 220 km2; known linear range 41 km.
Symphyla		
Hanseniella sp.	No	Higher order identification; distribution unknown. Sequencing unsuccessful.
Symphylella `BSYM120`	No	New species and B code. Distribution unknown. Molecular analysis supported recognition of a new species and B code.
Symphylella `BSYM121`	No	New species and B code. Distribution unknown. Molecular analysis supported recognition of a new species and B code.
Symphylella 'BSYM139'	No	Sequencing successful with new species code Symphylella 'BSYM139'.

Identification	Known from outside the Development	Comments
Diplura		
Japygidae `BDP155` (DPL002)	Yes	Known distribution of ca. 1,800 km2; known linear range 95 km. Genetics supported morphological identification.
Japygidae sp.	Yes	Some in poor condition but Japygids are cryptic and difficult to identify. Other Japygids in the area include Japygidae `BDP155` (DPL002) which has a relative wide distribution.
Zygentoma		
Dodecastyla sp. B02 (=Atelurodes sp.	Yes	Widespread in northern Western Australia.
Trinemura `BZY105`	No	New species and B code. Known linear range 250 m. Both specimens sequenced, supporting recognition of a new species and B code.
Trinemura `BZY117'	No	Seven specimens recorded from a single site. New species. Possible synonym to T. `BZY105`. Unfortunately, due to their life stage, these species cannot effectively be compared morphologically with certainty.
Trinemura sp.	Yes	Two specimens recorded from one drillhole during recent survey, and over 20 specimens previously recorded from Development Envelope and surrounding areas. Recently collected specimens in poor condition but likely to be T. B32 or T. `BZY112` based on size.
Blattodea		
Nocticola quartermainei s.l.	Yes	Widespread in northern Western Australia. One specimen sequenced, supported morphological identification, which was retained for the other specimens.
Nocticola `BBL038 / B10` (cockingi s.l.)	Yes	Three specimens recorded from one drill hole. Known linear distribution 64 km.
Nocticola sp. B36 (cockingi s.l.)	Yes	Known distribution of ca. 100 km^2; known linear range 15 km. One specimen sequenced, supported morphological identification, which was retained for the other specimen.
Hemiptera		
Cixiidae sp. B02	Yes	Widespread in Western Australia.

Identification	Known from outside the Development	Comments
Phaconeura sp.	Yes	Higher order identification; distribution unknown. Seven specimens recorded from two drillholes. Unable to progress ID based on morphology due to life stage (i.e. nymphs). May be a new species or the widespread *Phaconeura* sp. B02 or B03, or locally widespread 'BHE030' or 'BHE032'.
Coleoptera		
Coleoptera sp. B07/B09	Yes	Collected across the central Pilbara. Known linear range 130 km.
Gilesdytes vixsulcatus	Yes	Five specimens recorded from two drillholes. Known linear distribution of 30 km.
Cryptorhynchinae sp. B10	Yes	Three specimens recorded from two drillholes. Known linear distribution of 9 km.
Cryptorhynchinae sp. B20 (=sp. MA)	Yes	Known linear range 18 km.
Hesperanillus `BCO247`	No	New species and B code. Distribution unknown. Sequencing unsuccessful; morphological ID retained.
Ptinella sp. B01 (=MC)	Yes	Widespread in Pilbara.
Staphylinidae sp.	Yes	Higher order; distribution unknown. Only head of animal collected; unsuitable for genetics. May belong to the genus *Tripectenopus* (Britton 1974). Staphylinids are present fairly commonly in the area.
Diptera		
Allopnyxia sp. B01	Yes	Widespread in Western Australia.

Source: Bennelongia 2024b, c, 2025; Biologic 2024d

Species highlighted in blue are currently not known from outside the Development Envelope



Development Envelope
Indicative Footprint
Existing Disturbance
Palaeovalleys (Bell et. al. 2012)
Existing Pits
Proposed New Western E8 Pit
Proposed New Eastern E8 Pit

Species only known from the Development Envelope

- *Hesperanillus* `BCO247`
- Trigoniulidae `BDI075`
- Trigoniulidae `BDI079`
- *Indohya* `BPS274`
- Pauropodidae `BPU114`
- *Cryptops* `BSCOL111`
- *Cryptops* `BSCOL091`
- *Symphylella* `BSYM120`
- *Symphylella* `BSYM121`
- *Trinemura* `BZY105`
- *Hanseniella* sp.
- *Draculoides* 'sp. Koodaideri/Yandi'
- *Symphylella* 'BSYM139'
- *Lagynochthonius*`BPS601`
- *Trinemura*`BZY117`

BHPBIO 1:20000 Geology

- Phja- Dolerite 1
- Phjb - Shaly BIF 1
- Phjc - Dolerite 2
- Phjd - Shaly BIF 2
- Phje - Cherty BIF Band
- Phjg - BIF Marker 1
- Phjh - Dolerite 3
- Phji - BIF Marker 2
- Phjj - Dolerite 4
- Qa - Alluvium (drainage channels)
- Qc - Talus & colluvium
- Qct - Colluvium - TP talus
- Td - Duricrust - Limonitic mesa capping
- To - Oakover - Fluvial calcareous sediments
- Tp - Robe Pisolite - Goethite pisolite with fossil wood fragments

Surrounding 500k Regolith

- _Ac-PIP; Alluvial/fluvial unit, PIP
- _C-PIP; Colluvial unit, PIP
- _Rr-fh-PIP; Residual or relict unit, PIP
- _Rr-kc-PIP; Residual or relict unit, PIP
- _Rt-PIP; Residual or relict unit, PIP
- _Rt-fl-PIP; Residual or relict unit, PIP
- _X-PIP; Exposed unit, PIP

BHP

PUBLIC

MARILLANA CREEK (YANDI) SIGNIFICANT AMENDMENT

TROGLOFAUNA ONLY KNOWN FROM THE DEVELOPMENT ENVELOPE

WAIO PLANNING, TECHNICAL & ENVIRONMENT

SCALE @A4:	1:100,000	PREPARED:	GEOMATICS	FIGURE:	10-6
DATE:	29/04/2025	REQUESTOR:	ENV APPROVALS		

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10.3.2.4 Regional subterranean fauna values

Flat Rocks and Marillana Creek Pools

Subterranean fauna habitats in and around Flat Rocks and the Marillana Creek Pools (described in detail in Section 7.3.3) are likely to be suitable for both stygofauna and troglofauna, given the presence of suitable geologies (i.e. CID, calcrete, alluvium and colluvium) and the Yandicoogina Palaeovalley (Figure 10-3).

No targeted troglofauna or stygofauna sampling has historically been undertaken specifically within the Flat Rocks area off-tenure; however, nearby historical sampling for stygofauna has recorded taxa from the Nematoda, Arthorpoda, Rotifera and Annelida taxonomic groups (Bennelongia 2022). Recent aquatic ecosystem sampling within the Marillana Creek Pools has found that 12% of the aquatic taxa recorded are directly dependent on groundwater for their persistence (4% stygobite and 8% permanent hyporheos stygophiles) and two potentially restricted stygofauna species have been recorded (Biologic 2024b):

- *Guineaxonopsis* `sp. Biologic-ACAR013`; – a permanent hyporheos stygophile water mite recorded from the hyporheic zone at MarC2 and MarC4. Has a linear range of 1 km and isn't known from elsewhere.
- *Parastenocaris* `sp. Biologic-HARP037` - a singleton, copepod recorded MarC2; however, additional morphological and molecular work will likely increase the known distribution of this taxa in the future.

In addition, troglofauna species have also been recorded from the hypoheic zone during these surveys including *Hanseniella* `sp. Biologic-SYMP055 and *Hanseniella* `sp. Biologic-SYMP069 (Biologic 2024b).

Ministers North

Ministers North is located approximately 3 km south of the Proposal and partially occurs within the groundwater drawdown contours of the Combined Proposal (Figure 10-1). As described in Section 7.3.3.2, the Minsters North aquifer is assumed to support groundwater levels and associated groundwater dependent ecosystems in Yandicoogina Gorge, located directly to the east of Ministers North. Whilst groundwater throughout the tenement is fresh and suitable for stygofauna, the depth to the water table is relatively deep, ranging from around 40 m to over 150 m (an average of 61.5 m); depths which are generally not suitable for stygofauna. This is further demonstrated by recent surveys which recorded only six named stygofauna species and concluded that the stygofauna assemblage at Ministers North is relatively depauperate with no restricted species known (Bennelongia 2024b). To the east of the proposed mine pits at Ministers North, where it is associated with Yandicoogina Creek and Yandicoogina Gorge, the groundwater generally gets shallower and is likely to provide suitable habitat for stygofauna (see Yandicoogina Gorge values described below).

BIF is the most widespread surface geology at Ministers North, where weathering of exposed rock has led to the creation of a layer of hardcap about 20 m thick across the whole deposit. This layer contains numerous cavities, some of which are filled with clay material, but most are empty and provide suitable troglofauna habitats (Bennelongia 2024b). In contrast to stygofauna, a rich troglofauna community has been at Ministers North; however, given that the Combined Proposal will not impact these values, troglofauna at Ministers North are not considered further, unless to provide context on species distributions.

Yandicoogina Gorge

Yandicoogina Gorge occurs approximately 3 km south of the Development Envelope, directly to the east of Ministers North, and is an ecologically significant feature in the landscape. The head of the gorge occurs in the groundwater drawdown area of the Combined Proposal (Figure 10-1). No targeted subterranean fauna sampling has been conducted within Yandicoogina Gorge; however, sampling of the hyporheic zone has yielded over 20 stygal species, including at least eight species that are unique to the gorge, highlighting a high level of connection between ground- and surface- waters (Biologic 2023c, d).

Recent aquatic ecosystem sampling has recorded a relatively high percentage of stygobitic taxa (19%) compared to other hyporheic zones in the Pilbara (i.e. 5%), including five potentially restricted stygofauna species (Biologic 2023d; 2024c):

- *Gomphodella* `sp. Biologic-OSTR077 – a potential new species of ostracod recorded from YC7H. Currently not known from elsewhere.
- Bathynellidae sp. BES7547 (YC9H) – a potentially new species of syncarid. Currently not known from elsewhere.
- *Atopobathynella* `sp. Biologic-PBAT042` - a potential new species of syncarid. Is considered a Potential SRE (Data Deficient) that is currently not known from elsewhere.
- Bathynellidae `sp. Biologic-BATH019` - a potential new species of syncarid. Is considered a Potential SRE (Data Deficient) that is currently not known from elsewhere.
- *Pygolabis* `sp. Biologic-ISOP035` - potentially restricted isopod currently not known from elsewhere.

In addition, three troglofauna taxa were recorded from the hyporheic zone including the pseudoscorpion Chthoniidae `sp. Biologic-PSEU083`, the dipluran Projapygidae `sp. Biologic-DIPL053`, and the symphylan *Hanseniella* `sp. Biologic-SYMP054` (Biologic 2023c). All troglofauna taxa were recorded in the wet season in 2022 from sites which do not always have an inundated hyporheic zone (i.e., YC6H, YC8H and YC9H). These locations would likely represent a humid, subterranean environment, that is not often inundated in comparison to the other sites sampled for hyporheos fauna within Yandicoogina Creek, which may provide temporary habitat for troglofauna (Biologic 2023c).

10.4 Potential environmental impacts

BHP has considered the potential impacts outlined in the EPA's Environmental Factor Guideline for Subterranean Fauna (EPA 2016e) and considers that those relevant to the Proposal are:

- changes to stygofauna habitat and species assemblages from groundwater drawdown (direct)
- degradation of stygofauna habitat through vegetation clearing and/or groundwater contamination (indirect)
- loss or modification of troglofauna habitat and species assemblages from mine pit excavation (direct)
- degradation of troglofauna habitat through desiccation from groundwater drawdown, vegetation clearing, blasting and vibration and/or land or groundwater contamination (indirect).

BHP has focussed the discussion of potential impacts to subterranean fauna based on the Proposal alone as well as the Combined Proposal (noting that Combined Proposal impacts from groundwater drawdown are more representative of cumulative impacts due to influences from nearby third-party mining operations). Information about impacts associated with the Approved Proposal have been provided for context where relevant, but have not been reassessed. Unless specified otherwise, the potential impacts discussed in this section are unmitigated (i.e. potential impacts before mitigation measures are applied, if required).

Cumulative impacts to subterranean fauna have been considered and are addressed in Section 16.4.1. This includes a discussion of potential cumulative impacts to subterranean fauna values at Yandicoogina Gorge where causation is still unclear nor can be attributed to a single mining operation or climate process.

10.4.1 Changes to stygofauna habitat and species assemblages from groundwater drawdown

Proposal

The additional groundwater abstraction required for the Proposal has the potential to further lower groundwater levels in areas that have already experienced groundwater drawdown, as well as introduce drawdown into areas previously unaffected (mainly in the south-east corner of the Development Envelope but also extending beyond the boundaries of the Development Envelope to the south, east and west [Figure 10-4]). Lowered groundwater levels have the potential to result in the reduction, loss or modification of suitable stygofauna habitat and/or species assemblages within these areas.

As described in Section 7.4.2, groundwater levels within the Indicative Footprint will be reduced from 12 m below the pit base, which will result in a 20 m reduction in groundwater levels from 488 mAHD to 468 mAHD, additional to what has already occurred as part of the Approved Proposal (Figure 10-4). This will be mostly confined to the south-east corner of the Development Envelope, in which the Indicative Footprint is located, as well as extending into areas to the south, east and south-west, most of which occurs within third party mining operations located outside the Development Envelope (Figure 10-4). Groundwater levels in the CID are expected to drawdown by a maximum of 20 m directly beneath the E8 pit, whilst the 2 m groundwater drawdown contours are predicted to extend laterally up to a maximum of 2.5 km in an east-west direction, extending beyond the boundaries of the Development Envelope, and up to 250 m in a northerly direction towards Marillana Creek (Figure 10-4). The groundwater levels in the Basement are estimated to drawdown by a maximum of 10 m within the Indicative Footprint, with drawdown of up to 1 m predicted to extend between 2.5 km (north south) and 4.5 km (east west) extending into areas beyond the boundaries of the Development Envelope (Figure 10-4). The predicted groundwater drawdown contours of the Proposal do not extend into Flat Rocks (see Section 7.4.2) or to the Ministers North Aquifer or Yandicoogina Gorge (Figure 10-4 refer to Section 7.3.3.2 and 7.4.2).

A total of six stygofauna species are currently only known from the Development Envelope, one of which has been recorded within the predicted groundwater drawdown contours of the Proposal: the copepod *Dussartcyclops* 2222 `BCY095` (Table 10-5; Figure 10-4). The remaining five potentially restricted stygofauna species occur outside the predicted drawdown of the Proposal.

Combined Proposal

The combined effect will be changes to stygofauna habitat and/or stygofauna assemblages within the combined groundwater drawdown contours of the Combined Proposal, additional to what has already been approved for the Approved Proposal (Figure 10-5). Whilst groundwater modelling for the Combined Proposal alone could not be undertaken due to influences from nearby third party mines (see Section 7.4.2.1), the modelling does provide an indication of the predicted drawdown associated with the Combined Proposal (noting it is more representative of cumulative drawdown) and so has been included in this assessment on a conservative basis.

The Combined Proposal will result in a maximum drawdown of 55 m (to 468 mAHD) from pre-development groundwater levels within the Indicative Footprint, and a maximum of 60 m from pre-development groundwater levels throughout the rest of the Development Envelope. This represents an additional 20 m drawdown within the Indicative Footprint, but limited additional drawdown within the rest of the Development Envelope given that a 50-60 m decline in groundwater levels has already occurred as a result of the Approved Proposal (Figure 10-5). Based on this, there will be no additional impacts to five of the six potentially restricted stygofauna species, as they are known from operational areas already subject to drawdown (Figure 10-5). One stygofauna species, *Dussartcyclops* 2222 `BCY095`, will be subject to an additional 10-20 m drawdown as a result of the Combined Proposal (Table 10-7).

In the south-east section of the Development Envelope, the Combined Proposal drawdown contours for the CID extend approximately 6 km east and 1 km south to the adjacent RTIO mining pits (outside the Development Envelope) where habitats are already highly modified (Figure 10-5). Given these habitats are already modified by third-party operations, there are limited additional impacts from the Combined Proposal and these areas are not considered further. However, on the western side of the Development Envelope, the Combined Proposal drawdown contours for the CID extend 4 km to the west where they are predicted to result in an additional 3 m drawdown of groundwater off-tenure at Flat Rocks, taking levels from 12 m to 15 m (described in detail in Section 7.6.2; Figure 10-5). Whilst the groundwater modelling does include influence from third-party operations, given that Flat Rocks

occurs on the western side of the Development Envelope where there are no nearby third-party operations, these impacts are likely to be mostly attributable to BHP activities.

Drawdown in the basement throughout the Development Envelope is similar to the Approved Proposal (Figure 7-10 in Section 7.4.2.1) where a maximum drawdown of 40-60 m is predicted to occur; however, the 1-10 m basement drawdown contours for the Combined Proposal will potentially extend laterally up to 6 km south of the Development Envelope (Figure 10-5). This drawdown extends through the Ministers North aquifer and Yandicoogina Gorge (refer to Section 7.4.2.1; Figure 10-5) and therefore has the potential to result in the loss or modification of stygofauna habitat and/or assemblages within these areas. Given that these impacts cannot be solely attributed to BHP activities, occur partially off-tenure and include influences from third-party operations, these impacts are addressed in the cumulative impacts section (Section 16.4.2).

Table 10-7: Subterranean Fauna - potential impacts to stygofauna only known from the groundwater drawdown area

Taxon	Predicted groundwater drawdown contour locations where species recorded (mbgl)*			Subject to additional groundwater drawdown	
	Approved Proposal (existing drawdown#)	Proposal contours (predicted 2029 drawdown)	Combined Proposal contours (predicted 2029 drawdown)	Proposal only	Combined Proposal
Haplotaxidae sp. S01	20-30m	-	20-30m	No - recorded outside the Proposal drawdown contours.	No – recorded from an area already subject to 20-30m drawdown. No additional drawdown predicted.
Dussartcyclops 2222 `BCY095`	30-40m	10-20 m	30-40 m	Potential - one species record occurs within the 10-20 m drawdown contours of the Proposal	Potential – recorded from an area already subject to 30-40 m drawdown as well as areas that will be subject to an additional 10-20 m drawdown associated with the Proposal.
Elaphoidella sp. S02	20-30 m	-	20-30 m	No - recorded outside the Proposal drawdown contours.	No – recorded from an area already subject to 20-30 m drawdown. No additional drawdown predicted.
Candonopsis `BOS1831`	20-30 m	-	20-30 m	No - recorded outside the Proposal drawdown contours.	No – recorded from an area already subject to 20-30 m drawdown. No additional drawdown predicted.
Darwinulidae sp.	30-40m	-	30-40m	No - recorded outside the Proposal drawdown contours.	No – recorded from an area already subject to 30-40 m drawdown. No additional drawdown predicted.
Pilbaranella `BSY372`	30-40m	-	30-40 m	No - recorded outside the Proposal drawdown contours.	No – recorded from an area already subject to 30-40 m drawdown.

* note: the groundwater drawdown contours of the Approved Proposal and Combined Proposal are influenced by third party operations
# existing drawdown as of 2023

10.4.2 Degradation of stygofauna habitat

Proposal

Indirect impacts to stygofauna associated with the Proposal may occur as a result of vegetation clearing, changes in surface hydrology or groundwater contamination (EPA 2016e). Little is known about the origin of energy (i.e. organic carbon), key taxa or connectivity within the food web of subterranean systems. Organic carbon, moisture, and oxygen is expected to originate from the surface and be transferred into the subterranean environment by infiltration of water through soil voids (preferentially via plant root systems) and geological fissures.

Clearing of vegetation may lead to a reduction in organic inputs and potentially a localised reduction of surface water infiltration which can lead to degradation of stygofauna habitat.

Alterations to surface hydrology and increases in surface erosion can potentially reduce groundwater quality and degrade suitable stygofauna habitat. The potential for groundwater to become contaminated could also occur from exposure of PAF material, post-closure formation of pit lakes and/or handling of hazardous materials or wastes. These activities could potentially result in harmful substances infiltrating into the subterranean environment, thereby making suitable stygofauna habitat less favourable.

Combined Proposal

The combined effect will be the potential degradation of stygofauna habitat, as described above, throughout the Development Envelope; however, the majority of this is associated with the Approved Proposal and is not to be reassessed. Any additional potential degradation will be limited to the Indicative Footprint of this Proposal (described above).

10.4.3 Changes to troglofauna habitat and individuals/species assemblages from mine pit excavation

Proposal

Mine pit excavation will result in the direct removal of troglofauna habitat and individuals within the proposed western and eastern pits of the Proposal. Both pits comprise alluvials and CID, most of which occurs AWT and provides medium and high suitability habitat for troglofauna (Biologic 2024d; Appendix 15). This is further demonstrated by the presence of a rich troglofauna assemblage within Proposal area, including five troglofauna species that are currently only known from locations within the proposed E8 pit including *Hesperanillus* `BCO247`, *Cryptops* `BSCOL091`, Trigoniulidae `BDI079`, Draculoides ‘sp. Koodaideri/Yandi’ and *Hanseniella* sp. (Table 10-8; Figure 10-6 in Section 10.3.2.3).

Combined Proposal

The combined effect of mining for the Combined Proposal will be the combined loss of troglofauna habitat and/or individuals/species assemblages throughout the Development Envelope associated with the existing and proposed new mine pits, including potential impacts to the 15 troglofauna species that are currently known only from the Development Envelope (Table 10-8; Figure 10-6 in Section 10.3.2.3). Of these, five species are located in areas that will be subject to additional disturbance. The remaining nine species were recorded in operation areas where there is existing disturbance and where they will not be subject to additional impacts associated with the Combined Proposal (Table 10-8).

Table 10-8: Subterranean Fauna - troglofauna only known from the Development Envelope

Identification	Indicative Footprint	Development Envelope	Species description and distribution
	Within proposed pits	Existing impact areas	
Taxa only known from the proposed pits			
Hesperanillus `BCO247`	✓	-	New species and distribution unknown. Singleton recorded from a scrape at one location within the proposed eastern pit. Sequencing unsuccessful; morphological ID retained. DNA sequencing unsuccessful so relying on morphological ID
Cryptops `BSCOL091`	✓	-	New species and distribution unknown. Recorded as bycatch from stygofauna net hauling from two locations, both within the proposed eastern pit. Known linear range of 300 m. Distribution outside the Indicative Footprint remains unknown.
Trigoniulidae `BDI079`	✓	-	Singleton record from the proposed eastern pit collected as bycatch from stygofauna sampling. Distribution unknown. Genetic sequencing successful and designated as a new species. Troglofaunal trigoniulids often have highly localised ranges; however, based on the distribution of Trigoniulidae `BDI075, which was also collected within the proposed eastern pit but has a known distribution of 11 km, it is possible that Trigoniulidae `BDI079`this has a distribution that extends beyond the boundaries of the proposed pit.
Draculoides 'sp. Koodaideri/Yandi'	✓	-	Recorded from two sites within the proposed eastern pit. Many species of Draculoides in the Pilbara have been described and most have restricted ranges. There is uncertainty about how this species aligns with more recent identifications. The distribution of this species remains unknown.
Hanseniella sp.	✓	-	Singleton recorded from one location within the proposed eastern pit. Higher order identification; distribution unknown. Given it is the only specimen from this genus recorded in the Development Envelope and its occurrence within the proposed pit, it has been included here under the Precautionary Principle.
Taxa known from outside the proposed pits			
Cryptops `BSCOL111`	-	✓	Collected as a singleton from a trap in the western section of the Development Envelope, outside the proposed pits. Sequencing suggested the species has not been collected previously and a new code was created. Distribution is unknown; however, will not be subject to additional impacts as a result of the Combined Proposal given it was recorded from operational areas.

Identification	Indicative Footprint	Development Envelope	Species description and distribution
	Within proposed pits	Existing impact areas	
Trigoniulidae `BDI075`	✓	✓	Recorded via trapping and scraping from two locations including within the proposed eastern pit and another location in the northern section of the Development Envelope, outside the proposed pits. Known linear range 11 km. Molecular analysis of two specimens supported recognition of new species. Likely distribution beyond the Development Envelope is unknown; however, given it is known from outside the proposed pits, it will not be subject to additional impacts as a result of the Combined Proposal.
Pauropodidae `BPU114`	-	✓	Singleton record from the western section of the Development Envelope, outside the Indicative Footprint and outside the proposed pits. New species with an unknown distribution that was collected as bycatch from stygofauna sampling. Will not be subject to additional impacts as a result of the Combined Proposal given it was recorded from areas of existing impact.
Indohya `BPS274`	-	✓	Singleton record via a scrape from the northern section of the Development Envelope, outside the proposed pits. New species and distribution beyond the Development Envelope unknown. Will not be subject to additional impacts as a result of the Combined Proposal given it was recorded from areas of existing impact.
Lagynochthonius `*BPS601*`	-	✓	Two individuals were collected from a single site, within the western section of the Development Envelope, outside the proposed pits. Will not be subject to additional impacts as a result of the Combined Proposal given it was recorded from areas of existing impact.
Trinemura `BZY105`	-	✓	Recorded via both trapping and scraping from two sites within the northern section of the Development Envelope, outside the proposed pits. Known linear range 250 m. Both specimens sequenced, supporting recognition of a new species. Will not be subject to additional impacts as a result of the Combined Proposal given it was recorded from areas of existing impact.
Trinemura `BZY117'	-	✓	Seven specimens recorded from a single site within existing operation areas, outside the proposed new pits. Will not be subject to additional impacts as a result of the Combined Proposal given it was recorded from areas of existing impact.
Symphylella `BSYM120`	-	✓	Singleton record from the western section of the Development Envelope, outside the proposed pits. New species that was collected as bycatch from stygofauna sampling and has an unknown distribution. Will not be subject to additional impacts as a result of the Combined Proposal given it was recorded from areas of existing impact.

Identification	Indicative Footprint	Development Envelope	Species description and distribution
	Within proposed pits	Existing impact areas	
Symphylella `BSYM121`	-	✓	Singleton record from the Development Envelope, outside the proposed pits. New species collected from a scrape and with an unknown distribution unknown. Will not be subject to additional impacts as a result of the Combined Proposal given it was recorded from areas of existing impact.
Symphylella 'BSYM139'	-	✓	The re-analysed *Symphylella* sp. indet, now known as *Symphylell*a `BSYM139`, was collected from site YW3951DG located within operation areas of the Combined Proposal. Will not be subject to additional impacts as a result of the Combined Proposal given it was recorded from areas of existing impact.

10.4.4 Degradation of troglofauna habitat

Troglofauna have the potential to be indirectly impacted through degradation of the subterranean environment associated with vegetation clearing, vibration, groundwater drawdown or changes in surface hydrology, and/or land or water contamination and are similar to those described for stygofauna in Section 10.4.2.

Proposal

Vegetation clearing may lead to a reduction of surface inputs of energy and water and potentially a reduction of the quality of troglofauna habitat within the Indicative Footprint. Similarly, the potential exists for troglofauna habitat to become contaminated from the exposure of PAF material, post-closure formation of pit lakes and/or handling of hazardous materials or wastes. These activities could potentially result in harmful substances infiltrating into the subterranean environment, thereby making suitable troglofauna habitat less favourable.

Blasting activities and vibration may also have the potential to alter troglofauna habitats; however, these risks are generally considered very localised to the immediate vicinity of the pit walls.

Troglofauna rely on relatively stable temperature and humidity conditions underground and are highly susceptible to the effects of desiccation from changes to water tables or surface inputs of moisture from rainfall (EPA 2016e). The combined effects of groundwater drawdown may have some potential to reduce the humidity of subterranean habitats.

Combined Proposal

The combined effect would be the degradation of troglofauna habitat, as described above, extending throughout the Development Envelope; however, the majority of this will be associated with the Approved Proposal. Any additional potential degradation will be limited to activities associated with this Proposal (described above).

10.5 Mitigation

BHP considers that there are potentially significant impacts to Subterranean Fauna requiring targeted management measures, specifically in relation to subterranean fauna habitats and potentially locally restricted subterranean fauna species, including both stygofauna and troglofauna. The proposed mitigation (including standard management practices) for the Proposal is discussed below, including BHP's intentions to use additional targeted surveys to inform the mitigation hierarchy.

10.5.1 Avoid

Avoidance of subterranean fauna habitat and individuals is not possible given that dewatering and mine pit excavation are key components required for implementation of this Proposal.

10.5.2 Minimise

BHP proposes to continue to manage potential impacts to subterranean fauna and habitat from dewatering and surplus water discharge to Marillana Creek in accordance with the management approach in the MCWRMP (BHP 2025c; Appendix 6). The management measures in the MCWRMP include groundwater level and quality monitoring which will also assist in ensuring that subterranean fauna habitat is maintained.

To prevent the further decline of groundwater levels, BHP has already undertaken a number of mitigation strategies including a dewatering reduction trial which commenced in 2022 and ceasing dewatering at W0 altogether in 2023 (see Section 7.5.2.2). Proposed additional mitigation measures to manage groundwater drawdown within the Development Envelope and specifically at Flat Rocks includes (see Section 7.5.2.2):

- Off-tenure reinjection in the CID upstream of Flat Rocks (currently being investigated)
- Investigation into the feasibility of low permeability barriers to slow groundwater flow into W1 Pit and force water to mound within the CID channel upstream.

Other minimisation strategies for subterranean fauna include (but are not limited to):

- Groundwater abstraction will be minimised to that which is required for implementation of the Proposal and will be compliant with existing licence GWL89501
- Minimising vegetation clearing to that which is required for implementation of the Proposal (i.e. no more than 95 ha of vegetation to be cleared)
- During the mine planning phase, BHP will minimise the removal of potential troglofauna habitat from mine pit excavation as far as practical.

10.5.3 Rehabilitate

Rehabilitation at the Yandi Hub is addressed in the Yandi MCP which has been revised to include this Proposal (BHP 2025b) (Appendix 5). BHP will implement the MCP to ensure that the Combined Proposal is decommissioned, and the site rehabilitated to be safe, stable and non-polluting and in an ecologically appropriate and sustainable manner. This includes potential management strategies and processes for monitoring the risk indicators for groundwater quality. Conceptual and numerical groundwater modelling will be refined as new data becomes available and the backfill strategy evolves, to further analyse post-mining groundwater levels and water quality. The proposed E8 pit closure design is yet to be finalised; however, BHP intend to backfill the pit with the objective of preventing formation of a pit lake, and the capture of Marillana Creek. As detailed in the Yandi MCP, BHP's progressive closure strategy for the Yandi Hub includes progressive backfilling into mined-out pits where possible. Areas that are no longer in use will be rehabilitated as soon as practicable, and progressive rehabilitation will be undertaken which will assist in re-establishing nutrient flows into the subterranean environment.

10.5.4 Other statutory decision-making processes

BHP's view is that there is no other statutory decision-making process to mitigate the potential environmental impacts of the Proposal on Subterranean Fauna when considering the EPA's *Taking decision making processes into account in EIA: Interim Guidance* (EPA 2021b).

10.6 Assessment and significance of residual impact

10.6.1 Changes to stygofauna habitat and species assemblage from groundwater drawdown

10.6.1.1 Changes to stygofauna habitat from groundwater drawdown

As discussed in Section 7.4.2, the Proposal will not result in an increase in the peak dewatering rate or annual groundwater abstraction limits for the Approved Proposal. However, the additional groundwater abstraction (for mine dewatering) for the Proposal has the potential to result in the additional loss or modification of stygofauna habitat and species assemblages within the Proposal's groundwater drawdown contour areas (Figure 10-4; noting that additional impacts to stygofauna habitat within the third party operations area would be unlikely to occur as these habitats have already been modified).

At E8, the Marillana Formation CID is currently intact and forms a thick, uninterrupted layer of highly suitable a habitat (Biologic 2024d). Owing to a lack of potential barriers, the highly suitable subterranean habitat throughout the E8 area is interpreted as continuous throughout the current extent of CID (Biologic 2024d). The current water level sits 40-50 m below surface depending on topography and as such, the majority of suitable habitat in the CID around the East 8 area is AWT (i.e. troglofauna habitat). The BWT fraction of the CID (i.e. stygofauna habitat) is approximately 15-25 m thick from the water table to the basement. Dewatering for the Proposal will remove a large portion of this BWT habitat; however, some fragmented patches of suitable CID habitat will remain (Biologic 2024d). At the E7 pit, the CID has been subject to historical mining, but relatively thin areas of the Lower CID unit (M2) immediately surrounding the pit (up to 20 m thick) remain intact and will continue to provide refuge areas for stygofauna during mining for the Proposal. At East 3,4,5,6, the Marillana Formation CIDs have been largely removed through historic mining, but a thin layer (up to 15 m) of CID remains intact around the pit shells and under the benches. Suitable habitat may also remain within deeper local lithologies, such as fractured/weathered parts of the Weeli Wolli Formation; however, the extent to which stygofauna could utilise these deeper habitats remains uncertain. Alluvials surrounding the Proposal are no longer expected to occur BWT due to historical mining and dewatering, but may provide temporary habitat during heavy rainfall events where the groundwater has been observed to rise by up to 12 m. However, areas of calcrete of the Oakover Formation to the west are likely to provide suitable habitat in the wider surrounding local area and extend beyond the groundwater impact area of the Proposal (Figure 10-3). In addition to the habitat areas modelled, areas of uncertain suitability habitat for stygofauna occur to the north of the Proposal. These areas lacked suitable drill holes to enable 3D habitat modelling but may still provide some suitable habitat for stygofauna where sufficiently weathered/fractured and BWT (Biologic 2024d).

Habitat extent and connectivity outside the drawdown areas of the Proposal is further demonstrated by the occurrence of shared stygofauna species such as *Maarrka weeliwollii*, *Meridiescandona marillanae*, and Paramelitidae sp. B16 within nearby mining tenements Yandicoogina (Rio Tinto) and Iron Valley (BC Iron), as well as over 85% of the stygofauna assemblage at Yandi being known from areas outside the drawdown impact area. In addition, the Yandicoogina Palaeovalley is likely to provide suitable stygofauna habitat in the central areas of the valley and connects to the much larger Robe Palaeovalley (a subterranean fauna hotspot) to the north-east (Bennelongia 2024b; Clark et. al 2021).

Based on the above, impacts to stygofauna habitat as a result of the Proposal are unlikely to be significant and BHP considers that the EPA's objective for this factor can be met.

When considering impacts of the Combined Proposal, stygofauna within the Development Envelope have already been subject to groundwater drawdown as part of the Approved Proposal where a maximum of 50-60 m drawdown has occurred throughout most of the Development Envelope (see Section 7.4.2). Drawdown associated with the Approved Proposal has likely resulted in most of the highly suitable CID habitats being dewatered completely. Despite the existing groundwater drawdown throughout the Development Envelope, a rich stygofauna assemblage continues to persist with at least 56 species having been recorded during recent and historical surveys (Bennelongia 2024b, c, 2025). Groundwater drawdown predicted for the Combined Proposal will be 40-60 m, consistent with that already approved for the Approved Proposal. However, the Combined Proposal groundwater drawdown contours extend into areas off-tenure at Flat Rocks where an additional 3 m of drawdown is predicted to occur (see Section 7.6.2; Figure 10-5). Dewatering for the Approved Proposal at W0 and W1 has already lowered groundwater levels in the CID aquifer upgradient and off tenement at Flat Rocks (refer to Section 7.4.2.1 and Section 8.6.2). In response to lowered groundwater levels, BHP has commenced mitigation actions (i.e. ceasing dewatering at W0) and is currently investigating additional mitigation strategies including reinjection off tenure reinjection and investigation into the feasibility of a low permeability barrier, with the aim to slow groundwater flow into W1 Pit and force water to mound within the CID channel upstream (refer to Section 7.5.2.2 and Section 10.5).

Suitable stygofauna habitat throughout the Flat Rocks area is likely to occur within the CID, alluvium, colluvium and areas of calcrete (where BWT) which (based on surface geology) extend beyond the area of predicted groundwater drawdown (Figure 10-3). The extent and likely connectivity of these habitats is also indicated by historical monitoring surveys which have recorded at least 14 shared stygofauna species at Yandi and from the Upper Marillana area, approximately 3-10 km to the north-west (Bennelongia 2012; 2025).

Given the extent and connectivity of suitable stygofauna habitat beyond the groundwater drawdown area of the Combined Proposal, as well as the proposed management and mitigation of groundwater level decline at Flat Rocks, impacts to stygofauna habitat as a result of the Combined Proposal are considered unlikely to be significant.

10.6.1.2 Changes to stygofauna species assemblages from groundwater drawdown

As well as loss or modification of suitable BWT habitats, groundwater drawdown has the potential to result in the loss of individuals and/or modify species assemblages. There is limited information on how stygofauna respond to alterations in groundwater levels. Historical monitoring at Yandi has shown that groundwater drawdown associated with dewatering reduces stygofauna populations and/or alters assemblage composition, but that this reduction is often temporary, with assemblages seemingly returning, to some extent, once groundwater levels recover (Bennelongia 2013). Given that stygofauna of the Pilbara evolved in an environment where groundwater levels have shown considerable changes over both short and long timeframes, stygofauna would be expected to be tolerant of reductions in groundwater habitat and water chemistry changes associated with drought-induced drawdown (Bennelongia 2013). Groundwater levels in the alluvium aquifer system within Marillana Creek fluctuate with seasonal rainfall and streamflow, and will dry out completely or retain a few meters of water (BHP 2024c) whereas natural fluctuations within the CID can range from 5-7 m (refer to section 7.3.2.7). The local stygofauna assemblages are likely to have adapted to this environment and fluctuating groundwater levels.

Six stygofauna species are currently only known from the Development Envelope (Table 10-7); however, given the occurrence of non-widespread, shared stygofauna species in areas outside the drawdown, as well as over 85% of the Yandi stygofauna assemblage being known from elsewhere, this is likely to be an artefact of sampling rather than true distribution restriction. An assessment of the potential impact of the Proposal alone and the Combined Proposal to the six potentially restricted stygofauna species is provided in Table 10-9. Overall, only one stygofauna species will be subject to additional impacts associated with the Combined Proposal, *Dussartcyclops* 2222 `BCY095`, as it occurs in an area that may be subject to an additional 10-20 m drawdown. However, given that it has a known linear distribution of at least 10 km, and records occur in areas outside the additional drawdown area, impacts to this species are unlikely to be significant. There will be no additional impact to the remaining five stygofauna species (Table 10-9).

Overall, impacts to stygofauna as a result of the Proposal alone or the Combined Proposal are considered unlikely to be significant and BHP considers that the EPA objective for this factor can be met.

Table 10-9: Subterranean fauna – impacts to stygofauna species

Species	Description of predicted impact
Haplotaxidae sp. S01	Singleton recorded at one site outside the groundwater drawdown contours of the Proposal, but within the groundwater contours of the Combined Proposal (Figure 10-5). This is a historic record collected pre-2012 and remains the only known record of this taxa. Recorded from an area already subject to 20-30m drawdown. No additional drawdown predicted.
Dussartcyclops 2222 `BCY095`	Eight individuals recorded from two sites in 2023: one located in the drawdown contours of the Proposal (5-10m drawdown in CID) and one record approximately 10 km north, in the drawdown contours of the Combined Proposal (30-40 m basement drawdown). Cyclopoid copepods in the Pilbara are mostly widespread, with ranges usually covering multiple sub-regions and as such, this species is likely to have a wider distribution than is currently known. Given it has a known linear distribution of at least 10 km and is known from an area that is unlikely to experience any additional drawdown, impacts to this species as a result of either the Proposal alone or the Combined Proposal are unlikely to be significant.
Elaphoidella sp. S02	One individual was recorded at one site outside the groundwater drawdown contours of the Proposal, but within the 20-30 m basement contours the Combined Proposal which is within the Approved drawdown (Figure 10-5). This is a historical record, collected in 2009 and no subsequent records are known (Bennelongia 2024b). No additional drawdown predicted.
Candonopsis `BOS1831`	Recorded from one drillhole (five specimens) in 2023. It was recorded within the 10-20 m CID contours and 30-40 m basement drawdown contours of the Combined Proposal; however, this area has already experienced approximately 50 m drawdown. No additional drawdown predicted.
Darwinulidae sp.	Recorded from one drillhole (one specimens) in 2023 and has been included here as it is the only darwinulid recorded during the recent survey (Bennelongia 2024b). It was recorded within the 10-20 m CID contours and 30-40 m basement drawdown contours of the Combined Proposal; however, this area has already experienced approximately 50 m drawdown as a result of the Approved Proposal. No additional drawdown predicted.
Pilbaranella `BSY372`	A new species, recorded from one drill hole (nine specimens) in 2023. It was recorded within the 30-40 m basement drawdown contours of the Combined Proposal; however, this area has already experienced approximately 50 m drawdown. No additional drawdown predicted.

10.6.2 Degradation of stygofauna habitat

The Proposal has the potential to result in indirect impacts to stygofauna, additional to what has previously been assessed for the Approved Proposal; however, these are likely to be highly localised and restricted to the Indicative Footprint. The Proposal will utilise OSAs associated with the Approved Proposal and therefore, no additional indirect impacts associated with the placement of mineral waste material would occur.

Vegetation clearing will be minimised that that which is necessary for implementation of the Proposal and covers a relatively small area (i.e., 95 ha). These areas will be progressively cleared to assist in re-establishing nutrient flows into the subterranean environment.

As discussed in Section 10.4.2, there are unlikely to be direct or indirect impacts to surface water flows or impacts on water quality for the Combined Proposal. Indirect impacts to stygofauna associated with changes to surface water are therefore not considered to be significant.

Hydrocarbon storage and spill management procedures are expected to effectively mitigate the risk of hydrocarbon or chemical contamination of stygofauna habitat. BHP has well established strategies for the management of wastes at its Pilbara operations to ensure that risk of contamination of groundwater is minimised. Hydrocarbons will be handled, stored and disposed of in accordance with legal requirements.

Overall, indirect impacts associated with habitat degradation are expected to be localised, temporary and can be managed effectively through the management measures described in Section 10.5. Overall, the degradation of stygofauna habitat associated with either the Proposal alone or the Combined Proposal is considered unlikely to represent a significant residual impact to stygofauna.

10.6.3 Changes to troglofauna habitat and individuals/species assemblages from mine pit excavation

10.6.3.1 Loss of troglofauna habitat from mine pit excavation

Mine pit excavation associated with the Proposal will result in the direct removal of suitable troglofauna habitat within the proposed E8 pits. 2D and 3D habitat modelling shows that at E8, suitable troglofauna habitat is hosted within the AWT habitats in the CID and the alluvial detritals. The majority of troglofauna records from the proposed E8 pits were collected within these geological units (Biologic 2024d; Bennelongia 2024b). Whilst the Proposal will remove these habitats directly beneath the proposed pits, the 3D habitat modelling demonstrates that these habitats provide a well-connected network of high to medium suitability habitat AWT that extends into the wider area, with no known barriers, which will continue to provide refuge habitats for troglofauna post mining (Biologic 2024d; Appendix 15). Post-mining, some suitable habitat will remain intact within the CID beneath the pit, in between the proposed eastern and western E8 pits, and between the E7 and E8 pits, whilst medium suitability alluvial habitats will also remain intact to the west. Areas of uncertain habitat to the north could also provide suitable habitat; however, these could not be modelled due to the lack of available drillholes (Biologic 2024d; Appendix 15).

The combined effect of mining for the Combined Proposal will be the localised loss of troglofauna habitat associated with the existing and proposed mine pits throughout the Development Envelope, noting that additional impacts are associated with the Proposal alone (Figure 10-6). The 2D and 3D habitat modelling shows that the Upper and Lower CID, and alluvial detritals, where they occur AWT, provide high to medium suitability habitat for troglofauna within and surrounding the Indicative Footprint. Whilst specific 3D habitat modelling has not been undertaken for the remainder of the Development Envelope, these geologies do occur elsewhere in the Development Envelope and extend into areas beyond the Combined Proposal impacts (Figure 10-3). The extent and connectivity of troglofauna habitat throughout the Development Envelope is further demonstrated by the rich troglofauna assemblage (i.e. 33 species) that was recently recorded at Yandi, despite existing operations having resulted in a reduction in suitable habitat associated with the existing mine pits).

Based on the extent and connectivity of high and medium suitability troglofauna habitat that will remain post-mining, as well as the extent within, and extending beyond, the Development Envelope, the loss of troglofauna habitat due to either the Proposal alone or the Combined Proposal is unlikely to be significant and the EPA objective for this factor will be met.

10.6.3.2 Loss of troglofauna individuals from mine pit excavation

Of the 14 troglofauna species currently only known from the Development Envelope, five troglofauna species occur within the proposed E8 pits where they will be subject to additional impacts associated with the Proposal. An assessment of the potential impact to each of these five troglofauna species is provided below and in Appendix 15

(Biologic 2024d). Overall, no significant residual impacts to troglofauna species are expected as a result of the Proposal alone or Combined Proposal due to the extent and connectivity of suitable troglofauna habitats extending beyond the areas of impact and/or the potentially restricted species occurring in locations where suitable habitat will remain beneath or surrounding the species recorded location (Biologic 2024d; Appendix 15).

Hesperanillus `BCO247` was collected from a single site within the proposed eastern E8 pit (Figure 10-6). It is currently only known from this one location. Similar species tend to have small ranges, often known from a single site or up to several hundred square kilometres. Based on 2D modelling, the specimen was recorded in the CID unit; however, drill core analysis shows that additional AWT high and medium suitability habitats also occur at this location, extending to areas outside those to be impacted. The modelling predicts that some suitable habitat will remain intact directly underneath the known record location of *Hesperanillus* `sp. BCO247` within the CID and extending between the E8 and E7 pits, whilst medium suitability alluvial habitats will also remain intact to the north. Overall, impacts to this species are unlikely to be significant given that the proposed pits are relatively small, and given the extent of high and medium suitability habitat in the CID and alluvials that will remain intact post-mining (Biologic 2024d).

Cryptops `BSCOL091` was collected as bycatch during stygofauna net hauling from two locations within the E8 pit, approximately 300 m apart (Figure 10-6). Both specimens were successfully sequenced, identifying it as a new species. Other undescribed species of *Cryptops* are known from few specimens each with ranges from hundreds of metres up to tens of kilometres. The records within the Indicative Footprint occur at the edge of the proposed pit, where mining will be shallower (Biologic 2024d). Habitat modelling shows this species occurring in CID, shaly BIF and alluvials, and predicts that high suitability habitat will remain intact beneath the margins of the eastern E8 pit at proposed groundwater levels, and more broadly between the two E8 pits. To the north of the E8 pits, medium suitability habitat will remain intact throughout the alluvials. Based on the extent and connectivity of medium and high suitability habitat, impacts to *Cryptops* 'BSCOL091' are unlikely to be significant (Biologic 2024d).

Trigoniulidae `BDI079` is a singleton record identified during stygofauna net hauling from one location in the proposed eastern E8 pit (Figure 10-6). Genetic sequencing was successful and designated it as a new species. Troglofaunal trigoniulids often have highly localised ranges and the wider distribution of this species remains unknown; however, the species was recorded at the edge of the proposed eastern E8 pit, where mining is expected to be relatively shallow and 3D habitat modelling predicts that highly suitable habitat will remain beneath the proposed pit shell within the CID, as well as between the two E8 pits. In addition, medium suitability habitat will remain throughout the alluvial detritals to the north and west. Based on the extent and connectivity of medium and high suitability habitat, impacts to this species are unlikely to be significant (Biologic 2024d).

Draculoides 'sp. Koodaideri/Yandi' was identified from database records as it was historically recorded from two sites within the proposed eastern E8 pit (Figure 10-6). Many species of Draculoides in the Pilbara have been described and most have restricted ranges. There is uncertainty about how this species aligns with more recent identifications due to the historical nature of the species record and as such, the distribution of this species remains unknown. It was recorded from one location that is the same as Trigoniulidae `BDI079' and *Cryptops* `BSCOL091` (drill hole YE2033R), at the edge of the proposed eastern E8 pit, where mining is expected to be relatively shallow. Whilst it is unknown exactly which geological unit this species was recorded from, highly suitable troglofauna habitat will remain beneath the proposed pit shell within the CID at this location, as well as between the two E8 pits, whilst medium suitability habitat is also likely to occur throughout the alluvial detritals to the north and west. Based on the extent of high and medium suitability habitat that will remain post-mining, impacts to this species are unlikely to be significant (Biologic 2024d).

Hanseniella sp. is a singleton recorded from a scrape and only identified to genus level. This is the only record of *Hanseniella* at Yandi, so it can be inferred to represent a new species. DNA sequencing of the specimen was unsuccessful. Based on current records, it is only known from the Development Envelope. Other species from the same genus have an average linear range of 8 km; however, due to the taxonomic uncertainties, this species has been included here as a precaution. It was recorded from the proposed E8 eastern pit within CID and alluvials. 3D

habitat modelling shows that high and medium suitability habitats extend beyond the areas of impact, and as such, impacts to this species are unlikely to be significant (Biologic 2024d).

10.6.4 Degradation of troglofauna habitat

The Proposal has the potential to result in indirect impacts to troglofauna, additional to what has previously been assessed for the Approved Proposal. Little evidence is available examining the indirect impacts of above-ground disturbances such as vegetation removal and creation of infrastructure, although it is likely that any impacts would be limited to habitats directly beneath the footprint of disturbance.

Groundwater drawdown associated with dewatering for the Proposal has the potential to degrade troglofauna habitats in areas outside the Indicative Footprint by drying out suitable habitat and reducing humidity. As described in Section 10.4.1.1, groundwater drawdown in response to dewatering for the Proposal is expected to occur to the south, south-east and south-west of the Development Envelope; however, most of these areas currently comprise existing third-party mining operations where troglofauna habitats have already been lost or are highly modified. Indirect impacts associated with groundwater drawdown from the Combined Proposal are difficult to quantify and likely to include impacts from nearby operations and so have been considered under cumulative impacts, addressed further in Section 16.4.

Risks associated with blasting activities and vibration are generally considered minor but are difficult to measure and assess. Recent studies suggest that vibration and blasting have minimal effect on the integrity of geological structures (and therefore troglofauna habitat) even as close as 5 m away from the pit face (Rio Tinto 2018). Therefore, the risks from blasting or vibration for the Proposal are expected to be minor.

Hydrocarbon storage and spill management procedures, implemented in accordance with legal requirements, are expected to effectively mitigate the risk of hydrocarbon or chemical contamination of troglofauna habitats. BHP has well established strategies for the management of wastes at its Pilbara operations to ensure that risk of contamination of soil or groundwater is minimised.

Overall, indirect impacts associated with vegetation clearing, placement of infrastructure, blasting and vibration and contamination for the Proposal are likely to be highly localised, temporary and minor and are therefore not considered significant.

10.6.5 Significant residual impacts

Following the application of the mitigation hierarchy (Section 10.5), BHP considers that there will be no significant residual impacts to subterranean fauna from the Combined Proposal. Potential residual impacts to subterranean fauna values at Yandicoogina Gorge may be due to climate variability, or a combination of climate variability and groundwater drawdown from regional cumulative dewatering by both BHP and third-party operators, and are addressed in Section 16.4.

See Section 10.7 for the discussion on the outcomes relating to the identified residual impacts and BHP’s proposed assurance (regulation) and monitoring, where required, for Subterranean Fauna.

10.7 Environmental outcomes

Table 10-10 summarises the environmental outcomes, proposed assurance (regulation) and proposed monitoring (if required) for each residual impact to Subterranean Fauna. Table 10-10 demonstrates how the environmental outcomes for the Combined Proposal, together with the proposed regulation and monitoring, are anticipated to be consistent with the EPA's objective for Subterranean Fauna.

As required by the EPA's ERD Instructions, for Significant Amendments, BHP has included information about the existing implementation conditions for the Approved Proposal (Appendix 2). As provided for as an option in the EPA's ERD Instructions, BHP has proposed conditions (including outcome-based conditions) for Inland Waters (which will subsequently provide benefits for subterranean fauna) for the EPA's consideration, in Appendix 3.

Table 10-10: Subterranean Fauna - environmental outcomes, proposed regulation and monitoring of the Proposal

Residual impact	Environmental outcome	Proposed regulation (Condition[1] or other statutory decision-making process)	Proposed Monitoring	Consistency with EPA objective
Loss and/or modification of suitable BWT stygofauna habitat within the groundwater drawdown contours	Retention of some suitable BWT stygofauna habitat within and extending beyond the drawdown contours of the Proposal No adverse impact to stygofauna habitats in areas outside the drawdown contours as a result of the Proposal No further loss or modification of stygofauna habitat at Flat Rocks as a result of dewatering	Refer to Inland Waters Section 7.7 (Table 7-11, Residual impact 1 – RiWI Act 5C licence regulation and monitoring)	Ongoing monitoring, as detailed in the MCWRMP, to ensure groundwater level and quality are maintained.	The ecological integrity of stygofauna habitat and biological diversity of the stygofauna assemblage within the Development Envelope and wider region will be maintained which is consistent with the EPA's objective
Loss of stygofauna individuals due to groundwater drawdown	No adverse impacts to local or regional stygofauna assemblages as a result of groundwater drawdown for the Proposal			
Localised loss and/or modification of suitable AWT troglofauna habitat	Maintenance of suitable AWT troglofauna habitats		Standard management practices:	The ecological integrity of troglofauna habitat and biological diversity of the

Residual impact	Environmental outcome	Proposed regulation (Condition[1] or other statutory decision-making process)	Proposed Monitoring	Consistency with EPA objective
from mine pit excavation for the Proposal	within the Development Envelope	Refer to Inland Waters Section 7.7 (Table 7 8, Residual impact 1 – RiWI Act 5C licence regulation and monitoring)	• internal land disturbance approval process to manage ground disturbance • annual land disturbance reporting against approved limits/extents.	troglofauna assemblage will be maintained at a local and regional level which is consistent with the EPA's objective
Localised loss of troglofauna individuals due to mine pit excavation	No adverse impact to local or regional troglofauna assemblages as a result of the Proposal			

1 See Appendix 3 for proposed implementation conditions for the Combined Proposal

11 Social Surroundings

11.1 EPA environmental factor and objective

In accordance with the EPA Factor Guideline for Social Surroundings, the environmental impact assessment considered interactions between the Proposal, the Combined Proposal, and the surrounding biological environment, including potential impacts to a person's aesthetic, cultural, economic or social surroundings.

The EPA's objective for the Social Surroundings factor is:

> *To protect social surroundings from significant harm.*

11.2 Relevant policy and guidance

BHP assessed this environmental factor consistent with the following relevant EPA policies and guidance, as outlined in Table 11-1.

Table 11-1: Social Surroundings – policy and guidance

EPA, other State and Commonwealth policy and guidance	Consideration of EPA policy and guidance
Environmental factor Guideline – Social Surroundings (EPA 2023b) *Technical Guidance EIA of Social Surroundings – Aboriginal Cultural Heritage* (EPA 2023c)	• Identified the values which may be impacted, and their significance • Identified activities that can impact social surroundings • Applied the mitigation hierarchy to avoid or minimise impacts on social surroundings, where possible • Undertaken consultation with the Banjima representatives through BNTAC on the Proposal.

In November 2023, the EPA published updated *Environmental Factor Guideline – Social Surroundings and supporting Technical Guidance EIA of Social Surroundings – Aboriginal Cultural Heritage* (EPA 2023c). The guidance defines Social Surroundings and considerations for impact assessment. This guidance was updated to reflect the repeal of the *Aboriginal Cultural Heritage Act 2021* and amendments to the AH Act.

BHP recognises that Aboriginal and Torres Strait Islander People have an intrinsic connection to land, water, culture, and heritage and is committed to agreement making with Traditional Owners and to facilitating local decision making by Traditional Owners. BHP has undertaken consultation and engagement with the Banjima Traditional Owners, facilitated through BNTAC, in relation to the Proposal, to understand the social, cultural and heritage values of the proposed Development Envelope and surrounds, and to ensure that these values are managed in a consultative and holistic manner, in accordance with the current EPA social surrounds objective, legislative requirements, the Comprehensive Native Title Agreement in place between BHP and Banjima People and Traditional Owner expectations. These engagements are summarised in Section 11.3.2.

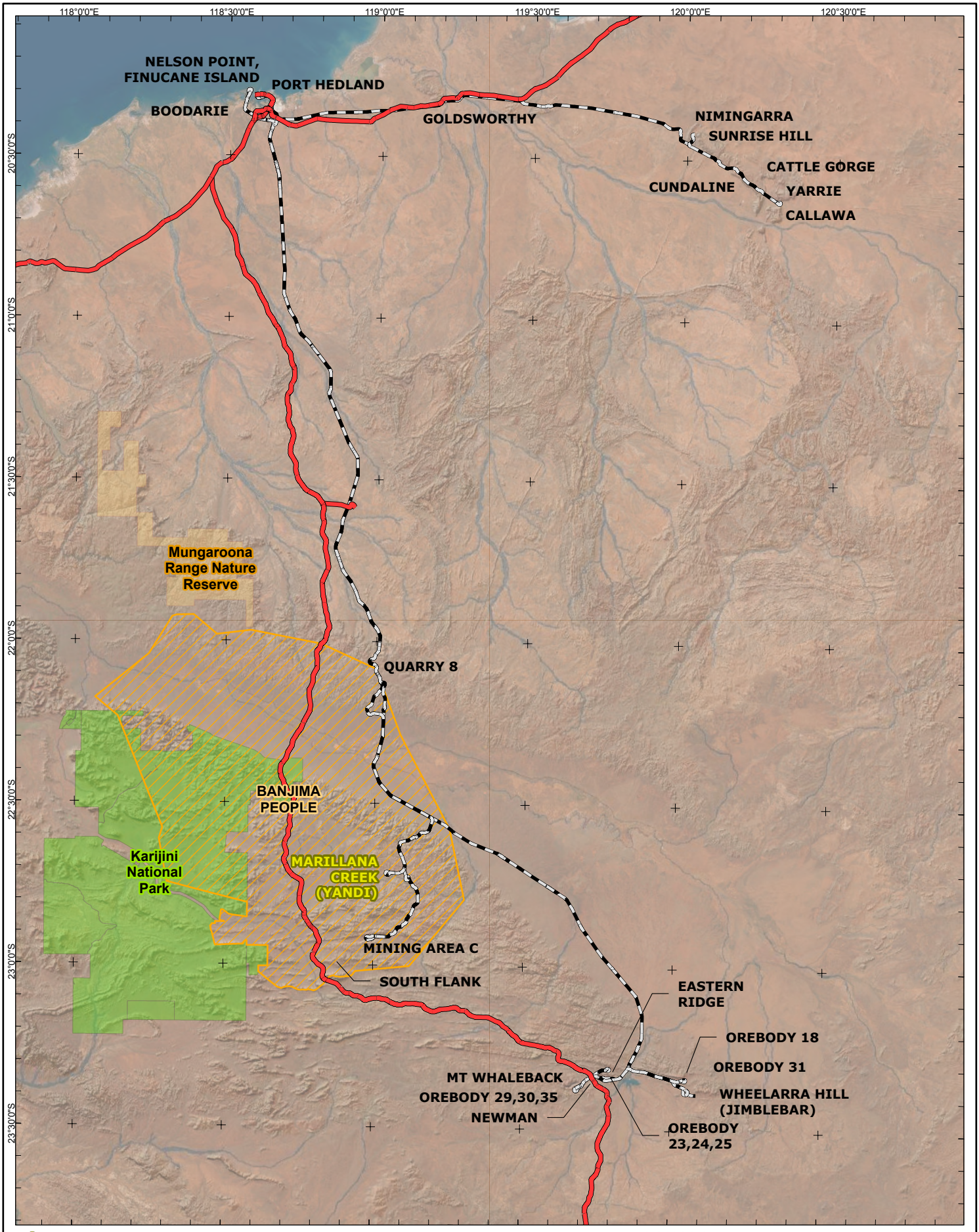
11.3 Traditional Owners, engagement and values

11.3.1 Banjima Native Title determination area

The Banjima People are the Traditional Owners of the land that underlies the Combined Proposal. The Development Envelope sits wholly within the external boundaries of the Banjima Native Title determination area (WCD2014/001) (Figure 11-1). BHP has an ongoing relationship with the Banjima People which is formalised through a

Comprehensive Agreement and associated registered Indigenous Land Use Agreement (ILUA). The Comprehensive Agreement includes a heritage protocol supporting the identification of heritage and cultural values within the determination area and the management of BHP's activities to minimise impact on cultural heritage and protect cultural heritage values from significant harm.

Representatives from both BHP and the Banjima Traditional Owners meet regularly through the established Heritage Advisory Council (HAC). This forum is an important part of the relationship between BHP and the Banjima Traditional Owners which enables sharing of information, feedback from recent engagements and identification and discussion of concerns and decision making in relation to matters including heritage and environment. BNTAC represents the Banjima Traditional Owners, and BHP maintains an ongoing relationship with BNTAC through regular communication and the pathways prescribed in the Comprehensive Agreement.



BHP WAIO operation
Town
National highway
Rail
WA Native Title Determinations (WAIO)
National park
Nature reserve

N

0 25 50 75
KILOMETRES

GDA 1994 MGA ZONE 50

BHP

PUBLIC

MARILLANA CREEK (YANDI) SIGNIFICANT AMENDMENT

BANJIMA NATIVE TITLE AREA

WAIO PLANNING, TECHNICAL & ENVIRONMENT

SCALE @ A4:	1:1,700,000	PREPARED:	GEOMATICS	FIGURE:	11-1
DATE:	29/04/2025	REQUESTOR:	ENV APPROVALS	NO:	A1072-023-RevB

Document Path: Y:\Jobs\A1001_A1500\A1205\3Project\A1072_023_YandiS45C_BanjimaNativeTitle_RevB.aprx

11.3.2 Engagement with Banjima Traditional Owners

BHP consulted with the Banjima Traditional Owners in relation to the Proposal from 22 November 2022 to 21 March 2025, to better understand the broader social, cultural, heritage and environmental values of their lands in and around the Combined Proposal, to understand and respond to any concerns and questions in relation to the potential impacts of the Proposal and Combined Proposal, and to work together to identify priorities for avoidance and management. These engagements to date have included HAC meetings and visits on country. BHP representatives presented the Proposal and the draft SCHEMP at the HAC meetings in December 2023, June 2024, September 2024 and March 2025.

A summary of engagement undertaken to date is provided in Table 11-2.

Table 11-2: Record of engagement with Traditional Owners

Date and location	Description of engagement	Summary	Banjima Feedback	BHP Response
22 November 2022, Perth	Banjima HAC Meeting	Banjima HAC meeting. BHP provided a project overview on identification of existing values, potential impacts and proposed environmental management to the committee members.	Banjima representatives identified water as a significant cultural value for BHP to draw focus to.	BHP committed to inviting water experts to the next consultation and providing further information on current modelling.
22 March 2023, Perth	Banjima HAC Meeting	At the Banjima HAC meeting in Perth, BHP provided a project overview of Yandi E8 including identification of existing values, potential impacts and proposed environmental management to the committee members.	Banjima representatives requested a site visit with Senior Elders, BHP General Managers and relevant Subject Matter Experts to discuss management of impacts to water on country.	BHP committed to an on-country consultation as requested.

13-15 June 2023, Yandi Mine	Banjima led Social Surroundings engagement including project overview.
	
	Locations visited as per Banjima request were Flat Rocks Spring, Stockyards located at E7 pit and land bridge location at C3 pit.
		During the consultation, Banjima representatives raised several concerns relating to likely and possible impacts on the physical and biological surroundings and the related potential harm to Social Surroundings.	During and following consultation Banjima provided feedback and requested further information regarding:
			
			• Mining Design
			  ○ Depth of E8 deposit
			  ○ Final design of C3 land bridge
			• Water Management
			  ○ Importance of water to Banjima People
			  ○ Distance of E8 pit to Marillana Creek
			  ○ Flat Rock Spring mitigation actions
			  ○ Mining below water table
			  ○ E7 discharge point
			• Biodiversity / Land
			  ○ Importance of biodiversity values in C3 areas
			  ○ Spatial data capture for additional hectares
				BHP committed to providing the information requested by Banjima People.
				
				BHP committed to working with Banjima to provide further information and investigate and mitigate impacts at Flat Rocks.
				
				BHP committed to co-developing the SCHEMP with Banjima People.

Date and location	Description of engagement	Summary	Banjima Feedback	BHP Response
			○ Cumulative impacts to Pebble Mound Mouse population • Closure ○ Encouraged by Yandi rehabilitation nursery ○ Strong preference for not having pit lakes.	
23 June 2023, Perth	Banjima HAC Meeting	Banjima HAC meeting in Perth, BHP provided a summary of the Social Surroundings consultation that took place a week prior and responded to comments/concerns raised by Banjima during the Social Surroundings consultation. BHP presented an understanding of groundwater decline at Flat Rocks, which is understood to be an impact of mine dewatering in the Western Pits. BHP committed to mitigation activities at Flat Rocks. BHP presented monitoring information showing declining groundwater levels across the Ministers North tenement, along with observations of declining groundwater dependent ecosystem health within Yandicoogina Gorge. While the potential causes of this decline are still under investigation, potential causes include climate variability (rainfall) or a combination of both climate variability and regional groundwater drawdown for mining (BHP and third-party). BHP shared the preliminary proposal for a mitigation trial to stabilise groundwater levels and sought feedback from Banjima. BHP advised Banjima of engagement with RTIO and intended engagement with DWER on the above.	Banjima reinforced feedback from on-country consultation with regards to the proposal. Additionally, Banjima supported BHPs mitigation action at Flat Rocks and advised this is the highest priority, and requested further information is provided on Yandicoogina Gorge.	BHP provided greater clarity on closure challenges and complexity with backfilling all pit voids. BHP committed to backfilling E8 to above water table. BHP committed to an implementation strategy to abate groundwater decline at Yandicoogina Gorge, including continued engagement with Banjima throughout implementation. BHP commit to facilitating a “Water Workshop” between BNTAC and BHP, focusing on water management across Banjima country.
14 – 15 July 2023, Perth	BHP/ BNTAC Workshop	BHP and BNTAC came together following concerns raised by Banjima regarding water values and mine closure at	BNTAC supports the development of mitigation strategies.	BHP committed to an implementation strategy to abate groundwater decline at Yandicoogina Gorge, including

Date and location	Description of engagement	Summary	Banjima Feedback	BHP Response
		Yandi. The objective of the workshop was to develop a mitigation strategy to address these concerns.		continued engagement with Banjima throughout implementation. • Mitigation and implementation strategy further defined.
25 August 2023, Perth	BHP/ RTIO/ BNTAC Workshop	BHP, Rio Tinto (RTIO) and BNTAC workshop, developing a mitigation strategy for closure outcomes and impacts to water values. RTIO joined workshop, in recognition and acknowledgement that impacts to these water values are shared and cumulative in nature. BHP presented proposed mitigation for Flat Rocks. BHP presented the closure strategy for E8, including backfill of the mine pit to returning groundwater level around invert level of the creek.	-	BHP/ RTIO agreed on pathway forward to develop collaborative solutions to shared challenges. • Flat Rocks aquifer recovery • Yandi Closure Strategy (long term) • E8 closure solution (near term)
26 – 27 September 2023, Perth	Banjima HAC Meeting	Banjima HAC meeting in Perth, BHP provided a project overview of Yandi E8 including identification of existing values, potential impacts and proposed environmental management to the committee members. The outcomes of the Water and Closure workshop were shared.	Requested further engagement on the project, however this does not need to be in the field.	Further information on Yandi E8 proposal provided to Banjima and Nov 23 consultation arranged.
20 October 2023	Workshop between BHP and BNTAC to co-develop SCHEMP	BHP and BNTAC came together following concerns raised by Banjima regarding water values and mine closure at Yandi. The objective of the workshop was to develop a mitigation strategy to address these concerns.	BNTAC/ Banjima provided feedback on the SCHEMP.	BHP amended the SCHEMP in accordance with BNTAC and the Banjima People's feedback.
2 November 2023, Perth	MIB social surroundings engagement to discuss Yandi E8 Proposal	BHP provided an overview of the Proposal for E8 (reduced scope now excluding C3 and Iowa creek diversion) and summary of recommendations from previous engagement. No further recommendations were provided during this one-day engagement.	No further recommendations.	BHP will continue working with Banjima on ongoing commitments/ recommendations.

Date and location	Description of engagement	Summary	Banjima Feedback	BHP Response
6 – 7 December 2023, Perth	Banjima HAC Meeting	BHP provided an overview of the engagement between Banjima and BHP to date for the E8 proposal, including issues raised by Banjima and recommendations/ commitments made by BHP. These include: • Amendment to the Indicative Footprint on the western side to provide options to haul road. • BHP to identify and implement mitigation option/s to mitigate tree health decline at Flat Rocks, Yandicoogina and Marillana Creeks • BHP to engage with Banjima on management plans applicable to the Proposal. • BHP to provide opportunity for Banjima to be involved in and undertake environmental monitoring, surveys and rehabilitation activities for the Proposal BHP to share key environmental data metrics which can be monitored through time by Banjima people. • BHP sought endorsement of the SCHEMP.	Banjima acknowledged the good work that BHP had undertaken regarding social surroundings engagement and mitigation planning progress for Flat Rocks and Yandicoogina Gorge. Regardless, Banjima were not in a position to support or endorse the SCHEMP.	BHP acknowledged the Banjima HAC position. BHP noted the strong concerns from Banjima regarding impacts occurring to GDV across Marillana Creek. BHP will continue to engage with Banjima on this matter.
6-7 June 2024	Banjima HAC Meeting	BHP provided an overview of the Proposal for E8 and tabled the SCHEMP for endorsement.	Banjima advised they were not in a position to endorse the SCHEMP. Banjima requested to review of the ERD.	BHP acknowledged the Banjima HAC position. BHP agreed to provide the ERD for Banjima review.
30 August 2024, Perth	BNTAC feedback session: Mine Closure Plan, and Environmental Referral Document	BNTAC consultants provided BHP feedback on a technical review of the proposed Mine Closure Plan for Yandi operations and the Draft Environmental Referral Document for the Proposal. Some feedback on the draft ERD was provided to BHP in advance on this session, to which BHP were able to provide a response.	The technical review sought clarification of the closure outcome for the proposed E8 pit. Several clarifications were sought, largely regarding the groundwater impact assessment, and the consideration of	BHP confirmed that the closure outcome for the proposed E8 pit will be backfilled to pit crest, creating a free-draining landform back towards Marillana Creek. BHP acknowledged clarifications sought from BNTAC. All clarifications were

Date and location	Description of engagement	Summary	Banjima Feedback	BHP Response
	(ERD) technical review		Flat Rocks and Yandicoogina Gorge as part of the Proposal. Clarification was sought regarding the impact assessment and proposed mitigation to subterranean fauna, specifically concerns regarding a species extinction risk. BNTAC requested BHP ensure the SCHEMP accurately reflects the strong concerns from Banjima regarding the overall riparian vegetation (GDV) health across the whole of Marillana Creek, with a desire to see collaborative management between BHP and nearby third-party operators. BNTAC noted that further work was required to update the MCWRMP, to support the Amended Proposal. Lastly, BNTAC expressed that past Social Surroundings (pre-2023 change in EPA guidance) did not effectively consider the concern of the Banjima People.	discussed verbally and largely resolved in session, with a commitment for BHP to ensure the ERD accurately represents the impact assessment. BHP resolved concerns from BNTAC regarding a potential species extinction risk to subterranean fauna; BHP stipulated the company would not refer a proposal that had an unmitigated species extinction risk. Further, BHP committed to ensuring the ERD accurately reflects the mitigation of potential impacts to subterranean fauna in ensuring there is no species extinction risk. Since the BNTAC feedback session, BHP have undertaken recent subterranean fauna surveys and 3D habitat modelling which has identified the potentially restricted stygofauna species and suitable troglofauna habitat outside the disturbance footprint for E8. BHP have committed to ensuring this SCHEMP accurately represents the Banjima People's strong concern for the health of riparian vegetation (GDV) across the whole of Marillana Creek. BHP acknowledged and committed to further work to update the MCWRMP.

Date and location	Description of engagement	Summary	Banjima Feedback	BHP Response
				BHP committed to adding wording in this SCHEMP, noting the ineffectiveness of past social surroundings. Further, BHP committed to including the ambition for this proposal and future proposals is to achieve current best practice social surroundings impact assessments. Lastly, BHP proposed to present the SCHEMP in its final format at the Banjima HAC meeting 5th/6th September. BHP will seek endorsement of the SCHEMP, with a commitment to resolve feedback received from BNTAC's review of the referral documentation (ERD and supporting Management Plans)
6 September 2024, Perth	Banjima HAC	BHP sought endorsement from the Banjima HAC of the E8 SCHEMP.	BNTAC representatives informed BHP that Banjima recognised BHP's recent good intentions and desire to establish a modern environmental management plan for the Yandi mine, however the Banjima were not in a position to support the E8 SCHEMP at this time. BNTAC confirmed that, except for a minor amendment, there were no technical concerns with the Yandi SCHEMP or the Environmental Review Document.	BHP agreed to defer the request to endorse the SCHEMP until other matters were adequately resolved.

Date and location	Description of engagement	Summary	Banjima Feedback	BHP Response
21 March 2025, Perth	Banjima HAC	BHP sought endorsement from the Banjima Heritage Advisory Council (Banjima HAC) for the E8 SCHEMP.	The Banjima HAC provided conditional support and the BNTAC Board of Directors formally endorsed the resolution on 8 April 2025.	BHP propose to refer the Marillana Creek (Yandi) Life of Mine Proposal, significant amendment to the EPA in May 2025

11.3.3 Surveys, values and interests

BHP has undertaken numerous archaeological and ethnographic surveys in the Development Envelope, see Table 11-3. Collectively, these surveys have identified the location and type of potential heritage sites within the Development Envelope.

Throughout BHP's engagement and consultation with the Banjima Traditional Owners through BNTAC, and during heritage surveys, Banjima Traditional Owners have spoken of the significance of water. Flat Rocks is a cultural and archaeological heritage site significant to the Banjima Traditional Owners located in the far western end of the Yandi mine. Flat Rocks is located where Marillana Creek crosses a broad exposure of bedrock which is the transition from the upper and lower parts of the catchment. The Flat Rocks pools are dependent on surface water flow from Marillana Creek, which is fed in turn by groundwater discharge from the CID at Flat Rocks Spring. The groundwater baseflow from Flat Rocks Spring has resulted in a surface water flow that supports the Flat Rocks pools. The hydrology of the Flat Rocks area is detailed in Section 7.3.2.

Yandicoogina Gorge is located approximately 4 km south of the Yandi Development Envelope and is an important feature of the Pilbara ecohydrological system. The Gorge is characterised by permanent and semi-permanent pools that are likely supported by groundwater at, or close to, the surface. The gorge contains cultural heritage values (archaeological sites) significant to the Banjima Traditional Owners.

Banjima Traditional Owners have raised concerns regarding loss of surface water values and associated vegetation, such as Flat Rocks riparian vegetation, where BHP mine dewatering in the far western end of the Development Envelope is a key contributor to this impact. Banjima Traditional Owners spoke of caring for plants and animals as part of their role and responsibility as Traditional Owners and advised BHP that plant species of cultural significance (bush tucker and medicinal plants) should be documented and used in rehabilitation seed mixes. Additionally, the Banjima Traditional Owners have requested BHP rehabilitate Flat Rocks (see Section 7.5.2.4) and Yandicoogina / Marillana Creeks, returning water and biodiversity to these culturally significant places. BHP considers that the studies outlined in Table 11-3 meet the relevant EPA guidance to support the assessment of Social Surroundings for the Proposal. The studies listed in Table 11-3 are confidential and so have not been appended to this ERD and the full citations are not provided in the reference list in Section 17.

Table 11-3: Ethnographic and heritage surveys

Title	Date	Summary
Culley (2021) Yandi Project Area: Detailed Archaeological Site Recording	2021	This report details the site recording survey of 19 previously recorded sites (tenements M270SA and E47/1239-I), within the Yandi project area. The survey area is in the east Pilbara, Western Australia, approximately 92 km north-west of Newman and lies wholly within the Banjima Native Title Determination. Banjima representatives were invited to attend the survey and contribute their traditional cultural knowledge about the project area. Site avoidance.
Slack et. al. (2018) Report of a DGPS Survey of Stone Arrangements Banjima Country, Pilbara, Western Australia.	2018	This report details the findings to verify, record, and assess 88 previously reported Aboriginal stone arrangement Heritage Sites across the Mudlark Well, Yandi, North Flank, Tandanya, East Packsaddle, Ministers North, Marillana, Packsaddle and South Flank project areas. The sites are located in BHP's mining tenements ML270 SA, ML281 SA, ML244 SA, E47/13, E47/14, E47/628, E47/1329, E47/1385, E47/1432, E47/1767, E47/1790, E47/3262, E47/3263, L47/92, L47/95 and P47/1811; as well as some areas that are not part of BHPs' tenements. The stone arrangements sit within Banjima Native Title Determination WC2011/006.

Title	Date	Summary
Stephenson (2017) Central Pilbara Grinding Material Use-Wear and Residue Research Project.	2017	This report details the findings of a residue analysis and cultural engagement workshop at the Mulla Mulla Camp in the Central Pilbara region of Western Australia between 16 and 18 May 2017.
Duffy & Bergin (2013) Archaeological Survey & Site Verification of Powerline between MAC & Yandi.	2013	This report details the findings of an archaeological survey of the proposed Yandi to MAC powerline corridor. In addition, Waru was required to verify 29 previously recorded sites and places occurring within or close to the project area.
Duffy & Mattner (2012) Verification of 30 reported sites at Yandi Mine.	2012	This report details the findings, re-recording and checking of the status of 30 places reported to contain archaeological material at Yandi Mine.
Wig (2012) Archaeological survey of Yandi	2012	This report details the results of an Aboriginal archaeological survey of Yandi Eastern 7 Deposit.
Mattner (2008) Archaeological site surveys at Yandi in August – September.	2008	Report detailing surveys of numerous areas at the Yandi Mine. The work included surveys of land at Marillana Rail Camp, NW Village, Main Village, OHP3 area, W1 extension, 2 AN Stores, security gates, land in OHP2 mining area, 2 water pipelines and part of a proposed powerline.
Quartermaine (2006) Report on an archaeological site inventory and audit programme: Impact assessment of archaeological sites, Yandi Project Area.	2006	This report details an archaeological inventory and audit of registered Aboriginal sites at the Yandi Project Area, in the Pilbara Region of Western Australia
Hook (2002). An Addendum Report to: Hook, F. (1999) A report of an Aboriginal Heritage Assessment of six archaeological sites located within BHP Iron Ore's Mining Area C Deposit, Hamersley Plateau, Pilbara, Western Australia	2002	This report details the methods employed in and results obtained from the Aboriginal archaeological site recording of two stone arrangement sites located within BHP Billiton's proposed Mining Area C and Yandi/MAC Railway Route, near Packsaddle and Yandi, Pilbara, Western Australia.
Jackson and Martin (2002) A Report of an Aboriginal Archaeological survey of the Proposed Newman to Marillana Creek 132 kV Powerline Pylon Locations, Pilbara, Western Australia.	2002	This report details the results of an Aboriginal archaeological survey (the Survey) of the proposed 132kV power line, between Newman and Marillana Creek, Pilbara, Western Australia.
McGann (2001) A Report of an Archaeological Inspection of Areas within the Mining Area C Infrastructure Corridor.	2001	This report details of the Archaeological Inspection of Areas within the Mining Area C Infrastructure Corridor.
Green, McGrath (2001) Report on the Ethnographic Survey of the BHP Iron Ore Pty Ltd's Mining Area C Project in the Pilbara Region of Western Australia	2001	The purpose of the ethnographic survey was to assess the ethnographic significance of the land within the Mining Area C Project (the Project Area). This included locating and recording any previously unrecorded Aboriginal sites, and visiting previously recorded Aboriginal sites BHP wishes to disturb in order to determine the views of the Claimants regarding proposed mitigation.
Warren (2000) A Report of BHP Iron Ore's Archaeological and Ethnographic surveys of the Mining Area C project and section 18 and 16 application	2000	Archaeological and ethnographic heritage surveys for Aboriginal sites have been commissioned by BHP over lands proposed for the development of the proposed Mining Area C project. These surveys involved various Aboriginal stakeholders, including heritage custodians and spokespeople, as well as members of, and

Title	Date	Summary
consultation (interim report October 2000)		claimants for various native title claims that have an interest in the lands subject to the proposed development. These surveys resulted in the finding and recording of a number of unrecorded and previously recorded Aboriginal sites.
Harris (1996) Report on an archaeological survey for MAC rail, road, transmission line and associated infrastructure, west of Newman.	1996	An archaeological survey for Aboriginal heritage sites was conducted in the Weeli Wolli area, west of Newman. The archaeological survey was carried out by Jacqueline Harris on behalf of Quartermaine Consultants in two stages in the months of May and August 1996. Six archaeological sites were recorded in the course of the survey.
Jackson (1994) Report of an Investigation of Archaeological sites in the Yandi Mine Project Area, Pilbara, WA.	1994	This report documents site investigations of a number of archaeological sites on BHPs Yandi (Yandi) mine site in the northeast section of the Hammersley Ranges, approximately 80 km northeast of Newman. The sites themselves are predominantly located along the course of the Marillana and Yandicoogina Creeks.
McDonald et. al. (1994) Report of an Aboriginal Heritage Survey: Proposed South Hedland – Newman 220 kV Power Transmission Corridor.	1994	This report presents the results of the studies undertaken in relation to the transmission corridor component of the project.
Quartermaine (1993) Report on an archaeological investigation of Aboriginal Sites – Yandi Project Area.	1993	This report is for an archaeological investigation of previously recorded sites on BHP Iron Ore leases at Yandi in the Pilbara Region. This involves research and an inspection of a number of previously recorded archaeological sites in areas of proposed drilling programs.
Strawbridge (1986) Further Investigations of Aboriginal Sites in the Vicinity of Yandicoogina Creek, Pilbara, Western Australia.	1986	In September 1986, the Centre for Prehistory (UWA) was requested by BHP (Engineering) to carry out detailed recording on some sites in the area planned for development by BHP in Yandi region north of Newman, Western Australia. The request arose from the recommendations of the Aboriginal Cultural Material Committee to the Minister for Aboriginal Affairs, based on the results of the earlier site surveys carried out in the area.
Tonkinson & Veth (1986) Anthropological Survey of the area surrounding BHP's Iron Ore Deposits (Marillana Creek)	1986	This report details the anthropological survey of the area surrounding BHP's Iron Ore Deposits (Marillana Creek) between 1982 - 1985.
Clarke, Smith (1982) Yandi Prospect, W.A. Archaeological surveys for Aboriginal Sites. A survey of temporary reserves 5259, 5603-4, 6501-4, 6685 and 6696. Prepared for C.S.R.	1982	This report details work carried out from 1979 to 1981, archaeological and ethnographic surveys were undertaken by the Department of Aboriginal Sites in the area of Yandi Creek for CSR.
Clarke and Reynolds (1981) A survey for Aboriginal Sites of TR 3359H, Yandicoogina Creek	1981	An archaeological survey of this area was carried out in March 1981, from a four-wheel drive vehicle with more detailed examination on foot of those areas indicated by the company to be known ore bodies, and those areas likely to be favoured site locations. Outside of these general areas, a number of random traverses and spot checks were conducted in order to gain a more accurate overall view.

11.4 Potential impacts

BHP has considered the potential impacts outlined in the EPA's *Environmental factor guideline – Social Surroundings* (EPA 2023b) and the EPA's *Technical Guidance - Environmental impact assessment of Social Surroundings – Aboriginal cultural heritage* (EPA 2023c). BHP understands that the following impacts have been identified by the Banjima as being relevant to the Proposal and the Combined Proposal:

- Disturbance of cultural heritage sites and values (direct)
- Impacts to access, landscape and amenity (direct)
- Degradation of cultural heritage values (indirect).

BHP has focused the discussion on potential direct and indirect impacts of the Proposal within the Development Envelope, with consideration of potential impacts extending beyond the boundaries of the Development Envelope where relevant and where the cause is likely to be attributed toward BHP activities alone (i.e. Flat Rocks). BHP has also outlined the combined effects which implementation of the Combined Proposal might have on Social Surroundings. Unless specified otherwise, the potential impacts discussed in this section are unmitigated (i.e. potential impacts before mitigation measures are applied, if required). Mitigation measures for Social Surroundings are also presented in Section 11.5 and in the SCHEMP.

Cumulative impacts to Social Surroundings are addressed in Section 16.5 and include a discussion of cumulative impacts to Social Surroundings outside the Development Envelope (where relevant), including potential impacts to Social Surroundings at Yandicoogina Gorge where causation is still unclear nor can be attributed to regional or a single mining operation or climate process.

11.4.1 Direct disturbance of social, cultural and heritage sites and values

Implementation of the Proposal will involve clearing of up to 95 ha of native vegetation (proposed clearing; additional to that approved for the Approved Proposal) for the excavation of mine pits, dewatering and surplus water discharge infrastructure, and other supporting infrastructure including, but not limited to haul roads and access tracks. The Proposal also has the potential to have an impact on surface water values such as Marillana Creek. The Proposal has the potential to directly disturb Aboriginal, social, cultural and heritage values located within the Development Envelope. These impacts are assessed in Section 11.6.

As detailed in Section 11.3 and Table 11-3, detailed significance assessments of known heritage sites within the Development Envelope have been undertaken for the Combined Proposal. Aboriginal Cultural Heritage will be managed in accordance with the AH Act. There are six Aboriginal cultural heritage sites located within the Indicative Footprint for the Proposal which will be directly impacted. Another three sites are within 50 m of the Indicative Footprint which will not be directly impacted. A Cultural Heritage Management Plan (CHMP) has been prepared in consultation with the Banjima Traditional Owners to address the management of the impacted sites. The CHMP is due to be reviewed and updated at least every two years to capture any changes or additional required management measures as the mine plan progresses. Historic disturbance to heritage sites from the Approved Proposal has been previously managed through s. 18 of the AH Act.

Clearing for the Proposal may result in the removal of some habitat which supports native fauna of cultural value. Desktop mapping indicates that the following species are likely to occur within the Indicative Footprint of the Proposal (Canning et al. 2021):

- Euro (*Macropus robustus*)
- Goanna (*Varanus* spp.)
- Emu (*Dromaius novaehollandiae*)

- Bush turkey or Australian bustard (*Ardeotis australis*)
- Native honeybee (*Trigona* and *Austroplebeia* spp.).

This is a snapshot of the cultural species likely to occur within the Indicative Footprint of the Proposal and is not a comprehensive list. Impact to these species is minimal given the comparatively small amount of clearing (95 ha) and the occurrence of similar habitat that extends outside of the Indicative Footprint.

11.4.2 Impacts to access, landscape and amenity

The installation of infrastructure and mine operation may alter the experience for Banjima Traditional Owners when on country, through altered access, landscape, and amenity.

Implementation of the Proposal may alter Banjima Traditional Owner access to heritage places or to conduct traditional practices, particularly to places and areas in proximity to active mining and related infrastructure within the Development Envelope. To ensure the safety and wellbeing of Traditional Owners when accessing areas in proximity to active mining and infrastructure, agreed access procedures have been established and such agreed measures include BHP escorts accompanying Banjima Traditional Owners, while on site. This has the potential to alter the timing or frequency of access and/or alter the experience when on country.

Aboriginal cultural heritage values extend beyond discrete identified Aboriginal cultural heritage places and are understood to be embedded in the combination of values which come together to form a landscape. Activities such as the excavation of mine pits, establishment of stockpiles, OSAs and installation of infrastructure may alter the utilisation of the landscape across the Development Envelope. Progressive rehabilitation will be undertaken over the life of the Yandi Project (Combined Proposal) where practicable, however, permanent alteration of the landscape will occur because of the Proposal as a result of mine pits. These impacts include those resulting from dewatering of mine pits and discharge of surplus water to Marillana Creek. As communicated to BHP by the Banjima Traditional Owners through BNTAC, it is the Banjima Traditional Owners preference for the avoidance of pit lakes. Based on the current mine plan, and due to availability of resource for backfill, pit lakes would be expected to form in several pits at Yandi, however the proposed E8 pits will be backfilled to above water table as part of closure, avoiding pit lake formation and the capture of Marillana Creek. In conjunction with the detailed closure studies, BHP has engaged with the Banjima Traditional Owners, to seek input into the closure strategy for the whole Yandi mine and inform on closure knowledge to explore alternatives following unfavourable Traditional Owner feedback on pit lake formation.

Construction and operation of the Proposal will result in noise and vibration. Noise and vibration are expected to be greatest during daylight hours, in relation to construction of infrastructure and active mining, including drilling and blasting. Exposure to noise and vibration will be greatest near construction activities and active mining and will decrease with increasing distance from mining and operations. Noise and vibration have the potential to alter or obscure the natural background sounds of the local environment and impact the enjoyment and experience when on country in proximity to the Indicative Footprint.

The Proposal has the potential to generate dust from vegetation clearing, vehicle and machinery use, construction of infrastructure, active mining, and transport of ore. Dust emissions have the potential to cause visual disturbance and impact amenity and experience when on country. The potential impact to amenity from dust is greatest near dust sources such as active mining and operational areas. Potential impacts to amenity from dust will decrease with increasing distance from sources.

11.4.3 Degradation of social, cultural and heritage values

Over many years, BHP have identified that heritage sites may be impacted by indirect disturbance if situated within:

- 100 m of a pit boundary (potential indirect impacts from blasting and fly rock)
- 30 m of all other infrastructure (e.g. roads, conveyors, pipelines, processing infrastructure etc.).

Six heritage sites will be directly disturbed as part of the construction of the E8 pits, with all other infrastructure having been designed to avoid cultural heritage sites as far as practical. Another three sites are within 50 m of the Indicative Footprint, with the closest one of these sites being located approximately 43 m from edge of the E8 haul road alignment. BHP will ensure appropriate protective measures such as fencing or other measures such as demarcation are in place for this site to avoid any direct impacts; however, given the proximity to Proposal activities, these sites have the potential to be impacted by indirect impacts such as dust or changes to surface water and/or groundwater regimes.

11.4.3.1 Impact from dust emissions

Construction and operation of the Proposal has the potential to generate dust emissions from activities. When dust is emitted into the air, it may subsequently deposit on surfaces including vegetation, with dust deposition decreasing with increasing distance from the source. Dust deposition has the potential to degrade Aboriginal social, cultural and heritage values including the condition of native vegetation including plants that may be used for bush tucker and bush medicine.

There is a perception that dust deposition on the surfaces of native vegetation can affect plant health and survival through reduced photosynthesis and transpiration. Matsuki (2016) assessed impacts of dust on plants in semi-arid environments and reported that cumulative rainfall is a greater determinant of plant health than dust. It is therefore not expected that dust emissions from the Proposal will indirectly impact plant health or survival; however, dust deposition has the potential to impact the desirability of plants that have ethnobotanical significance and therefore reduce the opportunity to utilise these plants.

11.4.3.2 Changes to groundwater and surface water values

The Proposal is located within the Marillana Creek Catchment which is located within the Fortescue River Basin. The installation of infrastructure and excavation of mine pits has the potential to directly alter surface water flows and reduce catchment size. Section 7.5 provides further detail on surface water management. These changes for the Proposal are not predicted to significantly impact surface water flows or water quality.

As detailed in Section 7.4, the Proposal will involve mine dewatering to enable the below water table mining of the E8 East pit. This may result in changes to the lateral and vertical extent of groundwater drawdown. Marillana Creek is directly adjacent to the E8 pit and is of value to the Banjima Traditional Owners.

As detailed in Section 11.3.3, Flat Rocks is a cultural and archaeological heritage site significant to the Banjima Traditional Owners, which has been impacted from mine dewatering associated with the implementation of the Approved Proposal. Predicted groundwater drawdown contours of the Proposal do not extend into Flat Rocks (see Section 7.4.2) or to the Ministers North aquifer and does not extend into the area of Yandicoogina Gorge (refer to Section 7.3.3 and 7.4.2). While the Proposal will not result in an increase in drawdown at Flat Rocks, the Combined Proposal does result in an increase in drawdown at Flat Rocks which is considered a significant impact. See Section 7.6.2.1 for further details. Drawdown in the CID adjacent to Flat Rocks from the Combined Proposal is currently estimated to be about 15 m. Measured groundwater levels at Flat Rocks estimate current drawdown is approximately 12 m, the Combined Proposal will result in an increase of 3 m. The current drawdown of 12 m has impacted on groundwater levels and the health of riparian vegetation and GDV. Monitoring of riparian tree health has been undertaken with riparian tree health decline/death being observed and reported in AERs at Flat Rocks (see Section 8.4.2 and Section 8.6.2).

Mine dewatering for the Proposal has the potential to impact the nearby riparian vegetation of Marillana Creek that is located adjacent to the Indicative Footprint. Marillana Creek is significant to the Banjima Traditional Owners. BHP considers that impacts from mine dewatering on Marillana Creek can be managed and minimised through the implementation of the MCWRMP (BHP, 2025c) (Appendix 6) and implementation of the mitigation strategies detailed in 7.5.2.4.

BHP will continue to discharge mine dewater to Marillana Creek at the current discharge point and within the current authorised extent of the Part V operating licence. BHP will manage the discharge of surplus water to the creek through the implementation of the MCWRMP (BHP, 2025c) (Appendix 6).

11.5 Mitigation

11.5.1 Avoid

BHP has implemented several measures in the design of the Proposal to avoid impacts to heritage sites. As detailed in Section 11.4.1, six heritage sites interact directly with the Indicative Footprint. The Proposal has been designed to maximise the use of existing disturbed areas and avoid the location of heritage places where possible. Through the design of the Proposal including a realignment of the haul road, BHP has avoided three heritage sites that are within 50 m of the Indicative Footprint.

Separately, a detailed CHMP has been developed by BHP and Banjima representatives through BNTAC. The CHMP is a detailed document which identifies all Aboriginal cultural heritage sites and values within the Development Envelope, the significance of those sites and values, site specific avoidance, management and monitoring measures, and identification of the Proposal's interaction with sites and values, where appropriate. The CHMP remains confidential, due to the sensitive nature of sites, locations and values.

11.5.2 Minimise

BHP and the Banjima People, represented by BNTAC have co-developed a Social Cultural Heritage Environmental Management Plan (SCHEMP) to meet the requirements under Part IV of the EP Act for the Proposal. The SCHEMP is designed to manage potential impacts of the Proposal throughout the life of the operation (in addition to the other existing engagement channels between BHP and Banjima People). The SCHEMP outlines:

- The surveys and consultation completed by BHP to gain a comprehensive understanding of the Social Surroundings, including Aboriginal cultural heritage values.
- The key Social Surroundings and Aboriginal cultural heritage values identified.
- The framework for ongoing consultation with the Banjima People during the life of the Proposal.
- The processes for the ongoing protection and management of Aboriginal cultural heritage and related environmental values.
- Provisions for ongoing land access and management actions to be undertaken where additional Aboriginal cultural heritage values are identified.

Several recommendations in respect of the Proposal and the Approved Proposal were developed during BHP's engagement with the Banjima Traditional Owners through BNTAC. All recommendations are provided in Appendix A of the SCHEMP (Appendix 16). Recommendations related to environmental aspects and management of the Proposal are discussed further in the following Sections. All Aboriginal cultural heritage related recommendations will be managed under specific aspects of the CHMPs for the Yandi Hub, including the CHMP specific to the Proposal.

With support from the Banjima Traditional Owners, BHP have commenced preliminary works into mitigating tree health decline at Flat Rocks. These mitigation activities are discussed in Section 7.5.2.4. In response, abstraction from the western most pit was ceased in 2022 and an increase in water levels of 8 m has been observed further upgradient, with a small increase of 0.8 m observed at bore MB16YSN0003 located at Flat Rocks Road crossing. BHP have provided the MCWRMP as part of this referral to inform the ongoing monitoring and management of water levels, water quality and riparian vegetation in the Marillana Creek.

Additional mitigation plans are being progressed which include the development of a reinjection proposal off tenure (further west / upstream). Long-term measures require further investigation and review but include an investigation into the feasibility of a low permeability barrier to slow groundwater flow into W1 Pit and force water to mound within the CID channel upstream to support vegetation health. This mitigation proposal has been discussed with the Banjima Traditional Owners, RTIO and DWER, and is discussed further in Section 7.5.2.2. Modelling indicates that the residual impact following implementation of mitigation measures will result in groundwater levels at bore HYW0002M recovering to 610 mAHD by 2040 but are unlikely to recover to pre-development water levels (613 mAHD).

Potential changes observed at Yandicoogina Gorge cannot be conclusively attributed to the Approved Proposal. With the current available data, the possible causes for declining groundwater levels in the Gorge includes climate variability (below average rainfall), or a combination of both climate variability and regional dewatering activities. However, as a precaution BHP has developed a mitigation strategy in consultation with the Banjima People and other relevant stakeholders with the objective of abating further groundwater decline at the Gorge. Further information regarding potential impacts and mitigation strategies are detailed in Sections 7.5.2 and 7.6.2 with discussion on cumulative impacts in Section 16.

Table 11-4 below provides a summary of other supporting management plans that are in addition to the SCHEMP which will assist in minimising potential indirect impacts to social surroundings and Aboriginal cultural heritage values.

Table 11-4: Social Surroundings - summary of other relevant management plans

Management Plan	Purpose
Biodiversity Environmental Management Plan (BHP 2025a) (Appendix 10)	To avoid and minimise direct impacts and indirect impacts to significant flora and fauna The plan includes management actions to limit impacts to flora and fauna values at Yandi
Yandi Mine Closure Plan (BHP 2025b) (Appendix 5)	To ensure that the proposed Development Envelope is rehabilitated in a manner that is safe, stable, and non-polluting and in an ecologically sustainable manner
Marillana Creek Diversion Management Plan (BHP Billiton 2016) (Appendix 17)	To provide environmental management measures so that diverted sections of Marillana Creek function as a fluvial system in a similar manner to the existing creek system
Marillana Creek Water Resource Management Plan (BHP 2025c) (Appendix 6)	To monitor the impacts to key water parameters; and to maintain the quantity and quality of water so that existing and potential environmental values, including ecosystem maintenance, are protected.

11.5.3 Rehabilitate

BHP is committed to the rehabilitation of land no longer required for operational purposes and understands that mine closure is an important issue for Banjima Traditional Owners. In addition to mine closure commitments relevant to flora and vegetation, terrestrial fauna and inland waters, BHP commits to consulting with the Banjima representatives through BNTAC, to identify post-mining land uses.

BHP will work with Traditional Owners in relation to ethnobotanical values and this may include the use of ethnobotanical species in rehabilitation seed mixes and/or the propagation of ethnobotanical species for planting in rehabilitation areas. Following consultation with the Banjima Traditional Owners, BHP will expand the capacity of the existing nursery over the next 2-3 years to ensure adequate resources and capacity are in place for rehabilitation once closure commences. The Banjima Traditional Owners have recommended that BHP rehabilitate Flat Rocks and Yandicoogina / Marillana Creeks returning water and biodiversity to these culturally significant places. In response, BHP have proposed a number of mitigation strategies for Flat Rocks and have committed to restoring the area.

BHP will implement the Yandi MCP (BHP 2025b; Appendix 5) to meet the following environmental objectives:

- ensure that the Combined Proposal is decommissioned and rehabilitated to be safe, stable, and non-polluting and in an ecological sustainable manner
- undertake rehabilitation in a progressive manner, where practicable.

BHP notes that Banjima representatives through BNTAC have expressed a clear preference for the avoidance of pit lakes at closure. Based on the current mine plan, pit lakes would be expected to form in several pits at Yandi, including W2, W3, C4/5 and E7. BHP acknowledges the Banjima Traditional Owners preference to avoid pit lakes and are reviewing the feasibility of avoiding pit lakes where possible. The proposed E8 pit will be backfilled to above water table to avoid the formation of a pit lake and the capture of Marillana Creek. As detailed in the Yandi MCP, BHP's progressive closure strategy for the Yandi mine includes progressive backfilling into mined-out pits where possible.

11.5.4 Other statutory decision-making processes

Table 11-5 summarises whether another statutory decision-making process can mitigate the potential environmental impacts of the Proposal on Social Surroundings (Aboriginal cultural heritage), considering the EPA's *Taking decision making processes into account in EIA: Interim Guidance* (EPA 2021b). Table 11-5 also provide reasons, including how, in relation to the specific potential impacts of the Proposal, the decision-making process takes the EP Act object and principles, and the EPA's objective for Social Surroundings, into account.

Table 11-5: Social Surroundings – other statutory decision-making processes

Potential impact	Statutory decision-making process can mitigate impacts on the environment?	Reasons (if Yes)
Impacts to heritage sites	Yes	AH Act Approval under the AH Act is required prior to impact to registered heritage sites, BHP have prepared an Aboriginal and Cultural Heritage Management Plan to mitigate potential impact to heritage sites from the construction and operation of the Proposal, other than those that are exempt under s18 of the AH Act.

11.6 Assessment and significance of residual impacts

11.6.1 Direct disturbance of social, cultural and heritage values

BHP has considered the direct disturbance of social, cultural and heritage values for the Proposal and the Combined Proposal. As discussed in Section 11.4.1, the Proposal has the potential to directly impact social, cultural and heritage sites and values through clearing, installation of infrastructure and development of mine pits etc. BHP has undertaken archaeological and ethnographic surveys in the Development Envelope. Collectively, these surveys have identified the location and type of Aboriginal cultural heritage sites within the Development Envelope. Aboriginal cultural heritage sites within the Development Envelope will be managed in accordance with the CHMP and the SCHEMP as agreed with Banjima representatives through BNTAC.

The Proposal will result in the construction of two creek crossings across Marillana Creek. Marillana Creek is considered significant to the Banjima Traditional Owners, as are all water sources. The Proposal will also include dewatering of E8 Pit East, which has the potential to impact riparian vegetation outside of the Indicative Footprint and Development Envelope.

Management of water and associated cultural values will be managed in accordance with:

- Yandi MCP (BHP 2025b; Appendix 5)
- Marillana Creek Diversion Management Plan (BHP 2016)
- Surface Water and Groundwater Management Plan (to be superseded by the MCWRMP provided with this referral in Appendix 6; BHP 2025c)
- Yandi BEMP (BHP 2025a; Appendix 10)
- Development of an integrated management plan for Flat Rocks.

BHP held engagements with Banjima representatives, facilitated through BNTAC, in June 2023 including an on-country visit to the existing Yandi mine and the proposed Indicative Footprint for the Proposal, and in Perth on 2 November 2023 to discuss the Proposal. The clearing of native vegetation and loss of plants and animals of cultural value represents an impact on social surroundings. Through co-development of the SCHEMP for the Proposal, BHP and BNTAC have proposed to continue ongoing engagement in relation to rehabilitation. The present draft, which has been endorsed by the Banjima Traditional Owners, details inclusion of bush tucker species in rehabilitation seed mixes where practicable and creation of fauna habitats during closure.

BHP has identified six Aboriginal cultural heritage sites that will be disturbed as part of the implementation of the Proposal. BHP has consulted with the Banjima Traditional Owners regarding these Aboriginal cultural heritage sites and has prepared the ACHMP to manage the impact to these Aboriginal cultural heritage sites. Approval under s.18 of the AH Act will be required to disturb the above registered sites.

Implementation of the Approved Proposal has resulted in impacts to riparian vegetation in the vicinity of Flat Rocks, located in the far west of the Development Envelope. Tree health decline has been observed within the CID to the west of Tree Health Site 8 at Flat Rocks; this impact has been reported in previous Annual Environmental Reports and mitigation measures discussed with DWER. Following a request by the Banjima Traditional Owners, BHP have commenced preliminary works into mitigation of tree health decline at Flat Rocks. In response, abstraction from the western most pit was ceased in 2022. Following this, an 8 m increase in water levels has been observed further upgradient, with a small increase of 0.8 m observed at bore MB16YSN0003 located at Flat Rocks Road crossing. BHP have provided the MCWRMP as part of this referral to inform the ongoing monitoring and management of water levels, water quality and riparian vegetation in the Marillana Creek.

Additional mitigation plans are being progressed which include the development of a reinjection proposal off tenure (further west / upstream). Long-term measures require further investigation and review but include an investigation into the feasibility of low permeability barriers to slow groundwater flow into W1 Pit and force water to mound within the CID channel upstream to support vegetation health. This mitigation proposal has been discussed with the Banjima Traditional Owners, RTIO and DWER, this is discussed further in Section 7.5.2.2. Modelling indicates that the residual impact following implementation of mitigation measures will result in groundwater levels at bore HYW0002M recovering to 610 mAHD by 2040 but are unlikely to recover to pre-development water levels (613 mAHD).

11.6.2 Impacts to access, landscape and amenity

The key potential direct impacts to identified Aboriginal cultural heritage values in respect of access, landscape and amenity are related to clearing for construction and operation of the Proposal. Potential indirect impacts relate to loss of water values from active mining, impacts to amenity, access to country and cumulative impacts from mining. BHP has sought to address these matters through the preparation of an SCHEMP in co-development with the Banjima Traditional Owners.

BHP's approach to creating the SCHEMP is to apply internal procedures and processes arising from BHP's agreements with the Banjima Traditional Owners to identify the outcomes, management actions, targets and

monitoring that BHP and the Banjima representatives, through BNTAC, will implement to achieve the objective of minimising impact to Aboriginal social, cultural and heritage values.

No targeted noise management measures are proposed for the Proposal, given that the Proposal is located within an existing operational mine.

Implementation of the management plans detailed in Table 11-4, will support management of Aboriginal social, cultural and heritage values by:

- Minimising and managing impacts to the health of riparian vegetation along Marillana Creek - BEMP and the MCWRMP
- Minimising and managing impacts to key water parameters to ensure quantity and quality of water is maintained to protect existing and potential environmental values – MCWRMP and Marillana Creek Diversion Management Plan
- Managing impacts to flora and fauna values at Yandi – BEMP
- Managing the diverted Sections of Marillana Creek to ensure the diversions function as a fluvial system in a similar manner to the existing creek system – Marillana Creek Diversion Management Plan
- Ensuring that the Combined Proposal is rehabilitated in an ecologically sustainable manner – Yandi MCP.

As detailed in Section 11.5.3, BHP will undertake progressive rehabilitation of the disturbed areas, where practicable, including backfill of pit voids to minimise the extent of post-closure pit lakes. While BHP acknowledges the Banjima Traditional Owner's preference to avoid all pit lakes, a number of pits will remain at closure due to lack of overburden to enable the complete backfill of all of the voids at Yandi. As detailed in Section 2.2.2, the Proposal does not include the final closure solution for the Yandi mine. BHP has progressed detailed internal closure studies for Yandi mine since 2019 and continues working towards an optimised and final closure strategy to meet regulatory obligations and an agreed stakeholder solution. BHP plan to submit the final closure solution to the EPA for assessment.

Through the development and implementation of management plans, mitigation strategies and rehabilitation and closure processes, it is expected that the impacts of the Combined Proposal will be appropriately managed such that impacts to Aboriginal cultural heritage values in respect of access, landscape, and amenity are minimised and not significantly impacted post closure.

11.6.3 Degradation of social, cultural and heritage values

As detailed in Section 11.5.1, BHP has designed the Proposal to ensure that there is reasonable separation distance between infrastructure and Aboriginal cultural heritage sites as far as practicable.

BHP will work with the Banjima representatives through BNTAC to manage impacts from the Proposal through the implementation of the CHMP.

Dust has the potential to indirectly impact social, cultural and heritage values through the degradation of native vegetation including plants that may be used for bush tucker and bush medicine and temporary surface water pools within the proposed Development Envelope.

To avoid and minimise dust emissions for the Proposal, BHP will implement appropriate dust controls in accordance with BHP internal standards. Water carts will be utilised to manage dust emissions from non-fixed infrastructure. It is anticipated that potential dust impacts to Marillana Creek from the Proposal will be minimal and not significant to ecosystem health or cultural value.

Through the development and implementation of the SCHEMP and CHMP, it is expected that indirect impacts from the Proposal will be appropriately managed so that social, cultural and heritage values are not significantly impacted.

BHP considers the Proposal will not significantly impact the culturally significant water values at the Yandi mine. BHP has been consulting with the Banjima Traditional Owners, through BNTAC and with DWER on proposed measures to mitigate existing impacts to Flat Rocks associated with the Approved Proposal (refer to Section 11.6.1). These measures include the cessation of dewatering at W0 pit to allow recovery of groundwater levels, and the reinjection of surplus water upstream in the CID.

11.6.4 Significant residual impacts

Following the application of the mitigation hierarchy (Section 11.5), BHP considers that there is no significant residual impact to Social Surroundings (Aboriginal cultural heritage) from the Proposal on the basis of the EPA's objective for Social Surroundings (EPA 2023b). However, BHP acknowledges that the Combined Proposal will contribute to the observed groundwater decline at Flat Rocks (see Section 16.5) which has the potential to contribute to a significant residual impact to Social Surroundings. Dewatering reduction and a reinjection trial are currently being investigated within the Flat Rocks area to mitigate these impacts (described in detail in Section 7.5.2.2).

BHP considers through the implementation of management and abatement measures, including supplementation and rehabilitation post closure, that significant residual impacts to Flat Rocks from the Combined Proposal can be minimised. Modelling indicates that the residual impact of ceasing dewatering at W0 will result in groundwater levels at bore HYW0002M recovering to 610 mAHD by 2040 but are unlikely to recover to pre-development water levels (613 mAHD). With the introduction of reinjection off tenure (in combination with ceasing dewatering at W0) groundwater levels will potentially recover to 610 mAHD values by 2030 (6 years post injection). After implementation of mitigation measures, including rehabilitation, BHP considers the likelihood of significant residual impacts to the values at Flat Rocks will be minimised post closure.

BHP considers there is a potential for significant residual impact to Yandicoogina Gorge. Causation for those potential significant residual impacts at Yandicoogina Gorge is still unclear nor can be attributed to regional or a single mining operation or climate process, however BHP have commenced abatement measures as a precaution and have commissioned further studies to better understand the causes of the groundwater decline. Cumulative impacts to Social Surroundings are further considered in Section 16.5.

See Section 11.7 below for the discussion on the outcomes relating to the identified residual impacts and BHP's proposed assurance (regulation) and monitoring, where required. BHP considers through the implementation of the proposed mitigation measures, implementation of the EMPs and rehabilitation of affected areas that a significant residual impact of the Combined Proposal post closure will be avoided. See Section 16.5 for assessment of cumulative impacts to Social Surroundings.

11.7 Environmental outcomes

Table 11-6 summarises the environmental outcomes, proposed assurance (regulation) and proposed monitoring (if required) for each residual impact for Social Surroundings (Aboriginal cultural heritage) from the Proposal. Detail of the proposed monitoring is set out in the Part IV environmental management plans and other relevant statutory decision-making documents discussed in Section 3.2.2. Table 11-6 demonstrates how the proposed environmental outcomes for the Proposal, together with the proposed regulation and monitoring, are consistent with the EPA's objective for Social Surroundings (Aboriginal cultural heritage) (Section 11.1).

As required by the EPA's ERD Instructions, for Significant Amendments, BHP has included information about the existing implementation conditions for the Approved Proposal (Appendix 2). BHP considers that the EPA should inquire into the Approved Proposal implementation conditions (relating to Social Surroundings (Aboriginal cultural heritage)), as provided for under s40AA(3), as part of the assessment of the Proposal under s40 and in the EPA's assessment report required under s44, for the following reasons:

- there are no specific conditions relating to Social Surroundings in the Ministerial Statements for the Approved Proposal.

Table 11-6: Social Surroundings - environmental outcomes, proposed regulation and monitoring

Residual impact	Environmental outcome	Proposed regulation (Condition[1] or other statutory decision-making process)	Proposed Monitoring	Consistency with EPA objective
Potential direct and indirect impact to Aboriginal social, cultural and heritage values	Minimising impacts to heritage sites within the Indicative Footprint of the Proposal Identification of potential impacts on values in consultation with the Banjima Traditional Owners Consult with the Banjima Traditional Owners through BNTAC	**Condition B4 Social Surroundings** Management of social, cultural, and heritage values and interests relevant to the Yandi Proposal. BHP will comply with the requirements of the *Aboriginal Heritage Act* (WA) 1972 or it's replacement. **Condition B1 Inland Waters** Implement the Marillana Creek Water Resource Management Plan (BHP 2025c) • Implementation of management measures to ensure water quality and quantity is maintained. Minimising impacts to places of value to the Banjima Traditional Owners. **Condition B2 Flora and Vegetation** Implement the Biodiversity Environmental Management Plan (BHP 2025a) • Implementation of management measures to ensure flora and vegetation condition outside of the impact areas is maintained. Minimising impacts to a place of value to the Banjima Traditional Owners. **Condition B3 Terrestrial Fauna** Implement the Biodiversity Environmental Management Plan (BHP 2025a) • Implementation of management measures to ensure impact to fauna species of interest to Banjima Traditional Owners is minimised.	**Condition B4 Social Surroundings** • Site-specific management measures pertaining to heritage sites are contained within the relevant Cultural Heritage Management Plans (CHMP) for the E8 pit and are therefore excluded from the SCHEMP • The SCHEMP details procedures and processes arising from BHP's agreements with the Banjima Traditional Owners to identify the outcomes, management actions, targets and monitoring that BHP and the Banjima representatives, through BNTAC, will implement to achieve the objective of minimising impact to Aboriginal social, cultural and heritage values. **Condition B1 Inland Waters**	BHP will continue to engage with Banjima representatives, through BNTAC, throughout the life of the Proposal in relation to the management of cultural heritage values, surplus water management, closure and other matters related to social surroundings, via the SCHEMP and CHMP (where required)

Residual impact	Environmental outcome	Proposed regulation (Condition[1] or other statutory decision-making process)	Proposed Monitoring	Consistency with EPA objective
		Condition B6 Decommissioning and Rehabilitation Prepare and implement a Decommissioning and Rehabilitation environmental management plan: • Implementation of management measures to ensure the Yandi mine is decommissioned and rehabilitated in an ecologically sustainable manner Implement the Marillana Creek (Yandi) Closure Plan (BHP 2025b)(Appendix 5) required under the *Mining Act 1978.* • Implementation of management measures to ensure the Yandi mine is safe, stable and non-polluting at closure	• Implement the Marillana Creek Water Resource Management Plan (BHP 2025c) • Implementation of monitoring measures to ensure water quality and quantity is maintained. Minimising impacts to a place of value to the Banjima Traditional Owners. **Condition B2 Flora and Vegetation** • Implement the Biodiversity Environmental Management Plan (BHP 2025a) • Implementation of monitoring measures to ensure flora and vegetation condition outside of the impact areas is maintained. Minimising impacts to places of value to the Banjima Traditional Owners.	

[1] See Appendix 3 for proposed implementation conditions for the Combined Proposal

12 Greenhouse Gas Emissions

12.1 EPA environmental factor and objective

The EPA's objective for the Greenhouse Gas (GHG) emissions factor is:

> *To minimise the risk of environmental harm associated with climate change by reducing greenhouse gas emissions as far as practicable.*

12.2 Relevant policy and guidance

BHP assessed this environmental factor considering the following EPA policies and guidance, as outlined in Table 12-1.

Table 12-1: Greenhouse Gas Emissions - policy and guidance

EPA (and other State and Commonwealth) policy and guidance	Consideration of policy and guidance
Environmental Factor Guideline - Greenhouse Gas Emissions (EPA 2024e)	BHP has considered the guideline and has addressed the requirements as follows: • Credible estimates of the expected Scope 1, Scope 2 and Scope 3 emissions associated with the Proposal and Combined Proposal, including breakdowns of GHG emissions by source, including land clearing emissions, grid-electricity, transport and domestic and international sources of Scope 3 emissions are presented in Section 12.4.4. • GHG emissions covered by the NGER Scheme, the indicative emissions baseline consistent with the requirements of the Safeguard Mechanism and the anticipated net emissions over the life of the Combined Proposal are provided in Section 12.4.4. • Adoption and consideration of best practice measures to avoid or reduce Scope 1, Scope 2 and Scope 3 emissions are summarised in Section 0. • Whether carbon offsets are proposed to be surrendered for more than 30% of the proposals baseline and BHP's offset strategy are summarised in Section 12.5.3. The application of the Safeguard Mechanism and sectoral measures to reduce Scope 2 emissions, and the international regulatory context covering Scope 3 emissions are summarised in Section 12.5.2.4 and Section 12.5.2.6.
Greenhouse Gas Emissions Policy for Major Projects (Government of Western Australia 2024)	• BHP has considered the Greenhouse Gas Emissions Policy for Major Projects and outlined alternative regulatory measures which require emission reductions associated with the Proposal and Combined Proposal, including the Safeguard Mechanism to meet the EPA's objectives.
Western Australian Climate Policy (Government of Western Australia 2020)	BHP supports and is aligned with this policy to enable the business to transition to the goal of net zero emissions by 2050.

EPA (and other State and Commonwealth) policy and guidance	Consideration of policy and guidance
National Greenhouse and Energy Reporting Act 2007 (NGER Act) (Government of Australia 2024)	This document details requirements of the NGER Act and Safeguard Mechanism, and application to the Combined Proposal. The NGER Act includes an emissions budget and 5-year rolling average reduction requirements to limit emissions from Safeguard Mechanism facilities through to FY2050. The emissions reduction for Safeguard Mechanism facilities will facilitate the EPA's objective of minimising the risk of environmental harm associated with climate change by reducing GHG emissions as far as practicable for the Combined Proposal.

12.3 Receiving environment

12.3.1 Studies

BHP has undertaken an assessment of GHG emissions associated with the Proposal, Approved Proposal and Combined Proposal (Proposals) utilising established methodologies to estimate GHG emissions consistent with methods developed and applied by the DCCEEW in National and State climate change inventory reporting, specifically the NGER Scheme and the Full Carbon Accounting Model (FullCAM) for land clearing emissions. BHP has included the outcomes of GHG modelling in this document including the methodologies, inputs and assumptions used to estimate GHG emissions associated with the Proposals. Other supporting information is referenced, where relevant. BHP considers that this information is provided in accordance with the EPA's Environmental Factor Guideline - Greenhouse Gas Emissions (EPA 2024e) to support the assessment of GHG emissions for the Proposal.

12.3.2 Emissions calculation methodology

GHG emissions estimates for the Proposals have been calculated in accordance with DCCEEW emission factors and methods of the NGER Act and National Greenhouse Accounts, with the exception of land clearing emissions for which the NGER Act does not include a calculation methodology. Consistent with the land-use change emission estimation methods adopted by the Australian Government, BHPIO has derived land-use change emissions using the Full Carbon Accounting Model (FullCAM) methodology, which is consistent with the National Inventory reporting used by DCCEEW to determine Land use, Land Use Change and Forestry (LULUCF) emissions in both National and State emission inventory reporting (DCCEEW 2024b).

Scope 1 emissions

The steps to determine diesel demand from the operation of mining equipment and dewatering to estimate Scope 1 emissions associated with the Proposals are summarised below to provide further detail on each step, including estimation of emissions from land use change.

- heavy haulage and ancillary equipment: Diesel consumed by haul trucks and other mining equipment, is derived from estimated equipment hours and work required to support iron ore and waste movements, and OEM fuel consumption rate estimates. These factors are routinely reviewed against business records and by subject matter experts (SMEs).
- Other consumers of diesel have been considered and compared to estimates used in BHP Business Plans in conjunction with project specific assumptions from relevant SMEs.

- dewatering: Emissions associated with diesel use for dewatering infrastructure, have been derived by comparing estimates used in BHP Business Plans and project specific assumptions from relevant SMEs.
- land clearing: Estimating GHG emissions associated with land use (clearing of vegetation) aligned with the FullCAM methodology, the model utilised by DCCEEW for modelling Australia's GHG emissions from the land sector, and for reporting Australia's GHG emissions and State and Territory GHG Inventories.

Consistent with the land-use change emission estimation methods adopted by the Australian Government, BHP has derived land-use change emissions using the FullCAM methodology. FullCAM is a calculation tool developed and utilised by DCCEEW to inform LULUCF emissions reporting in National and State Inventories and to support estimates for the generation of abatement and associated Australian Carbon Credit Units (ACCUs) for vegetation methods under the Emissions Reduction Fund (ERF).

Land clearing emissions have been estimated for the Proposals using the FullCAM model, GHG emissions for each year of mine operations were estimated for two cases, a 'baseline case' wherein no anthropogenic clearing was assumed, and a 'progressive clearing' case. GHG emissions attributed to land clearing are defined as the difference between the two cases. Sequestration from revegetation associated with mine rehabilitation is not included in estimates, ensuring emissions estimates remain conservative.

Land clearing will be progressive through the life of the Proposal, with a total of 95 ha of clearing estimated to support the following key activities and elements of the Proposal:

- clearing of 95 ha of native vegetation for the construction of the E8 West and East pits, haul roads, light vehicle access tracks and associated infrastructure
- mining of up to 5 Mt of iron ore annually from above and below water table for a period of approximately 5 years, plus approximately 10 years of closure and decommissioning.
- Marillana Creek crossings for haul roads and light vehicle access
- dewatering of up to approximately 4.6 GL/a to access BWT ore in E8 east pit
- discharge of up to approximately 10 GL/a to Marillana Creek.

The FullCAM database identifies Acacia Shrubland as the dominant vegetation type associated with land clearing. Growth and other properties required by the FullCAM model are sourced from the FullCAM database. Estimated land-use change emissions are 1,207 t CO_2-e for the Proposal (95 ha of additional clearing) and 2,271 t CO_2-e for the Combined Proposal (total of 161 ha of clearing, including areas previously approved) which represent ~ 3.19% of the Proposal's and ~0.51% of the Combined Proposal's total Scope 1 emissions (Safeguard Mechanism covered emissions and land-use change emissions).

Scope 2 emissions (Grid-connected electricity)

Electricity emissions are based of the recent average of BHP's NGER Act reported emissions associated with the megawatt hours of electricity generation from Yarnima Power Station. The electricity emissions for the Proposals have been calculated by apportioning estimated electricity demand associated with development scenarios to the unit emissions per megawatt hour based on BHPIO's NGER Act reported emissions.

Scope 3 emissions (Domestic – Iron ore rail transport)

Rail transport emissions are based on the recent average of BHP's NGER Act reported emissions associated with iron ore transport activities. The average unit emissions per net tonne kilometre to transport iron ore from BHPIO's

mines to Port Hedland has been calculated. The Proposals specific rail emissions are determined through the apportionment of saleable production of iron ore and the average rail emissions per net tonne kilometre.

Scope 3 emissions (Domestic – Port Hedland ship loading)

Emissions associated with diesel and electricity use at BHPIO's Port Hedland operations, supporting iron ore ship loading activities have been estimated by apportioning the NGER Act reported emissions associated with BHPIO's Port Hedland activities required to support the forecasted production from the Proposals.

Scope 3 emissions (International – Shipping & steelmaking)

Emissions have been estimated based on the most material Scope 3 emission sources (the dominant sources being processing of sold products, and downstream shipping of sold products). We outline below the industry average emission factors and key assumptions used in the calculations. These provide an estimate for material Scope 3 emissions sources, but because they are not customer, shipper or geography-specific, may only approximate the activities taking place within our value chain. Estimates exclude less material sources of Scope 3 emissions, such as upstream emissions associated with purchased goods and services. Therefore, the Proposals Scope 3 estimates are directly aligned with downstream activities of the iron value chain.

GHG emissions associated with the downstream processing of BHPIO's iron ore products into steel has been estimated according to the same industry-average emissions factors used at BHP Group level reporting of Scope 3 Category 10 "Processing of Sold Products" emissions in FY2024 (BHP 2024f). GHG emissions relating to steelmaking from processing raw materials associated with the Proposals is estimated using global average emissions intensity factor (tonnes of CO_2 per tonne of crude steel) for the blast furnace to basic oxygen furnace (BF-BOF) process route sourced from the International Energy Agency (IEA). This emissions intensity factor for crude steel is assumed to be attributable to iron ore only and not scrap steel.

The emissions intensity factor is applied to an equivalent crude steel production volume assuming 100% of a Proposals iron ore product is processed using this route (BHP 2024f). The crude steel equivalent is calculated assuming the average annual rate of output for the orebodies that are relevant to the Proposals and the average percentage iron (Fe) content across BHP's product portfolio in FY2022, converted to equivalent crude steel quantity assuming the global industry average iron content of crude steel (99.1% Fe) from the International Energy Agency Iron and Steel CCS Study (IEA GHG 2013). This estimate does not take into account site-specific production grades or fluctuations in production volumes anticipated from the Proposal.

This estimate is a straight-line extrapolation of the potential indirect emissions associated with the downstream processing of our iron ore products, holding all assumptions constant from FY2022. Shipping emissions have been estimated assuming 100% of production from the Proposals will be shipped over a distance reflecting a North Asia dispatch region using an industry average, historical emissions intensity factor per voyage. We assume this emissions intensity factor and distance travelled holds constant across the life of the Proposals.

Scope 3 emissions estimates do not contain any forward-looking views on potential emissions abatement measures that may occur in the value-chain that may impact future Scope 3 emissions.

12.3.3 Environmental values

The Proposal is located approximately 90 km north-west of Newman in the Shire of East Pilbara. Iron Ore Mining is the dominant land use in the local area. Existing local contributors to GHG emissions include but are not limited to power generation for town and mine supply, diesel consumption for mining and vehicle use.

12.4 Potential environmental impacts

BHP has considered the development activities that have the potential to contribute to GHG emissions, as outlined in the EPA's Environmental Factor Guideline - Greenhouse Gas Emissions (EPA 2024e) when considering the potential impacts relevant to the Proposal.

BHP has provided information on GHG emissions for the Proposals, being the Proposal, the Approved Proposal and the Combined Proposal. Consistent with the guideline, BHP has estimated the expected Scope 1 emissions covered by the Safeguard Mechanism for the Proposals. Other sources of Scope 1 emissions from the Proposal summarised in Section 12.4.4.2 are not expected to exceed the EPA's Scope 1 information Option B threshold of 100,000 t CO2-e emissions in any year. Accordingly, the Option A Safeguard Mechanism confirmation for the Proposal's assessment of GHG emissions approach has therefore been adopted.

The cumulative emissions from the Combined Proposal will contribute to WA's GHG emissions. Consistent with BHP's NGER Act reporting, GHG emissions from iron ore operations are primarily associated with diesel combustion emissions and therefore tend to comprise of predominantly carbon dioxide (CO2). Other greenhouse gases emitted include methane (CH4), nitrous oxide (N2O) and sulphur hexafluoride (SF6), quantities of these other greenhouse gases are immaterial compared to carbon dioxide.

Unless specified otherwise, the potential impacts discussed in this section are unmitigated (i.e. potential impacts before mitigation measures are applied, if required).

12.4.1 GHG emissions sources

12.4.1.1 GHG types and Global Warming Potentials

The types of GHG estimated from the Proposals are summarised in **Error! Reference source not found.** with their corresponding Global Warming Potentials (GWP). GHG emissions from these sources are required to be reported under the NGER Act and are included within the scope of the Proposals. The Scope 1 emissions inventory is based on NGER Act reportable activities occurring within the Development Envelope. Scope 2 emissions associated with grid-connected electricity supply and Scope 3 emissions associated with iron ore rail transport and ship loading activities are also subject to the reporting requirements of the NGER Act.

Table 12-2: GHG and GWP (Clean Energy Regulator 2025)

Greenhouse gas	GWP (FY2024-25 onwards)[7]
Carbon dioxide (CO_2)	1
Methane (CH_4)	28
Hydrofluorocarbons (HFCs)	116 – 12,400 (Dependent of HFC type)
Nitrous oxide (N_2O)	265
Perfluorocarbons (PFCs)	8,550 – 11,100 (Dependent of PFC type)

[7] GWPs are consistent with the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5). Use of AR5 GWP's is consistent with emission estimation methods governed by the NGER Scheme for FY2024-25 onwards.

Greenhouse gas	GWP (FY2024-25 onwards)[7]
Sulphur hexafluoride (SF_6)	23,500
Nitrogen trifluoride (NF_3)	See comment below

As of compilation number 29 (Government of Australia 2024), NF_3 is not a listed greenhouse gas in the NGER Scheme. NF_3 is used in a relatively small number of industrial processes. It is primarily produced in the manufacture of semiconductors and LCD (Liquid Crystal Display) panels, and certain types of solar panels and chemical lasers (World Resources Institute 2013). There are no Scope 1 emissions sources of NF_3 associated with the Proposals.

SF_6 emissions have been considered and evaluated as immaterial[8]. Annual GHG emissions inventory reporting required by NGER Act of BHP's existing iron ore mining operations continue to validate this category of GHG emissions to be immaterial. BHP's NGER reporting continues to be independently assured to a reasonably assurance level.

12.4.1.2 Scope 1 emissions (Direct emissions from the Development Envelope)

BHPIO has adopted the NGER Act framework as a basis of identifying and estimating all sources of Scope 1 emissions generated for activities associated with the Proposals.

Scope 1 (direct emissions) from the Proposals will be generated through:

- diesel used for heavy haulage, primarily movement of ore and waste material using haul trucks
- diesel used for ancillary equipment such as excavators, drills, and other equipment used to support mine development
- diesel energy powering dewatering activities, including abstraction of groundwater and movement of water across the operation and surplus disposal
- oil and greases, primarily used by heavy equipment
- land clearing, made up of embodied emissions association with vegetation clearing[9].
- decommissioning and closure phase activities associated with diesel used in haul trucks and other ancillary equipment for backfill and contouring operations
- fugitive emissions of sulphur hexafluoride used in electrical switchgear.

The largest source of Scope 1 GHG emissions is associated with diesel consumed by heavy haulage and ancillary equipment. Oils and greases will be consumed for haul truck and ancillary equipment use.

12.4.1.3 Scope 2 emissions (grid-connected electricity generation)

In the context of the Proposals, Scope 2 emissions are associated with electricity demand from grid-connected electricity sourced from Yarnima Power Station which is generated outside of the Development Envelope. Electricity

[8] Aggregation of CH_4, N_2O and SF_6 emissions from Yandi represented 0.49% or 535 t CO_2-e of the NGER Facility's Scope 1 emissions in FY2024.

[9] The NGER Act does not provide a calculation methodology for GHG emissions associated with land clearing. Estimates of land clearing emissions in this Proposal have been derived from the Full Carbon Accounting Model (FullCAM), consistent with the framework used in National Inventory reporting used by Department of Climate Change, Energy, the Environment and Water (DCCEEW) to determine land use, land use change and forestry (LULUCF) emissions.

supply from Yarnima Power Station is primarily generated by a combination of pre-existing natural gas fired power generation plant and waste heat recovery.

Scope 2 emissions associated with generation and transmission of electricity from Yarnima Power Station supporting the Proposals, include:

- natural gas consumed for power generation
- diesel consumed for power generation, including backup and black-start operations
- fugitive emissions of sulphur hexafluoride used in electrical switchgear.

12.4.1.4 Scope 3 emissions sources (Domestic)

BHPIO's domestic sources of downstream emissions are associated with activities that occur outside of the Development Envelope including iron ore rail transport, and ship loading activities at Port Hedland, (other than a small section of rail loop within the Development Envelope). BHP has therefore considered iron ore transport and ship loading activities as Scope 3 emissions to the Proposals. This categorisation of GHG emissions is consistent with BHPIO's NGER, which excludes rail and port activities and GHG emissions from the Yandi NGER facility.

Iron ore is transported to Port Hedland via BHPIO's owned and operated rail operations for export by sea. Rail operations generate GHG emissions outside of the Development Envelope and are considered a source of Scope 3 emissions to the Proposals.

Emissions associated with the transport of iron ore via rail from mining hub to Port Hedland, include:

- diesel consumed by locomotives and rail maintenance activities
- diesel power generation, supporting remote camps.

BHP's Port Hedland operations include GHG emissions from grid-connected electricity associated with unloading, stacking and reclaiming, and ship loading of iron ore.

12.4.1.5 Scope 3 emissions sources (International)

Scope 3 emissions are also associated with the iron ore value chain including the shipping of iron ore to BHP's customers and the emissions associated with the production of steel, using coal to reduce iron ore. Each of these activities is undertaken by third parties.

BHP estimates that the most significant contribution to Scope 3 emissions associated with the Proposals will be from the shipping of products to customers and customer's processing of iron ore in steelmaking. Scope 3 estimates are not necessarily representative of the specific activities taking place within BHP's value chain, nor reflective of the quality of BHP's products, as they are based on industry average emission factors or proxy input data or assumptions.

12.4.1.6 Excluded sources of emissions

Scope 1 emissions for the Proposals have been determined in accordance with the NGER Act, which establishes a national emissions reporting framework. In accordance with the NGER framework, several minor sources of Scope 1 emissions have been excluded from emissions estimates from the Proposals, these are summarised below.

The following sources of emissions are not included in the scope of the Proposals:

- emissions of HFCs, PFCs, and wastewater effluent which are below NGER reporting thresholds[10].
- emissions associated with landfill have been considered as per NGER reporting methods[10].
- minor sources of Scope 3, including diesel value chain emissions have been excluded on the basis that they are immaterial to total Scope 3 estimates. By way of comparison the total upstream Scope 3 emissions associated with BHPIO's diesel consumption for the period equates to <0.01% of the emissions associated with steelmaking and international shipping or iron ore.

12.4.2 Assessed emissions for the Approved Proposal

The Approved Proposal has a long history of assessments undertaken by the EPA under Part IV of the EP Act, with the most recent assessment under section 38 of the EP Act being undertaken in 2005. However, GHG emissions were not quantified by BHP in environmental impact assessment documentation, nor assessed by the EPA as part of any of these assessments as they pre-dated the introduction of Greenhouse Gas Emissions as an EPA factor.

12.4.3 Historical emissions reporting

The Approved Proposal aligns with the activities reported by the Yandi NGER facility, which is subject to NGER Act energy and emissions reporting. BHPIO is required to prepare and report emissions consistent with methodologies and emission factors associated with the NGER (Measurement) Determination 2008 every financial year, reporting emissions to the Clean Energy Regulator (CER) by the 31 October, following the relevant reporting period.

NGER facilities which have Scope 1 emissions which exceed 100,000 t CO_2-e will have their Scope 1 emissions reported publicly for the individual NGER facility on the CER's website. **Error! Reference source not found.** summarises the Scope 1 emissions from the Yandi NGER facility reported through the NGER Act.

Table 12-3: Yandi recent NGER Act reported GHG emissions

Year	Scope 1 emissions t CO_2-e	Scope 2 emissions t CO_2-e[1]
FY2021	190,343	N/A
FY2022	149,694	N/A
FY2023	111,995	N/A
FY2024	107,160	N/A

[1] To avoid double-counting of Scope 1 and Scope 2 emissions, previous versions of the NGER Act required WAIO to report the Scope 1 emissions associated with electricity generation at Yarnima Power Station and in turn, electricity use at WAIO's mines was not reportable as Scope 2 emissions through NGER Act reporting obligations. From FY2025 updates to the NGER Act will allow for Yarnima's electricity supply to WAIO's individual mines to be reported as Scope 2, adjustments will be made to aggregated emissions reporting of BHPIO and BHP to avoid double-counting of Scope 1 and Scope 2 emissions from Yarnima Power Station.

[10] Annual GHG emissions inventory reporting required by the NGER Act of BHPIO's existing iron ore mining operations continue to validate these categories of GHG are below reporting thresholds under the NGER scheme or not applicable to iron ore mining. BHPIO's NGER reporting has been and continues to be independently assured to a reasonable assurance level.

12.4.4 Emissions estimates

12.4.4.1 GHG modelling scenarios

Three scenarios were modelled to support the assessment of the Proposals:

- Approved Proposal Scenario: This scenario is consistent with the existing mining operations at Yandi permitted by Ministerial Statement (MS) 679, as amended by MS 1039.
- Proposal Scenario: This scenario seeks to dewatering of up to approximately 4.6 GL/a to access BWT ore in E8 east pit enabling mining of approximately up to 5 Mt of iron ore annually from above and below water table from the E8 pit.
- Combined Proposal Scenario: Aggregation of the Approved Proposal and the Proposal scenarios.

12.4.4.2 Scope 1 emissions estimates

BHP has estimated annual Scope 1 emissions for the Proposal, Approved Proposal and the Combined Proposal. A summary of modelled GHG emissions for the Proposal and Combined Proposal which are and are not covered by the NGER Scheme and Safeguard Mechanism is provided in Table 12-4 and Table 12-5 and includes the following:

- Estimated peak annual emissions
- Estimated total emissions
- Estimated average annual emissions.

The Proposal's Scope 1 emissions not covered by the NGER Scheme and Safeguard Mechanism are associated with land-use change and peak at 167 t CO_2-e in FY2029. NGER Scheme Scope 1 emissions greater than 100,000 t CO_2-e are covered by the Safeguard Mechanism. Although Scope 1 emissions associated with the Proposals are predicted to remain below 100,000 t CO_2-e, should these reported emissions exceed 100,000 t CO_2-e in any year Safeguard Mechanism obligations would apply and be enforced by the CER.

Scope 1 emissions which are not covered by the Safeguard Mechanism are not estimated to reasonably be likely to exceed 100,000 t CO_2-e in any year, supporting an Option A: Safeguard Mechanism confirmation assessment in accordance with the EPA's guidelines (EPA 2024e).

Table 12-4: Proposal Scope 1 NGER Scheme covered emissions summary[11]

Emissions estimate	Scope 1 emissions covered by the NGER (t CO_2-e)	Scope 1 emissions Not covered by the NGER (t CO_2-e)[1]	Scope 1 emissions Total (t CO_2-e)
Peak annual emissions	17,238 (FY27)	167 (FY29)	17,238 (FY27)

[11] The threshold for coverage by the Safeguard Mechanism is 100,000 t CO_2-e of Scope 1 emissions measured by NGER facility. The Yandi NGER Facility boundary is consistent with the Proposal's Development Envelope and has recently continued to be covered by the Safeguard Mechanism. Scope 1 emitting activities associated with the Combined Proposal's emissions forecast directly contribute to the total Scope 1 emissions reportable by the Yandi NGER facility. In any given year, where reported Scope 1 emissions from an NGER Facility exceed 100,000 t CO2-e Safeguard Mechanism obligations will apply and be enforced by the CER.

Emissions estimate	Scope 1 emissions covered by the NGER (t CO_2-e)	Scope 1 emissions Not covered by the NGER (t CO_2-e)[1]	Scope 1 emissions Total (t CO_2-e)
Total emissions over the life of the Proposal	36,634	1,207	37,841
Average annual emissions[2]	8,986	38	9,024

[1] Land clearing emissions are the only source of Scope 1 emissions within the Development Envelope of the Proposal not covered by the NGER Scheme and Safeguard Mechanism.

[2] Annual average emissions for the Proposal are from FY2025 and FY2028 and excludes periods of low emissions to better represent average operational emissions.

Table 12-5: Combined Proposal Scope 1 NGER Scheme covered emissions summary[11]

Emissions estimate	Scope 1 emissions covered by the NGER (t CO_2-e)	Scope 1 emissions Not covered by the NGER (t CO_2-e) [1]	Scope 1 emissions Total (t CO_2-e)
Peak annual emissions	89,791 (FY28)	284 (FY29)	90,069 (FY28)
Total emissions over the life of the Proposal	445,794	2,271	448,065
Average annual emissions[2]	49,533	175	49,654

[1] Land clearing emissions are the only source of Scope 1 emissions within the Development Envelope of the Proposal not covered by the NGER Scheme and Safeguard Mechanism. Scope 1 emissions not covered by the Safeguard Mechanism are estimated to remain below the EPA's 100,000 t CO_2-e per annum threshold, supporting an Option A: Safeguard Mechanism confirmation assessment.

[2] Annual average emissions for the Combined Proposal are from FY2025 to FY2033 and excludes periods of low emissions to better represent average operational emissions.

The peak, average and total Scope 1 emissions covered by the Safeguard Mechanism for the Approved Proposal, Proposal, and Combined Proposal are summarised in Table 12-6. Peak annual Scope 1 emissions are estimated to occur in FY2028 for the Combined Proposal. Increases of average annual Scope 1 GHG emissions from the Proposal are primarily associated with the extraction of groundwater and below water table mining activities. Section 12.5 provides a detailed summary of the measures included in this Proposal to reduce GHG emissions.

Table 12-6: Scope 1 emissions summary – Proposal, Approved Proposal, and Combined Proposal

Emissions estimate[1]	Proposal	Approved Proposal	Combined Proposal
Peak annual emissions	17,238 (FY27)	84,003 (FY28)	89,791 (FY28)

Emissions estimate[1]	Proposal	Approved Proposal	Combined Proposal
Total emissions over the life of the Proposal	36,634	409,160	445,794
Average annual emissions[2]	8,986	45,462	49,533

[1] Excludes land clearing emissions, as this source of Scope 1 emissions is not covered by the NGER Scheme and Safeguard Mechanism
[2] Annual average emissions for the Approved Proposal and Combined Proposal are from FY2025 to FY2033. Annual average emissions for the Proposal are from FY2025 and FY2028 and excludes periods of low emissions to better represent average operational emissions.

Table 12-7 provides a summary of the estimated annual Scope 1 emissions covered by the NGER Scheme for activities within the Development Envelope for the Proposal, Approved Proposal and the Combined Proposal.

Emission sources of annual and lifetime Scope 1 emission for the Combined Proposal are presented in Table 12-7 The Scope 1 emissions profile (including by source) of the Combined Proposal is illustrated in Figure 12-1: Combined Proposal Scope 1 GHG emissions profile Included are annual estimates of land-use change emissions, although land-use change emissions are not covered by the NGER Scheme and Safeguard Mechanism, their inclusion in Scope 1 emission source summaries illustrates they are estimated to remain below 100,000 t CO_2-e in any year.

Table 12-7: Scope 1 GHG emissions by year

Financial year	Scope 1 GHG emissions (t CO_2-e)[1]		
	Proposal	Approved Proposal	Combined Proposal
2025	885	64,277	65,162
2026	12,035	59,061	71,096
2027	17,238	55,300	72,538
2028	5,788	84,003	89,791
2029	138	30,114	30,252
2030	138	29,296	29,434
2031	138	30,726	30,864
2032	138	27,805	27,943
2033	138	28,576	28,713
Annual Average[2]	**8,986**	**45,462**	**49,533**
Total	**36,634**	**409,160**	**445,794**

[1] Excludes land clearing emissions, as this source of Scope 1 emissions is not covered by the NGER Scheme and Safeguard Mechanism

[2] Annual average emissions for the Approved Proposal and Combined Proposal are from FY2025 to FY2033. Annual average emissions for the Proposal are from FY2025 and FY2028 and excludes periods of low emissions to better represent average operational emissions.

Table 12-8: Combined Proposal Scope 1 emissions by source

Year	Combined Proposal Scope 1 emissions estimates (t CO_2-e)				
	Heavy haulage & ancillary (diesel)	Dewatering (diesel)	Oils & greases	Land-use change[1]	Total (excluding land-use change)[2]
2025	63,006	2,080	76	-	65,162
2026	68,933	2,080	83	60	71,096
2027	70,374	2,080	84	106	72,538
2028	87,606	2,080	105	278	89,791
2029	28,138	2,080	34	284	30,252
2030	27,321	2,080	33	245	29,434
2031	28,750	2,080	34	221	30,864
2032	25,832	2,080	31	200	27,943
2033	26,601	2,080	32	182	28,713
2034	-	-	-	165	-
2035	-	-	-	151	-
2036	-	-	-	138	-
2037	-	-	-	126	-
2038	-	-	-	116	-
Average[3]	47,396	1,407	57	175	49,533
Total	**426,560**	**18,722**	**512**	**2,271**	**445,794**

[1] Land-use change emissions are not covered by the Safeguard Mechanism. FullCAM model emissions from land-use change continues beyond cessation of mining and closure; estimates have been included to 2038. The declining total carbon pool is driven by predicted soil carbon loss in the absence of commensurate increase in above and below ground plant comments, presumably because vegetation is assumed within the model (FullCAM) to have reached full maturity. To what extent the total carbon pool actually declines at the project site over time is uncertain, however

the FullCAM simulated result does suggest that the loss in future sequestration potential, if vegetation was not cleared at the project site, is not expected to be overly significant.

[2] Land-use change emissions are not covered by the NGER Scheme and Safeguard Mechanism and have been excluded from Scope 1 emission totals in this table.

[3] Annual average emissions for the Combined Proposal are from FY2025 to FY2033 and excludes periods of low emissions to better represent average operational emissions.

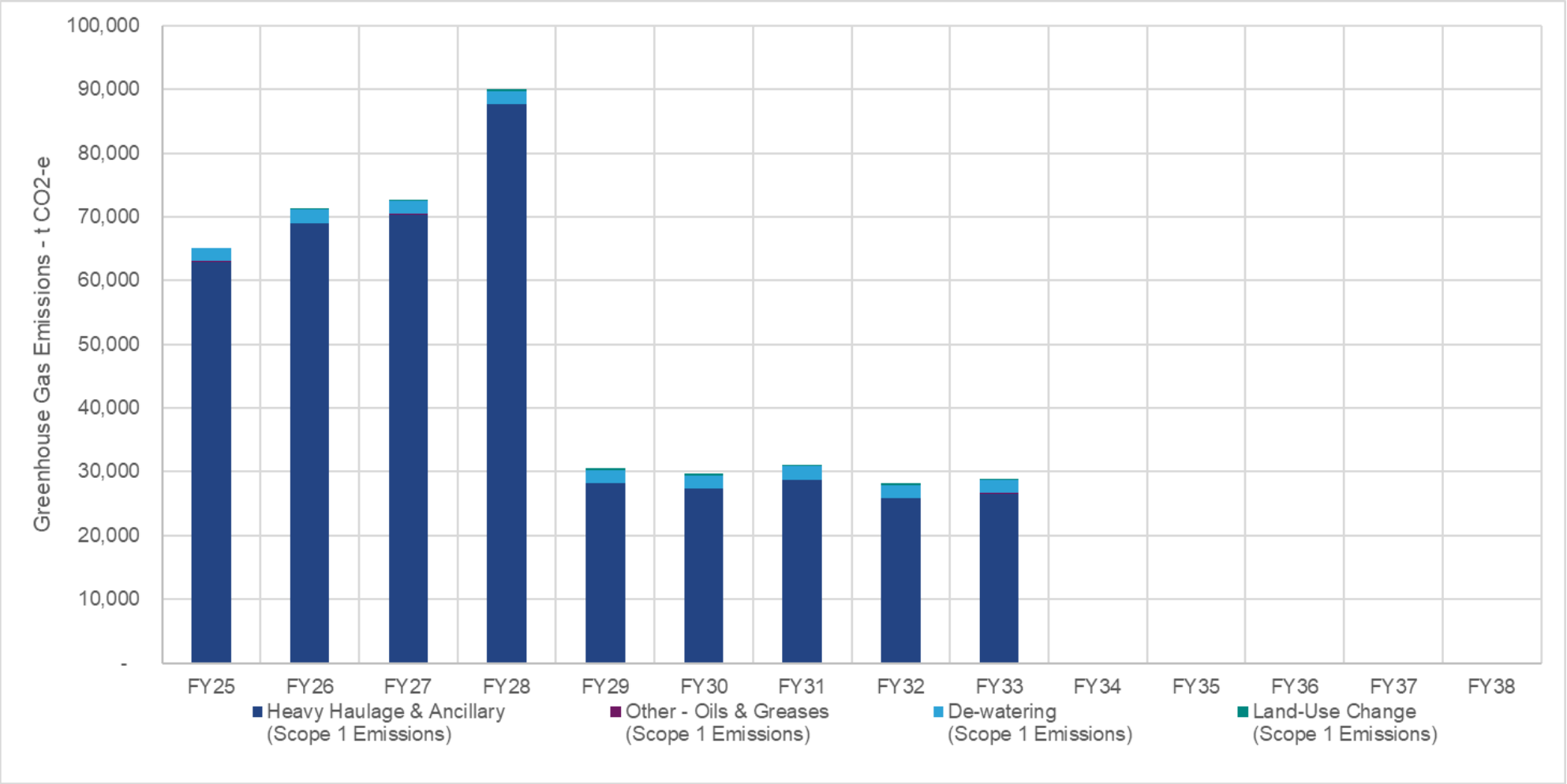


Figure 12-1: Combined Proposal Scope 1 GHG emissions profile[12]

[12] Land-use change emissions are not covered by the NGER scheme or Safeguard Mechanism

12.4.4.3 Scope 2 emissions estimates

BHP has estimated annual Scope 2 emissions for the Proposal, Approved Proposal and the Combined Proposal. A summary of modelled GHG emissions for the Proposal and Combined Proposal is provided in Table 12-9: and **Error! Reference source not found.Error! Reference source not found.** and includes the following:

- estimated peak annual emissions
- estimated total emissions
- estimated average annual emissions.

Table 12-9: Scope 2 emissions summary – Proposal, Approved Proposal, and Combined Proposal

Emissions estimate	Proposal	Approved Proposal	Combined Proposal
Peak annual emissions	12,252 (FY27)	21,229 (FY25)	25,460 (FY26)
Total emissions over the life of the Proposal	21,912	66,947	88,859
Average annual emissions[1]	5,478	7,439	9,873

1 Annual average emissions for the Approved Proposal and Combined Proposal are from FY2025 to FY2033. Annual average emissions for the Proposal are from FY2025 and FY2028 and excludes periods of low emissions to better represent average operational emissions.

Table 12-10: Scope 2 GHG emissions (Grid-connected electricity demand) by year

	Estimated Scope 2 emissions (t CO_2-e)		
Financial year	Proposal	Approved Proposal	Combined Proposal
2025	-	21,229	21,229
2026	5,298	20,162	25,460
2027	12,252	9,937	22,189
2028	4,361	15,620	19,981
2029	-	-	-
2030	-	-	-
2031	-	-	-
2032	-	-	-

Financial year	Estimated Scope 2 emissions (t CO_2-e)		
	Proposal	Approved Proposal	Combined Proposal
2033	-	-	-
Annual Average[1]	**5,478**	**7,439**	**9,873**
Total	**21,912**	**66,947**	**88,859**

1 Annual average emissions for the Approved Proposal and Combined Proposal are from FY2025 to FY2033. Annual average emissions for the Proposal are from FY2025 and FY2028 and excludes periods of low emissions to better represent average operational emissions.

12.4.4.4 Scope 3 emissions estimates

A summary of estimated Scope 3 GHG emissions is provided in Table 12-11Table 12-11 and includes the following for the Combined Proposal:

- estimated peak annual emissions
- estimated total emissions
- estimated average annual emissions.

Table 12-11: Proposal Scope 3 GHG emissions summary

Emissions estimate	Steel-making (t CO_2-e)	Shipping (t CO_2-e)	BHPIO Port: Downstream (t CO_2-e)	BHPIO Rail Transport (t CO_2-e)	Total (t CO_2-e)
Peak annual emissions[1]	9,427,609	90,078	7,963	13,054	9,538,704
Total emissions over the life of the Proposal	17,061,175	162,999	14,409	23,622	17,262,205
Average annual emissions	4,265,294	40,750	3,602	5,906	4,315,551

[1] Peak total Scope 3 emissions are estimated in 2027.

The total downstream and Scope 3 emissions have been estimated to be 18,312,706 t CO_2-e (annual average) and 73,340,971 t CO_2-e (total life of the Combined Proposal; Table 12-12:). This is comprised of:

- domestic rail transport of iron ore from the Proposal to Port Hedland relevant to the Combined Proposal are estimated to average 11,199 t CO_2-e per year or total 100,789 t CO_2-e for the life of the Proposal[13].
- domestic ship loading activities at Port Hedland relevant to the Combined Proposal are estimated to average 6,831 t CO_2-e per year or total 61,478 t CO_2-e for the life of the Proposal[13].
- international shipping of iron ore associated with the Combined Proposal is estimated to average 173,865 t CO_2-e per year or total 695,461 t CO_2-e for the life of the Proposal.
- international steelmaking of products associated with the Combined Proposal is estimated to average 18,120,811 t CO_2-e per year or total 72,483,243 t CO_2-e for the life of the Proposal.

Table 12-12: Combined Proposal Scope 3 GHG emissions summary

Emissions estimate	Steel-making (t CO_2-e)	Shipping (t CO_2-e)	BHPIO Port: Downstream (t CO_2-e)	BHPIO Rail Transport (t CO_2-e)	Total (t CO_2-e)
Peak annual emissions[1]	20,609,665	196,325	17,355	28,452	20,851,796
Total emissions over the life of the Combined Proposal	72,483,243	695,461	61,478	100,789	73,340,971
Average annual emissions	18,120,811	173,865	6,831	11,199	18,312,706

[1] Peak total Scope 3 emissions are estimated in 2026.

[13] The CER defines "Scope 3 emissions as indirect GHG emissions other than Scope 2 emissions that are generated in the wider economy. They occur as a consequence of the activities of a facility, but from sources not owned or controlled by that facility's business". Although BHP's activities associated with rail iron ore transport and at Port Hedland, are controlled by BHP, from the perspective of the Proposals they occur outside the Development Envelope, and therefore are neither Scope 1 or Scope 2 emissions associated with the Proposals.

12.5 Mitigation

GHG emissions abatement opportunities for the Proposal have been assessed by BHPIO to determine whether they are reasonable and practicable against multiple criteria including safety, technical performance, operability, emissions reduction, availability, scale, and economic viability. In addition, BHPIO has assessed these abatement opportunities in the context that the Proposal relates to a brownfields expansion of an operating mine which by its nature limits the scope of such opportunities.

There is potential for substantial changes in GHG policies, markets, technology, and regional energy infrastructure over the lifetime of BHPIO's operations in the Pilbara. This may provide opportunities to accelerate adoption of GHG abatement measures or influence the reasonableness or practicability of GHG abatement measures.

BHP manages its operational decarbonisation program on an enterprise-wide basis, reflecting the global nature of climate change and the opportunities for implementation of decarbonisation technologies across multiple sites. Through studies and a capital allocation process, BHP seeks to optimise the risk and reward proposition for operational decarbonisation projects and optimise decarbonisation at a portfolio level. BHP has developed an internal marginal abatement cost curve designed to support identification of the most efficient and effective decarbonisation projects. Further information regarding BHP climate change strategy and commitments is available in the BHP Climate Transition Action Plan 2024 (BHP 2024g).

12.5.1 Avoid

The Scope 1 and Scope 2 emissions from the Combined Proposal are estimated to increase by 58,546 t CO_2-e as a result of the Proposal, which represents a 12.30% increase in emissions compared to the Approved Proposal. These increases in emissions include Scope 1 emission (36,634 t CO_2-e) sources within the Development Envelope[14] and Scope 2 emissions associated with electricity generation outside the Development Envelope (21,912 t CO_2-e).

The Approved Proposal is a brownfields development, which includes established mining fleet and mine infrastructure which will be utilised by the Proposal. The Proposal includes a modest extension to the mine life of approximately 5 years, prior to cessation of iron ore production. These factors limit the scope of GHG emission avoidance opportunities at commencement of the Proposal.

Figure 12-2: summarises the total Scope 1 emission sources within the Development Envelope excluding land-use change emissions not covered by the Safeguard Mechanism and Scope 2 emissions associated with electricity generation outside the Development Envelope for both the Combined Proposal and Approved Proposal, and the specific activities associated with the Proposal which result in the 12.3% increase in emissions from the Approved Proposal to the Combined Proposal.

BHP has avoided Scope 1 emissions where possible by minimising land clearing through the use of existing infrastructure where practicable to support the development and operation of the Proposal, including the use of existing cleared tracks and roads, as well as mine processing infrastructure and overburden storage areas.

Electrification of heavy mining equipment (Pilbara-wide Initiatives)

The most material source of Scope 1 emissions associated with the Combined Proposal are from diesel consumption from existing mining equipment (heavy haulage & ancillary). Section 12.5.2.3 summarises BHPIO's plans to avoid and reduce these diesel emissions through the adoption of battery-electric haul trucks and other electric equipment,

[14] Excludes Scope 1 emissions sources not covered by the Safeguard Mechanism as this assessment is aligned with an Option A: Safeguard Mechanism confirmation

including excavators and drills. Section 12.5.2.3 also provides summary of BHPIO's initiatives to decarbonise grid-connected electricity generation.

Dewatering & Other measures

Strategies to reduce emissions from dewatering at BHPIO include the trial and utilisation of high-efficiency pumps and motors, optimisation of bore location, piping layouts and pipe diameter to reduce operational energy demand and where feasible sourcing grid-based electricity to power dewatering operations. These strategies continue to be actively evaluated and implemented by BHPIO.

Additionally, BHP has avoided Scope 1 emissions where possible by minimising land clearing through the use of existing infrastructure where practicable to support the development and operation of the Proposal, including the use of existing cleared tracks and roads and mine processing infrastructure.

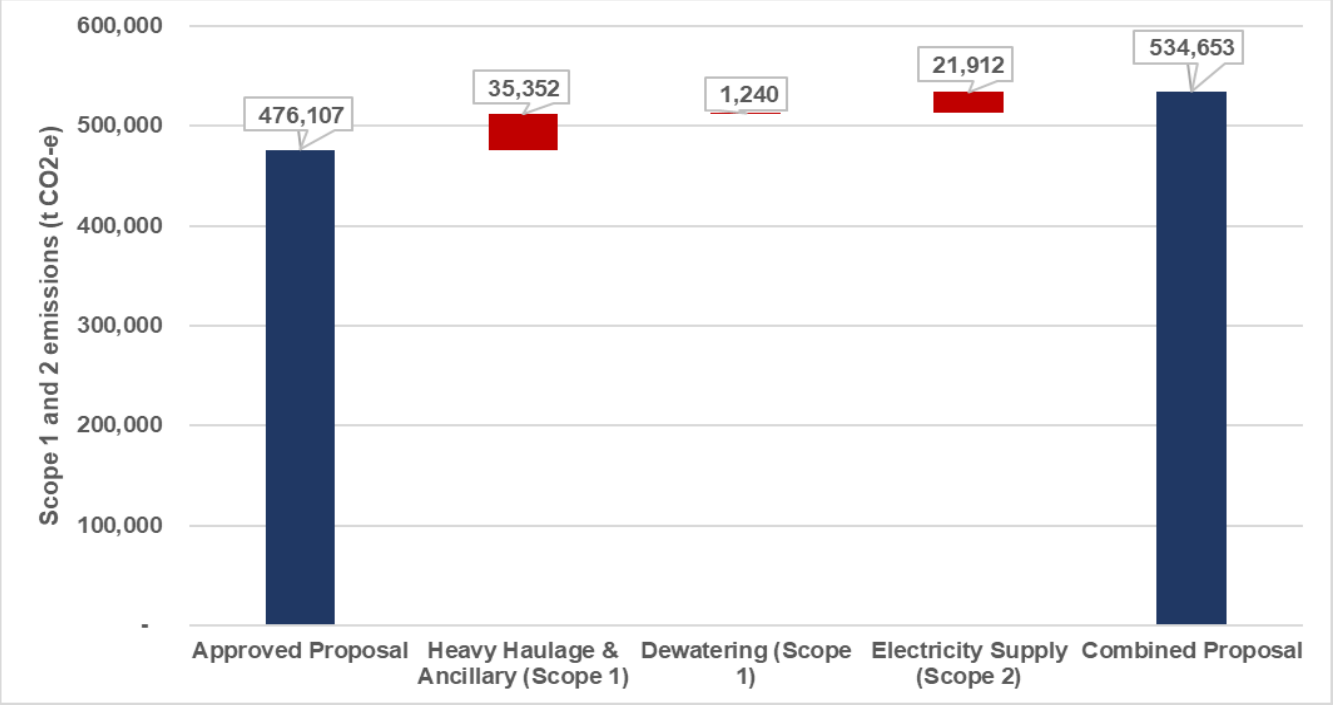


Figure 12-2: Combined Proposal GHG emissions comparison for operational scenarios.

12.5.2 Reduce

BHP intends to reduce GHG emissions, including in accordance with the NGER Act and Safeguard Mechanism, as described below:

- BHP's contribution towards the Western Australian and Commonwealth Governments aspiration of net zero emissions by 2050
- the consideration given to evolving Western Australian and Commonwealth legislative and policy settings, including new international commitments, through which the net zero emissions by 2050 aspiration is intended to be delivered
- progressive reduction of Scope 1 emissions for the Combined Proposal through the setting of an indicative emissions reduction trajectory aligned with the Safeguard Mechanism and incorporates the enforceable annual baselines
- all reasonable and practicable measures have been considered to avoid, reduce, and offset the Scope 1 emissions from the Combined Proposal
- that consideration has been given to opportunities for reducing BHP's downstream and other Scope 3 emissions associated with the Combined Proposal where reasonably practicable.

The activities associated with the Approved Proposal broadly align with the NGER facilities listed in **Error! Reference source not found.**, which is subject to NGER Act energy and emissions reporting. BHP is also required to report on both Scope 1 and Scope 2 emissions annually by NGER facility.

The NGER Act and Safeguard Mechanism provide contemporary, robust, transparent, and enforceable requirements to deliver GHG emissions reductions commensurate to Australia's international obligations. These mechanisms apply to GHG emissions associated with the Combined Proposal and enable the objectives of the EPA to be met (EPA 2024e), as well as the WA Government's Greenhouse Gas (GHG) Emissions Policy for Major Projects (Government of Western Australia 2024).

12.5.2.1 Indicative Scope 1 emissions reduction trajectory

Figure 12-3: illustrates the Scope 1 emissions baseline and the indicative emissions trajectory for the Combined Proposal. BHPIO has estimated the indicative emissions reduction trajectory for the Proposal by applying the relevant Safeguard Mechanism decline rates to the combined proposal's baseline emissions and factoring the 100,000 t CO2-e Safeguard Mechanism coverage threshold. The actual Safeguard Mechanism (production-adjusted) emission baseline, which the indicative emissions baseline represents, will vary based on a number of factors, including the transition from "Site-specific emission intensities" to "Default Emission Intensities", planned consultation to revise FY2031 to FY2035 Safeguard Mechanism decline rates, and variance between forecast and recorded production.

Production-adjusted baselines are determined by the CER annually and once emissions and production data has been reported through the NGER Act, which are due 31 October preceding a financial compliance year. Production-adjusted baselines compensate for the potential for actual production to vary, ensuring that emissions limits remain relative to actual production, limiting issues of discrepancy between estimated production and emissions, and those which occur in practice. As a result, BHPIO provides an estimate of the expected baseline or 'indicative emissions reduction trajectory' as the CER will annually determine the Yandi's NGER facility emission baseline, which will operate as the net GHG emissions limit for that year.

Indicative emissions reduction trajectories are subject to a range of uncertainties, including:

- mine strategy and production may fluctuate in response to changes in the market or operational considerations, which may impact GHG emissions from mining associated with the Proposals; and
- amendments to the Safeguard Mechanism, which may include changes to production variables, relevant production variable emissions intensities (default or industry best practice), revised annual decline rates and/or coverage thresholds. However, any amendments to the Safeguard Mechanism Rule would need to be consistent with the NGER Act objects, notably the 'hard cap' and overarching emissions reduction requirements.

Table 12-13: and

Figure 12-3: provides the Scope 1 emissions baseline and indicative emissions reduction trajectory (applying the Safeguard Mechanism decline rate for the Combined Proposal. Reductions in GHG emissions will be achieved through BHP's operational decarbonisation strategy, which prioritises structural abatement, including the use of low carbon and renewable power and fleet electrification which are discussed in Sections12.5.2.3 and 12.5.2.4.

Table 12-13: Scope 1 GHG Emissions attributable to the Combined Proposal [15, 16, 17]

Fiscal Year	Baseline Yandi Combined Proposal mining activities (t CO_2-e)	Safeguard Mechanism decline rate (%)	Indicative Emissions Reduction Trajectory – Yandi Combined Proposal mining activities (t CO_2-e)
2025	65,162	9.80	65,162
2026	71,096	14.70	71,096
2027	72,538	19.60	72,538
2028	89,791	24.50	89,791
2029	30,252	29.40	30,252
2030	29,434	34.30	29,434
2031	30,864	37.59	30,864
2032	27,943	40.87	27,943
2033	28,713	44.16	28,713
2034	-	47.44	-
2035	-	50.73	-
Total	**445,794**	N/A	**445,794**

[15] Safeguard Mechanism decline rate is sourced from the NGER (Safeguard Mechanism) Rule 2015. Decline rates are subject to change, with DCCEEW indicating that the decline rates for FY2031 to FY2050, subject of 2027 consultation.

[16] 'Indicative emissions reductions are based on the Safeguard Mechanism Decline Rate and estimated emissions associated with the Yandi Combined Proposal. Actual reductions will vary based on factors, including 'Site-specific' and "Schedule 2 – Default Emission Intensities', and recorded production variable outputs.

[17] The threshold for coverage by the Safeguard Mechanism is 100,000 t CO2-e of Scope 1 emissions measured by NGER facility. The Yandi NGER Facility boundary is consistent with the Proposal's Development Envelope and has recently continued to be covered by the Safeguard Mechanism. Scope 1 emitting activities associated with the Combined Proposal's emissions forecast directly contribute to the total Scope 1 emissions reportable by the Yandi NGER facility. In any given year, where reported Scope 1 emissions from an NGER Facility exceed 100,000 t CO2-e Safeguard Mechanism obligations will apply and be enforced by the CER.

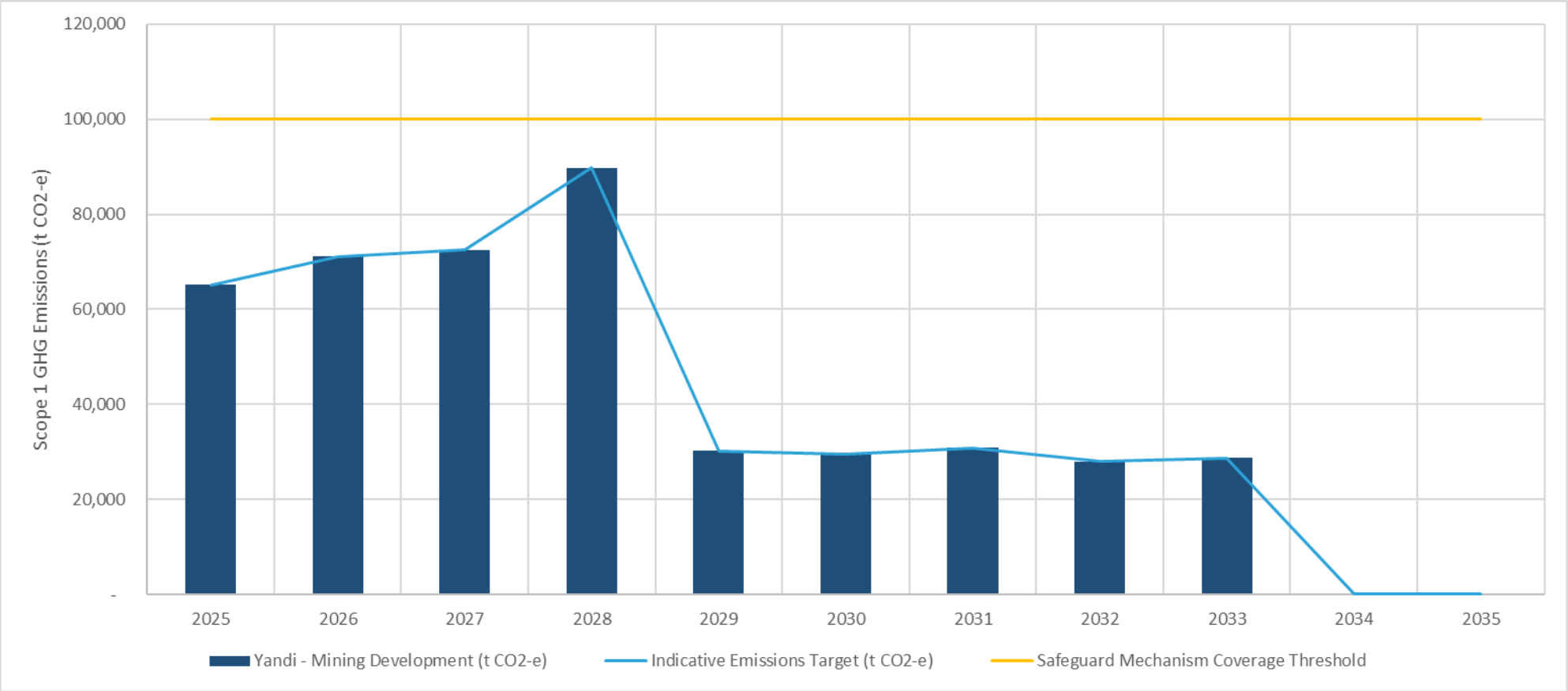


Figure 12-3: Combined Proposal Scope 1 emissions baseline and indicative emissions reduction trajectory[18]

[18] The threshold for coverage by the Safeguard Mechanism is 100,000 t CO2-e of Scope 1 emissions measured by NGER facility. The Yandi NGER Facility boundary is consistent with the Proposal's Development Envelope and has recently continued to be covered by the Safeguard Mechanism. Scope 1 emitting activities associated with the Combined Proposal's emissions forecast directly contribute to the total Scope 1 emissions reportable by the Yandi NGER facility. In any given year, where reported Scope 1 emissions from an NGER Facility exceed 100,000 t CO2-e Safeguard Mechanism obligations will apply and be enforced by the CER.

12.5.2.2 NGER Act and Safeguard Mechanism coverage

BHPIO is the responsible emitter in respect of a number of designated large facilities that are covered by the Safeguard Mechanism. The facilities described below are relevant to the Proposals. Table 12-14 summarises the links between the NGER facility and the Safeguard Mechanism production variable and default emissions intensity, applicable to determine emission baselines through the Safeguard Mechanism.

The threshold for coverage by the Safeguard Mechanism is 100,000 t CO2-e of Scope 1 emissions measured by NGER facility. The Yandi NGER Facility boundary is consistent with the Proposal's Development Envelope and has recently continued to be covered by the Safeguard Mechanism. Scope 1 emitting activities associated with the Combined Proposal's emissions forecast directly contribute to the total Scope 1 emissions reportable by the Yandi NGER facility. In any given year, where reported Scope 1 emissions from an NGER Facility exceed 100,000 t CO2-e Safeguard Mechanism obligations will apply and be enforced by the CER.

Table 12-14: Summary of Safeguard Mechanism coverage of BHPIO's relevant operations to the Proposals

NGER Facility	Production Variable	Relevance to Proposal
YAN01 Yandi/Marillana Creek Mine – MNG Facility	Iron ore default emissions intensity of 0.00476 t CO_2-e per tonne of iron ore applicable	Scope 1 activities generated by the Yandi NGER facility are aligned with the Proposal.
Yarnima Power Station	Megawatt hours of electricity generation default emissions intensity of 0.539 t CO_2-e applicable	Source of Scope 2 emissions, Yarnima is the primary source of off-site electricity supply to the Proposal
PRL03 Rail – IOR Facility	Net-tonne-kilometres of bulk freight on a dedicated line default emissions intensity of 5.29 x 10^{-6} t CO_2-e per net-tonne-kilometre applicable	Source of Scope 3 emissions, rail transport of iron ore from the Proposal

YAN01 Yandi/Marillana Creek Mine – MNG Facility (Yandi)

Yandi is located approximately 178 km north-west of Newman in the Pilbara region of WA. The Yandi hub produces iron ore through open-pit iron ore mining methods. The Yandi NGER facility reports the energy and emissions supporting the mining and production of iron ore to where it is loaded onto BHPIO's rail.

Yarnima Power Station

Yarnima is a combined cycle gas turbine (CCGT) power station located in Newman in the Pilbara region of WA. The power station operates gas turbines equipped with heat recovery steam generators to capture waste heat. Waste heat recovery generates additional power, reducing gas use for electricity generation and increasing the overall thermal efficiency and reducing carbon emissions intensity of the power station.

In the event of a gas supply interruption or shortfall, the power station is configured to allow normal operations to continue using diesel fuel. Yarnima supplies electricity to BHPIO's mines and the Newman township via BHPIO's inland electricity grid, including for the Proposals.

PRL03 Rail – IOR Facility

BHPIO's mining hubs are connected by more than 1,000 km of railway infrastructure in the Pilbara region of WA. This railway infrastructure is dedicated for BHPIO's sole use and rail transport activities are operated by BHPIO, which includes the transport of ore from the Proposals. The NGER facility, PRL03 Rail – IOR Facility reports the

energy and emissions from activities which support the transport of iron ore from BHPIO's mining hubs, where it is loaded, to Port Hedland where iron ore is unloaded for export.

Legislative and policy settings for GHG emissions reductions

The Commonwealth *Climate Change Act 2022* (CC Act) enshrines into law Australia's updated nationally determined contribution under Article 4 of the Paris Agreement. The emissions reduction targets are 43% below 2005 levels by 2030 and net zero by 2050.

Significant reforms have been undertaken to the NGER Act and Safeguard Mechanism which took effect from 1 July 2023. The reforms are directed at ensuring covered facilities achieve a proportionate share of Australia's emissions reduction target.

Key components of the NGER Act and Safeguard Mechanism reform framework are:

- Ensuring that total net Safeguard Mechanism emissions (emissions from all covered facilities) for all of the financial years between 1 July 2020 and 30 June 2030 do not exceed a total of 1,233 Mt CO_2-e (known as the 'hard cap')
- An annual baseline decline rate for all facilities through until 2050. Emission limits will be periodically monitored and updated by Government to ensure the scheme remains effective.
- Baselines operate as a compliance limit and facilities must undertake abatement activities at site and/or use carbon credits to meet the declining baseline. Any use of carbon offsets in excess of 30% will trigger the requirement for a public statement explaining why more onsite abatement has not been undertaken.
- Transparency in respect of all key aspects of the regime. This including publishing of facility baselines, Scope 1 emissions data and ACCUs and/or SMCs surrendered by the CER each year.
- Significant penalties and other enforcement options apply for failure to comply with the NGER Act and Safeguard Mechanism. The CER and Government also have wide ranging tools to monitor compliance.

The activities associated with the Proposals are aligned with the Yandi NGER facility boundary, which is subject to the NGER Act energy and emissions reporting requirements. BHP is also required to report on both Scope 1 and Scope 2 emissions annually by NGER facility.

The NGER Act and Safeguard Mechanism apply to the majority of GHG emissions associated with the Combined Proposal and enable the objectives of the EPA to be met, as well as the WA Government's GHG Emissions Policy for Major Projects (Government of Western Australia 2024).

12.5.2.3 Reduction of Scope 1 emissions through fleet electrification

Displacing diesel as an energy source requires a transformation of mining operations through an integrated abatement program. The decarbonisation pathway is non-linear and will rely heavily on development of technologies that are not currently commercially available, with each component needing to reach maturity in line with the transformation program.

BHP has partnered with Caterpillar and Komatsu to develop zero emissions trucks. BHP is collaborating with Caterpillar through its Early Learner program to develop and deploy CAT zero-exhaust emission trucks. The pace of development of some decarbonisation technology has slowed, particularly relating to the displacement of diesel used for materials movement. We continue to work with Original Equipment Manufacturer partners (OEMs) to advance zero emission technology. Following successful demonstration of its first battery electric 793 prototype in 2022 at the Tucson Proving Ground facility, Arizona (Caterpillar 2022), Caterpillar's Early Learner proof-of-concept trials continue to progress the research and development of battery electric haul trucks in production environments (Caterpillar

2024) including a planned battery-electric haul truck trial at BHPIO's Jimblebar mine. Subject to technology readiness and commercial viability, BHP expects to deploy electric haul trucks at selected BHP operations, displacing diesel emissions via electrification (BHP 2024g).

Replacing diesel as a fuel source requires a new operational ecosystem, impacting mine planning, haulage networks, and reconsideration of safety and operational factors. In FY2022, BHP became a founding member of the mining taskforce at CHARIN, an association dedicated to promoting interoperability of charging systems. The taskforce aims to ensure that any truck charging interfaces across the industry will be standard, regardless of the manufacturer.

BHP has also partnered with Toyota Australia to trial a new light electric vehicle at a site in Western Australia and BHPIO plans to eventually replace its diesel light vehicles with electric light vehicles at across its Pilbara iron ore operations (BHP 2024h). Once implemented, electric light vehicles will play a part in reducing the emissions associated with diesel powered light vehicles.

Studies of electric fleet at BHP will contribute to these industry decarbonisation initiatives. Potential replacement of mining and other equipment at Yandi is anticipated to be in line with any industry standards set.

Diesel emissions from excavators are also a material source of BHPIO's Scope 1 emissions, BHPIO's Yandi mine has been trialling the operation of an electric excavator since February 2024 seeking to determine how tethered electrical heavy mining equipment may be effectively integrated into BHPIO's existing and future mining operations.

12.5.2.4 Reduction of Scope 2 emissions through low carbon and renewable energy[19]

The Combined Proposal, together with the rest of BHP's Pilbara operations, will initially be powered by an islanded network that is supplied primarily by power from Yarnima Power Station. Yarnima is a highly efficient combined cycle gas turbine power station which emits approximately 29% less CO2 than the Australian average20, achieved through waste-heat recovery.

An estimated further 900 MW of power will be required to support operations at WAIO once BHP displaces diesel with electricity (BHP 2023c). BHP plans to source that additional power from renewable sources, subject to availability. Acknowledging the need for exponential growth in renewable power infrastructure in the Pilbara, BHP is engaging with the WA government's Pilbara Roundtable to develop interconnectivity with broader networks in the Pilbara (WA Government 2025). As the proportion of renewable power available to the Pilbara network grows, the Scope 2 emissions related to electricity generation for the Combined Proposal will decrease accordingly.

Yarnima Power Station is covered by a facility-specific Safeguard Mechanism emissions baseline. BHPIO is required to reduce emissions associated with electricity generation at Yarnima Power Station through compliance with the Safeguard Mechanism on a trajectory aligned with a 34.3% decline rate by 2030 and net-zero by 2050 on a production-adjusted basis. Additionally, Yarnima Power Station is subject to the Renewable Energy Target, which requires renewable energy certificates (RECs) to be surrendered for electricity consumed. The purchase and surrender of RECs financially supports renewable electricity generation across Australia, contributing to a reduction in Australia's Scope 1 emissions from the electricity sector.

[19] In the context of the Proposals, emissions which occur outside of the Development Envelope associated with Yarnima Power Station are identified as Scope 2 emissions, BHPIO's rail activities and BHP's Port Hedland activities supporting the Proposals are identified as Scope 3. Although these emissions are managed by BHP, they are classified as Scope 2 or Scope 3 as these emission sources are outside of the Development Envelope of the Proposals.

[20] Compared to the National average Scope 2 emissions intensity (0.63 kg CO_2-e/kWh) sourced from DCCEEW's National Greenhouse Account Factors 2024

12.5.2.5 Reduction of domestic Scope 3 emissions

Iron ore rail transport

Transportation of iron ore from the Combined Proposal to Port Hedland will be supported by BHPIO's rail operations. In January 2023, BHPIO signed partnership agreements with two locomotive manufacturers, Wabtec and Progress Rail, to develop battery electric locomotives. Prototypes have already been developed by these manufacturers (BHP 2023).

Trials of two locomotives from Wabtec and two locomotives from Progress Rail are due to commence in 2025. Subject to technology readiness and commercial viability, deployment is expected to follow in subsequent years. Battery electric locomotives have the potential to reduce emissions across BHPIO's operations by ~20% if fully implemented.

BHPIO's rail operations are covered by a facility-specific Safeguard Mechanism emissions baseline and required to reduce emissions under the NGER Act and Safeguard Mechanism.

Iron ore ship loading – Port Hedland

GHG emissions associated with BHP's Port Hedland operations are primarily associated with grid-connected electricity generation supporting stacking, reclaiming and ship loading activities. APA's (formerly Alinta Energy Pty Ltd's) Port Hedland Power Station is the principal source of electricity supplied to BHP's Port Hedland operations.

In September 2022, BHP signed a Power Purchase Agreement with APA to purchase 100% of the energy produced by a solar farm that will be constructed near Port Hedland, and which became operational in 2024. This solar battery hybrid project includes a 45-Megawatt solar array and 36.7 Megawatt hours of battery energy storage system reducing BHPIO's Port Hedland purchased electricity GHG emissions (APA 2024).

BHP's Port Hedland electricity supply, which is supplied by APA's Port Hedland Power Station is currently subject to 5-yearly emission reductions on a linear trajectory to net-zero by 2050 as established in MS1236 which is held by APA. Additionally, electricity demand is subject to the Renewable Energy Target, which requires RECs to be surrendered for electricity consumed, which financially supports renewable electricity generation across Australia, contributing to a reduction in Australia's Scope 1 emissions from the electricity sector.

12.5.2.6 Reduction of international Scope 3 emissions

BHP is pursuing the long-term goal of net zero Scope 3 GHG emissions by 2050. Achievement of this goal is uncertain, particularly given the challenges of a net zero pathway for our customers in steelmaking, and we cannot ensure the outcome alone. Due to the hard to abate emissions sources outlined below in steelmaking and shipping and the need to develop new low GHG emissions technology pathways, material decarbonisation opportunities in these sectors will take time to realise.

Measures to support decarbonisation of steel production

The most material contribution to Scope 3 emissions associated with the Proposal is expected to be the downstream processing of iron ore into steel by steelmakers. In FY2024, use of iron ore in steelmaking was 75% of BHP's total reported emissions inventory (Scope 1, 2 and 3 emissions combined, across all commodities).

For the world to transition to a net zero economy and produce the steel needed to meet the demands of increasing urbanisation, population growth and energy transition infrastructure, widespread deployment of near zero emissions steelmaking technology is needed. Currently there are no near zero emissions technologies for iron ore-based steelmaking that are ready for widespread commercial adoption.

Although Scope 3 steelmaking emissions are outside of our operational control, we are taking measures to support the industry to decarbonise. We have set a medium-term goal to support industry to develop steel production technology capable of 30 per cent lower GHG emissions intensity relative to conventional blast furnace steelmaking,

and a long-term goal of net-zero Scope 3 GHG emissions by CY2050. To deliver these goals, we have established our steelmaking decarbonisation program.

As of FY2024, BHP had committed US$140 million into steelmaking decarbonisation, with an additional US$75 million planned. Our steelmaking partnerships are with companies representing approximately 22% of reported global steel production. More information about our partnerships and program activities can be found in BHP's Climate Transition Action Plan (BHP 2024g).

Examples of recent activities under the program include:

- In FY2024, we successfully used hydrogen to convert our WAIO iron ore fines into direct reduced iron, then electrically smelted the direct reduced iron to produce molten iron at laboratory scale
- In FY2023, we announced a pre-feasibility design study for a pilot-scale electric smelting furnace facility (ESF) with global engineering firm, Hatch. The study examined scale, configuration, and location of a potential pilot facility and was completed in FY2024.
- In FY2024, we formed a consortium with BlueScope and Rio Tinto to conduct a joint pre-feasibility study for a pilot ESF facility located in Australia. This arose from a shared ambition to collaborate and advance near zero emissions steelmaking in Australia. If the study is successful and further investment is approved by all partners, a pilot plant could be commissioned as early as CY2027.
- In FY2024, we commissioned industrial CCUS trial equipment at ArcelorMittal's Ghent steelworks in Belgium, in partnership with ArcelorMittal and Mitsubishi Heavy Industries, and commenced carbon capture trials, testing its efficiency and effectiveness on blast furnace gas streams.
- We are investing in nascent molten oxide electrolysis (Boston Metal) and low temperature electrolysis (Electra) technologies which have the potential to provide a scalable, near zero emissions ironmaking process with the flexibility to process a variety of iron ore types.

Our strategy, actions and progress to support steelmaking GHG emission reductions are subject to existing Board and management governance and undergo regular periodic review. We also regularly monitor the merits of technologies under development and update our strategy and activities. All investments related to steelmaking GHG emission reductions that are above a certain financial threshold are subject to existing capital management processes.

International regulatory context

The majority of global steel production currently occurs in China (OECD 2023) and China and India are key geographical markets for BHP. Through its Nationally Determined Contribution (NDC) China has a target to reach peak CO_2-e emissions by 2030 and achieve carbon neutrality by 2060 (People's Republic of China 2022). China has also made additional commitments by 2030, such as reducing CO_2 emissions per unit of GDP by over 65% (on a 2005 base year), increasing non-fossil energy by 25%, and increasing total wind and solar capacity to 1.2 billion kilowatts (People's Republic of China 2021a).

These ambitions are supported by two documents that outline the strategic plan to achieve China's targets across the economy, the *Working Guidance for Carbon Dioxide Peaking* (People's Republic of China 2021a) and *Carbon Neutrality and Action Plan for Carbon Dioxide Peaking Before 2030* (People's Republic of China 2021b).

China's national emissions trading scheme, which currently covers power generation, is anticipated to be extended to their domestic steel sector by end of 2024 and 2024-2026 as the initiating stage with marginal range (International Carbon Action Partnership 2024). In the early years of its operation, China's national ETS has allocated a share of free permits to covered entities in the power sector based on emissions intensity (World Bank 2021) and is planning to apply a similar approach for the steel sector.

China Iron and Steel Association (CISA) also released its suggested Decarbonisation Pathway for the China Steel Industry:

- Ensure carbon peak before 2030 and develop technologies and resources capable of 15% emission volume reduction by 2030 (2020 baseline)
- 40% and 85% carbon emission volume reduction by 2040 and 2050 respectively
- 95% carbon emission volume reduction by 2060 and achieve carbon neutral using carbon offset.

India submitted its updated NDCs to the UNFCCC in August 2022: to reduce emissions intensity by 45% below 2005 levels by 2030, and to increase the share of non-fossil power capacity to 50% by 2030 and achieve net zero emissions by 2070 (Government of India 2022).

The iron and steel industry in India is covered under the Environment Protection Act (EPA) and Environment Protection Rules & Regulations enacted & published by Ministry of Environment, Forest and Climate Change (MoEFCC). Initiatives to reduce emissions in the sector include (Government of India 2023):

- The National Steel Policy, launched in 2017 by the Ministry of Steel. This policy includes targets to improve energy efficiency, which are adopted through the Government of India's Perform, Achieve, and Trade scheme
- The Steel Scrap Recycling Policy (2019) is aimed at increasing the utilisation of steel scrap
- Charter on Corporate Responsibility for Environment Protection (CREP). An initiative of the Indian government and major steel producers to improve environmental performance such as limiting pollution, water consumption, and energy consumption. A National Task Force has been established to implement the recommendations of CREP

There has been successful implementation of two United Nations Development Programme (UNDP) projects ("Energy efficiency in steel re-rolling mills" and "Up-scaling energy efficient production in small-scale steel industry in India"). In 2023, the Ministry of Steel initiated 14 Task Forces to develop a green steel roadmap. The associated roadmap, released in September 2024, provides a pathway to a reduction of 13.39% of steelmaking carbon intensity against a 2024-25 baseline. (MoS 2024).

While India does not have a direct price on carbon, it has initiated several policy measures relating to carbon and energy efficiency trading (MoEFCC 2023, MoEFCC n.d.).

12.5.2.7 Measures to support decarbonisation of shipping

BHP is one of the world's largest dry bulk charterers and we aim to use our chartering size and scale to increase the speed of the shipping industry's pace and progress towards decarbonisation. We seek to influence the supply chain and broader market through execution of many industry- and world-first initiatives along with creating demand for low and zero GHG emission fuels and energy efficient technologies in shipping.

Vessel propulsion is still primarily powered by the combustion of fuel oil. The long distances travelled, need for suitable port infrastructure, long life of vessels, safety concerns, and nascent alternative fuel options contribute to making international shipping a hard-to-abate sector. We play several important roles towards maritime decarbonisation, such as:

- Create demand for lower, low and zero GHG emissions fuels, such as biodiesel, LNG and low to zero GHG emissions ammonia, which assists to accelerate the adoption of fuels and technologies (once proven) and provide suppliers confidence to make investment decisions.
- Partner to bring energy saving technologies to maturity to reduce the use of bunker fuel.

- Advocate for industry regulations to increase the speed and scale of shipping decarbonisation.
- Use real-time data analytics to optimise vessel and route selection for voyage and vessel efficiency.

We collaborate with industry organisations (such as the Global Centre for Maritime Decarbonisation and Global Maritime Forum) and port authorities on decarbonisation frameworks and industry wide collaborations. We also joined the First Movers Coalition as a Founding Member in the shipping sector, committing that 10% of BHP's products shipped to our customers, on our time charter vessels, will be on vessels using zero emissions fuels by 2030, subject to the availability of technology, supply, safety standards, and the establishment of reasonable thresholds for price premiums.

12.5.3 Offset

BHP prioritises GHG emissions reduction at its operated assets to achieve our Scope 1 and 2 targets and goals, with investments in external carbon offset projects considered complementary to this 'structural abatement'.

The proposed GHG emissions reduction trajectory for the Combined Proposal aligns to the recently reformed Safeguard Mechanism. Although we prioritise structural abatement of the Combined Proposal, we acknowledge a role for the use of flexible compliance arrangements as allowed under the reformed Safeguard Mechanism.

This means that where structural abatement of emissions is insufficient to meet the Combined Proposal emissions reduction trajectory, BHP will ensure that these targets are met by either using banked SMC's from prior years, transferring SMCs from other BHP facilities (to allow decarbonisation to be optimised across BHP, for example displacing diesel trucks progressively by mine, rather than a smaller proportion of trucks at all mines in parallel), and/or retiring eligible carbon offsets in a temporary or transitional capacity while abatement options are being studied, as well as for 'hard to abate' emissions with limited or no current technological solutions, and where access to renewable energy is constrained.

In the context of BHP's operations in Western Australia, including at Yandi, our preference is to source offsets in line with our operational footprint in WA and in recognition of the WA state government's preference for locally generated offsets. We may also source offsets from international markets, in accordance with EPA guidance on the use of offsets within WA, if the use of international credits to meet Safeguard Mechanism obligations becomes allowed in the future, given the implementation of A6.4 of PA. Domestic sourcing of offsets may be from the domestic market or through offset generation from BHP's tenure or other locations in Australia, in partnership with reputable project developers under ERF methodologies.

BHP's procurement of carbon credits, includes due diligence so that we invest in carbon offsets that meet the following minimum quality standards:

- **Satisfies national carbon offset standards** for compliance offsets (i.e. ACCUs and other eligible regulatory offset instruments), including ACCUs that are established under (and meet the integrity standards of) the *Carbon Credits (Carbon Farming Initiative) Act 2011* (Cth) and/or **Registered in an internationally recognised standard** that independently verifies and issues voluntary carbon credits (including but not limited to Verra and Gold Standard) that is accredited by and compliant to the International Carbon Reduction & Offset Alliance (ICROA) Code of Best Practice.
- **Adheres to a robust emissions reduction accounting methodology**, to provide assurance of the volume of emissions reduced through a project.
- **Meets additionally criteria** to ensure that the emissions reduction would not have occurred in the absence of a carbon offset market.

- **Has a high likelihood of permanence** to ensure that the emissions reduction is ongoing and not reversed (e.g. in the case of forestry projects, the trees are not cut down or destroyed by a natural disaster).
- **Provides robust mitigation against leakage**, ensuring an offsetting project does not increase emissions elsewhere (e.g. an area is protected from deforestation through offsetting, but another forest area is destroyed).
- **Demonstrates high environmental and social integrity**, ensuring no broader social or environmental harm (e.g. hydropower projects that require forest clearing and community displacement).
- **Limit offset vintage to the last five years of offset generation**, to avoid claiming emissions reduction from activities that occurred a long time ago.

Whether surrender of carbon offsets may exceed 30% of the Proposal's expected baseline

BHP is committed to achieving net zero Scope 1 and 2 GHG emissions by 2050. BHP prioritises the 'structural abatement' to reduce GHG emissions at its operated assets to achieve our Scope 1 and 2 goals. The exact measures to be implemented to achieve net zero Scope 1 and 2 GHG emissions remains subject to uncertainty due to the long-time horizon of BHPIO's operations in the Pilbara, changing policy and regulation and the rapid evolution of availability and feasibility of technological solutions. The magnitude and timing of emissions reduction will be subject to a range of factors, some of which are uncertain or otherwise outside the control of BHP, including:

- mine strategy and production may fluctuate in response to changes in the market or operational considerations, which may impact GHG emissions from the Proposals due to changes to forecast mining activities and power demand
- adoption, availability or effectiveness of decarbonisation technologies may change as new technologies emerge, or as complexities of implementation become clearer
- suitable sources of renewable energy may take longer to become available than forecasted, for example through delays in developing suitable regional energy infrastructure
- increased competition for decarbonisation expertise, services and technology may impact speed, effectiveness, or cost of implementation.

Acknowledging these uncertainties, there is potential that BHPIO's use of carbon offsets may exceed 30% of the Yandi's Safeguard Mechanism baseline in any given year [21,22]. Under the Safeguard Mechanism:

- only Australian Carbon Credit Units and Safeguard Mechanism Credits may be used offset emissions, which ensures only credible offsets and credits are used
- BHPIO is required to provide a statement to the CER setting out technological and regulatory barriers to decarbonisation in respect of facilities which surrender carbon offsets equal or greater than 30% of its annual baseline, as an accountability measure (DCCEEW 2024a).

[21] The Yandi NGER Facility and the Proposals activities and Scope 1 emission sources are aligned.

[22] The threshold for coverage by the Safeguard Mechanism is 100,000 t CO_2-e of Scope 1 emissions measured by NGER facility. The Yandi NGER Facility boundary is consistent with the Proposal's Development Envelope and has recently continued to be covered by the Safeguard Mechanism. Scope 1 emitting activities associated with the Combined Proposal's emissions forecast directly contribute to the total Scope 1 emissions reportable by the Yandi NGER facility. In any given year, where reported Scope 1 emissions from an NGER Facility exceed 100,000 t CO_2-e Safeguard Mechanism obligations will apply and be enforced by the CER.

12.5.4 Other statutory decision-making processes

Table 12-15 summarises whether another statutory decision-making process can mitigate the potential environmental impacts of the Combined Proposal on Greenhouse Gas Emissions, considering the EPA's *Taking decision making processes into account in EIA: Interim Guidance* (EPA 2021b). Table 12-15 also provide reasons, including how, in relation to the specific potential impacts of the Proposal, the decision-making process takes the EP Act object and principles, and the EPA's objective for GHG emissions, into account.

Table 12-15: Greenhouse Gas Emissions – other statutory decision-making processes

Potential impact	Statutory decision-making process can mitigate impacts on the environment?	Reasons (if Yes)
Generation of GHG emissions	Yes	**NGER Act** • provides a framework for Nationally consistent reporting of Scope 1 and Scope 2 emissions and where Scope 1 emissions exceed defined thresholds, BHP will be required to undertake action to manage these emissions **NGER Safeguard Mechanism** • imposes Scope 1 limits and annual reporting requirements on large GHG emitting facilities to keep net emissions below a defined baseline, consistent with Australia's emission targets **Renewable Energy Target** • aims to reduce greenhouse gas emissions in the electricity sector and increase renewable electricity generation through creation of market incentive for the generation and use of renewable energy through obligation for electricity consumers to surrender renewable energy credits for a proportion of their electricity use **Emissions Reduction Fund** • allows for the purchase and surrender of offsets to counterbalance GHG emissions.

12.6 Assessment and significance of residual impacts

12.6.1.1 Change in GHG emissions (unmitigated) as a result of the Proposal

Using the Scope 1 emissions forecasting data presented in Section12.4.4.2, the:

- total Scope 1 emissions covered by the NGER Scheme for the Approved Proposal are 409,160 t CO_2-e[23]

[23] The threshold for coverage by the Safeguard Mechanism is 100,000 t CO_2-e of Scope 1 emissions measured by NGER facility. The Yandi NGER Facility boundary is consistent with the Proposal's Development Envelope and has recently continued to be covered by the Safeguard Mechanism. Scope 1 emitting activities associated with the Combined Proposal's emissions forecast directly contribute to the total Scope 1 emissions reportable by the Yandi NGER facility. In any given year, where reported Scope 1 emissions from an NGER Facility exceed 100,000 t CO_2-e Safeguard Mechanism obligations will apply and be enforced by the CER.

- the Proposal's emissions are estimated to increase by 36,634 t CO_2-e which represents a 8.95% increase in Scope 1 emissions when compared to the emissions of the Approved Proposal (409,1601 t CO_2-e)
- the Combined Proposal is estimated to generate a total of 534,653 t CO_2-e Scope 1 emissions.
- the Proposal and Combined Proposal Scope 1 emissions not covered by the Safeguard Mechanism are not likely to be above 100,000 t CO_2-e in any year [23].

Using the electricity demand Scope 2 emissions forecasting data presented in Section12.4.4.3, the:

- total Scope 2 electricity demand emissions for the Approved Proposal are 66,947 t CO_2-e
- the Proposal is estimated to generate a total of 21,912 t CO_2-e of Scope 2 electricity demand emissions which represents a 32.7% increase when compared to the electricity demand emissions of the Approved Proposal (66,947 t CO_2-e)
- the Combined Proposal is estimated to generate a total of 88,859 t CO_2-e of Scope 2 electricity demand emissions.

Table 12-16 shows the Scope 1 and Scope 2 emissions for the Proposal, Approved Proposal and Combined Proposal for the life of the Project.

Table 12-16: Greenhouse Gas Emissions – Scope 1 and Scope 2 Greenhouse Gas Emissions Summary

Scope	Estimated emissions (t CO_2-e)		
	Proposal	Approved Proposal	Combined Proposal
Scope 1 emissions	36,634	409,160	445,794
Scope 2 emissions	21,912	66,947	88,859

Using the forecasting data presented in Section12.4.4.4, the Combined Proposal is estimated to generate a total of 73,340,971t CO2-e Scope 3 emissions, including rail transport emissions. 17,262,205 t CO2-e Scope 3 emissions are estimated to be generated as a result of the Proposal and 56,078,766t CO2-e for the Approved Proposal.

12.6.2 Comparison of GHG emissions (residual) against State and National GHG emissions

Based on the 2022 Western Australian emissions and 2022 National emissions inventory reported by DCCEEW and the Combined Proposal estimated average Scope 1 emissions (49,533 t CO_2-e), the estimated percentage contribution of the Combined Proposal average Scope 1 emissions to State and National GHG emissions is 0.06% and 0.011% respectively.

The average emissions of the Combined Proposal including Scope 1 and Scope 2 emission sources (59,406 t CO_2-e) is estimated to represent 0.072% of the 2022 Western Australian emissions inventory, and 0.013% of the National emissions inventory.

12.6.3 GHG emissions following application of the mitigation hierarchy

The threshold for coverage by the Safeguard Mechanism is 100,000 t CO2-e of Scope 1 emissions measured by NGER facility. The Yandi NGER Facility boundary is consistent with the Proposal's Development Envelope and has recently continued to be covered by the Safeguard Mechanism. Scope 1 emitting activities associated with the Combined Proposal's emissions forecast directly contribute to the total Scope 1 emissions reportable by the Yandi NGER facility. In any given year, where reported Scope 1 emissions from an NGER Facility exceed 100,000 t CO2-e Safeguard Mechanism obligations will apply and be enforced by the CER.

For the purposes of this assessment, BHP has not applied the indicative Safeguard Mechanism decline rate to the forecast Scope 1 emissions from the Combined Proposal, as Scope 1 emissions are predicted to remain below 100,000 tCO2-e, with maximum Scope 1 emissions of 89,791 t CO2-e and average of 49,533 t CO2-e for the Combined Proposal. Scope 1 emissions from the Proposals not covered by the Safeguard Mechanism are not likely to be above 100,000 t CO2-e in any year, should the NGER Scope 1 emissions from the Proposals exceed 100,000 t CO2-e, then Safeguard Mechanism obligations will apply and be enforced by the CER.

Scope 1 emissions from the Proposals and the future application of the Safeguard Mechanism are subject to uncertainties including:

- mine strategy and production may fluctuate in response to changes in the market or operational considerations, which may impact GHG emissions from mining associated with the Proposals
- amendments to the Safeguard Mechanism, which may include changes to production variables, relevant production variable emissions intensities (default or industry best practice), revised annual decline rates and/or coverage thresholds. However, any amendments to the Safeguard Mechanism Rule would need to be consistent with the NGER Act objects, notably the 'hard cap' and overarching emissions reduction requirements.

12.6.4 Significant residual impacts

Following the application of the mitigation hierarchy (Section 12.5), the potential significant residual impacts are:

- Contribution of 445,794 t CO_2-e of Scope 1 emissions (residual) over the life of the Combined Proposal
- Contribution of 88,859 t CO_2-e of Scope 2 emissions (residual) over the life of the Combined Proposal
- Contribution of 73,340,971 t CO_2-e of Scope 3 emissions (residual) over the life of the Combined Proposal.

The detailed assessment of offsets is discussed in Section 12.5.3, including how the proposed offset/s may counterbalance the significant residual impact of GHG emissions.

12.7 Environmental outcomes

Table 12-17 summarises the environmental outcomes, proposed assurance (regulation) and proposed monitoring (if required) for each residual impact for GHG emissions. Detail of the proposed monitoring enforced by other relevant statutory decision-making documents is discussed in Section 12.5.4. Table 12-17 demonstrates how the proposed environmental outcomes for the Combined Proposal, together with the proposed regulation and monitoring, are consistent with the EPA's objective for Greenhouse Gas Emissions (Section 12.1).

As required by the EPA's ERD Instructions, for Significant Amendments, BHP has included information about the existing implementation conditions for the Approved Proposal (Section 12.4.2). BHP considers that the EPA should inquire into the Approved Proposal implementation conditions (relating to GHG emissions), as provided for under s40AA(3), as part of the assessment of the Proposal under s40 and in the EPA's assessment report required under s44, to contemporise the conditions to reflect the contemporary condition setting approach recommended by the EPA.

Table 12-17: Greenhouse Gas Emissions – Proposal environmental outcomes, proposed regulation and monitoring

Residual impact from the Proposal	Environmental outcome	Proposed regulation (Condition[1] or other statutory decision-making process)	Proposed Monitoring	Consistency with EPA objective
1. Generation of GHG emissions	• Contribution of 445,794 t CO_2-e of Scope 1 emissions (residual using the indicative Safeguard Mechanism decline rate from the Yandi over the life of the Combined Proposal • Contribution of 88,859 t CO_2-e of Scope 2 emissions (residual) over the life of the Combined Proposal • Contribution of 73,340,971 t CO_2-e of Scope 3 emissions (residual) over the life of the Combined Proposal	**NGER Act** • reporting of emissions from the Yandi mine (Combined Proposal) NGER Facility • reporting of emissions from the Yarnima Power Station NGER Facility • reporting of emissions from the Rail NGER Facility • emissions decline in accordance with the indicative Safeguard Mechanism Decline Rates **Renewable Energy Target** • defined emissions targets for purchase and surrender of renewable energy certificates **CC Act** • requirements for facilities to be on a broad trajectory to net zero emissions by 2050	Annual monitoring will be conducted in accordance with the NGER measurement determination, with a summary of Scope 1 emissions and any surrendered offsets published as part of the Safeguard Mechanism by the CER.	The significant residual impact of contribution of GHG emissions from the Combined Proposal will be counterbalanced by available abatement measures or offsets applied. GHG emissions will also be avoided and reduced over the life of the project, in accordance with the NGER Act and the Safeguard Mechanism

1. See Appendix 3 for proposed implementation conditions for the Combined Proposal

13 Other environmental factors

Table 13-1 presents BHP's evaluation of 'other factors'. This includes justification as to why BHP considers that the factors listed are not preliminary key environmental factors. To support BHP's position that an environmental factor is not a preliminary key environmental factor for the Proposal, BHP has included supporting information as appendices, where relevant.

Table 13-1: Other environmental factors

Relevant activities for the Proposal	Potential impacts	Justification for why factor is not considered to be a preliminary key environmental factor
LAND		
Landforms EPA objective: *To maintain the variety and integrity of significant physical landforms so that environmental values are protected*		
Ground disturbance and earthworks Drainage and stormwater management	Modification of natural landforms from the construction and operation of mines and associated infrastructure Erosion of natural landforms as a result of altered surface water regimes	**Significance considerations** BHP has reviewed the potential impacts of the Proposal on Landforms, considering the *Environmental factor guideline – Landforms* (EPA 2018b), with the findings summarised below: • No significant landforms (consistent with the description in Environmental factor guideline – Landforms (EPA 2018b) are located within the Development Envelope. • No major modifications to creeks (drainage diversions) will be undertaken. **Proposed mitigation** • BHP has developed the Marillana Creek (Yandi) Mine Closure Plan (MCP) (BHP 2025b) The MCP has been updated to include the Proposal and will address the potential impacts on natural landforms, including provision of flood bunds, spillways, abandonment bunds and rehabilitation of mine landforms. • BHP proposes that mine closure and rehabilitation is regulated under Part IV of the EP Act. **Environmental outcome** • The implementation of the Proposal will maintain the variety and integrity of significant physical landforms.
Terrestrial Environmental Quality EPA objective: *To maintain the quality of land and soils so that environmental values are protected*		
Mine pit excavation Ground disturbance and earthworks Drainage and stormwater management Rehabilitation and decommissioning activities	Increased erosion AMD	**Significance considerations** BHP has reviewed the potential impacts of the Proposal on Terrestrial Environmental Quality, considering the *Environmental factor guideline – Terrestrial Environmental Quality* (EPA 2016f), with the findings summarised below: • A recent assessment of geochemical source hazard in the Development Envelope (Mine Waste Management 2022) concluded that based on all data gathered to date for Yandi (including 31 samples collected from drilling within the E8 deposit), the likelihood of generating AMD is low. **Proposed mitigation** • BHP has updated the Yandi MCP to incorporate the Proposal (BHP 2025b, Appendix 5). • BHP continues to undertake studies of the geochemical and physical properties of waste material at Yandi to confirm the appropriate erosion and AMD management requirements. • BHP proposes that mine closure and rehabilitation is regulated under Part IV of the EP Act. **Environmental outcome** The implementation of the Proposal will maintain the quality of land and soils so that environmental values are protected.
AIR		
Air Quality EPA objective: *To maintain air quality and minimise emissions so that environmental values are protected*		
Waste handling and transport Ore handling and transport Construction and operation of infrastructure (haul roads, surplus water transfer)	Particulate emissions (dust) reducing ambient air quality at sensitive receptors	**Significance considerations** BHP has reviewed the potential impacts of the Proposal on Air Quality, considering the *Environmental factor guideline – Air quality* (EPA 2020b), with the findings summarised below: • Existing high levels of dust are present within the Pilbara region and windblown dust is expected to be a significant contributor to the ambient dust levels in the area. • No sensitive receptors will be affected by the Proposal. The nearest permanently occupied receptor is the Marillana Homestead 35 km to the east. The Yandi workforce accommodation consists primarily of the Spinifex Camp and the now intermittently used Yandi Village, located 17 km north-west and 8 km north of the Indicative Footprint respectively. • The current Part V Operating Licence L6168/1991/11 Category 5 – Processing or beneficiation of metallic or non-metallic ore authorises the processing of 87,000,000 t of ore per year and this will not increase as a result of the Proposal. **Proposed mitigation** • Examples of existing dust management measures at the Approved Proposal that will be applied to the Proposal include the following:

Relevant activities for the Proposal	Potential impacts	Justification for why factor is not considered to be a preliminary key environmental factor
		– maintain dust controls (e.g. water sprays/cannons) – water sites with water tankers within operational areas, including unsealed roads, haul roads and construction areas – seal major traffic thoroughfares and install kerbing or bunding discourage off-road passage where practicable – enforce speed limits – minimise areas of exposed soil (land disturbance) and rehabilitate disturbed areas as they become available. • Air quality (dust) was assessed under Part IV of the EP Act as part of the Marillana Creek (Yandi) Life of Mine Proposal in 2005. The assessment of dust emissions indicated that the distance to the nearest public sensitive receptor (Marillana Homestead 35 km to the east) and the management controls at the time were appropriate to manage the predicted dust emissions associated with the proposed expansion. No additional regulatory controls were required to mitigate the risk of dust impacts on sensitive receptors. • BHP notes that Air Quality (dust) can be regulated under Part V (Section 49) of the EP Act, if required. **Environmental outcome** The proposal will maintain air quality and minimise dust emissions so that environmental values are protected.
PEOPLE		
Social Surroundings EPA objective: *To protect social surroundings from significant harm*		
Amenity (Noise and Visual Amenity)		
Blasting, drilling, and extraction Ground disturbance and earthworks for mine infrastructure (including surplus water/ drainage management) Ongoing implementation of rehabilitation and decommissioning activities	Noise emissions and visual changes to the landscape	**Significance considerations** BHP has reviewed the potential impacts of Social Surroundings (Amenity), considering the *Environmental factor guideline – Social surroundings* (EPA 2023b), with the findings summarised below: • No sensitive receptors will be affected by the Proposal. The nearest permanently occupied receptor is 35 km to the east (Marillana Homestead). The Yandi Spinifex Camp is located 17 km north-west of the Indicative Footprint and the lesser used Yandi Village is located 8 km north. • A landscape and visual impact assessment conducted by GHD and 360 Environmental (2015) concluded that there are limited sites within the Yandi area that represent key viewpoints. The region is largely undeveloped and primarily used for pastoral purposes, mining and some transport including roads and railways. The study concluded there are no areas within or surrounding the Development Envelope where there was a significant risk of visual amenity impacts. Since the GHD and 360 Environmental study, Golder Associates (2020) identified the Three Sisters as a potentially sensitive viewpoint, however this lies 4 km east of the Development Envelope. Given this significant distance, the level of disturbance that has already occurred in the Development Envelope and no OSAs are required for the Proposal, BHP considers it unlikely that Visual Amenity will be significantly impacted. • The potential impacts of noise were assessed under Part IV of the EP Act as part of the Marillana Creek (Yandi) Life of Mine Proposal in 2005. The assessment indicated that no significant noise related impacts on the Pilbara community were expected due to the planned continuation of management measures to minimise noise, as well as the nearest public sensitive receptor being located a significant distance away (Marillana Homestead, 35 km east). • The Proposal will not impact on any significant landforms and no construction of landforms is proposed. • The Proposal will not be in the viewshed of locations with high amenity values (panoramic viewpoints, lookouts, gorges and rockpools). **Proposed mitigation** • BHP proposes that mine closure and rehabilitation is regulated under Part IV of the EP Act. • Examples of existing noise management measures at the Approved Proposal that will be applied to the Proposal include the following: – use of low-noise equipment where practicable – use of silencers, where necessary and use of exhaust mufflers – regular service of machinery • The provisions of the *Environmental Protection (Noise) Regulations 1997 (WA)* (Noise Regulations) are applicable, and BHP notes that Noise can be regulated under the Noise Regulations, if required. **Environmental outcome** The implementation of the Proposal will protect Social Surroundings (Amenity) from significant harm.

14 Offsets

14.1 Biodiversity factors

14.1.1 Identification of and quantification of significant residual impacts for the Proposal

Table 14-1 identifies the significant residual impacts for the Proposal according to the residual impact significance model in the *WA Environmental Offsets Guidelines* (Government of Western Australia 2014).

Following the assessment of the significance of residual impacts (Sections 7.6, 8.6, 9.6, 10.6, 11.6 and 12.6) and as summarised in Table 14-1 and Table 14-2, BHP concluded that offsets are required for the following significant residual impacts for the Combined Proposal:

- Clearing of up to 85 ha of Good to Excellent condition vegetation in the Pilbara IBRA region (Section 8.6.5)
- Clearing of up to 72 ha of critical foraging habitat[24] for significant fauna including Pilbara Olive Python, Ghost Bat and Grey Falcon
- Clearing of 48 ha riparian vegetation
- Impact to 2 ha of riparian vegetation Flat Rocks from dewatering as part of the Approved Proposal
- Clearing of up to 72 ha of supporting habitat[25] for significant fauna including Northern Quoll, Pilbara Olive Python, Pilbara Leaf-nosed bat and Grey Falcon.

It should be noted that critical and supporting fauna habitats wholly overlap and therefore, to avoid duplication of offsets, where values overlap, the higher offset rate for critical habitat will be paid. Figure 8-4 in Section 8.3.2.1 shows the areas of Good to Excellent condition vegetation within the Pilbara IBRA bioregion and subregions and the likely areas of significant residual impact (i.e. the proposed clearing within the Indicative Footprint). Critical habitat for the Pilbara Olive Python, Ghost Bat and Grey Falcon within the Development Envelope has been identified as Wetland, Major Drainage Line, Medium Drainage Line, Drainage Area/ Floodplain and Stony Plain habitats. Figure 9-4 in Section 9.3.2.1 shows these habitats within the Development Envelope and the likely areas of impact (i.e. the proposed clearing within the Indicative Footprint). A completed *Offsets Template* is provided in Table 14-2, which identifies and quantifies the significant residual impacts and proposed offsets.

[24] Critical fauna habitats for the different species partially overlap and therefore, to avoid duplication of offsets, where values overlap, they are accounted for once, not multiple times.

[25] Supporting habitat for the different species partially overlap. Where an overlap is identified for more than one species, the area has been accounted for once.

Table 14-1: Residual Impact Significance Model

Part IV Environmental Factors	Vegetation and Flora			Terrestrial Fauna		Subterranean Fauna	
Part V Clearing Principals	**Rare flora**	**Threatened ecological communities**	**Remnant vegetation**	**Wetlands & waterways**	**Conservation areas**	**High biological diversity**	**Habitat for fauna**
Residual impact that is environmentally unacceptable or cannot be offset	None	None	None	None	None	None	None
Significant residual impacts that will require an offset **All significant residual impacts to species and ecosystems protected by statute or where the cumulative impact is already at a critical level**	None	None	Clearing of up to 85 ha of native vegetation in Good to Excellent condition in the Pilbara IBRA region (Section 8.6.5) Clearing of up to 48 ha of riparian vegetation Clearing of 2 ha of riparian vegetation from dewatering as part of the Approved Proposal	None	None	None	Clearing of 72 ha of critical Ghost Bat, Pilbara Olive Python and Grey Falcon foraging habitat (Section 9.6.1.1) Clearing of 72 ha of supporting habitat for Northen Quoll, Pilbara Olive Python, Pilbara Leaf-nosed bat and Grey Falcon (Section 9.6.7) Impact to 2 ha of critical and supporting habitat from dewatering as part of the Approved Proposal.
Significant residual impacts that may require an offset **Any significant residual impact to potentially threatened species and ecosystems, areas of high environmental value or where the cumulative impact may reach critical levels if not managed**	None	None	None	None	None	None	None
Residual impacts that are not significant	None No plant taxon gazetted as Threatened Flora under the BC Act or EPBC Act have been recorded from within the proposed Development Envelope	None	Each Beard vegetation association will have more than 98% of their pre-European extent remaining and are not considered regionally significant. The associations are well represented within Western Australia occurring broadly within, or extending beyond, the Pilbara bioregion	No significant wetlands (e.g. Ramsar) occur within the proposed Development Envelope	None The nearest conservation area is Karijini National Park, 34 km to the south-west	Clearing of less than 2% of known populations of the priority *species Rostellularia adscendens var. latifolia* (Priority 3) No direct impact to known records of Threatened fauna species, except for two historical records of the Pilbara Olive Python Direct impacts to two Uncertain SREs: *Afrosternophorus* `BPS506' and *Beierolpium* 8/4 small `BPS505; both of which also occur outside the area of impact, in widespread habitat types. Groundwater drawdown associated with the Proposal will result in the loss of	Clearing of 44 ha of fauna habitat that does not represent critical or supporting habitat for significant fauna Groundwater drawdown associated with the Proposal will result in the loss or changes to stygofauna habitat Mine pit excavation will remove suitable habitat for troglofauna

Part IV Environmental Factors	Vegetation and Flora			Terrestrial Fauna		Subterranean Fauna	
Part V Clearing Principals	**Rare flora**	**Threatened ecological communities**	**Remnant vegetation**	**Wetlands & waterways**	**Conservation areas**	**High biological diversity**	**Habitat for fauna**
						stygofauna individuals, none of which are restricted species Mine pit excavation will result in the loss of troglofauna individuals, however, suitable troglofauna habitat will remain in areas beneath the pit shelves and areas beyond those to be impacted which will continue to provide refuge for troglofauna in the area.	

Table 14-2: Offsets Template

Marillana Creek (Yandi) Significant Amendment (the Proposal)									
Existing environment/ impact	**Mitigation**			**Significant residual impact**	**Offsets calculation methodology**				
	Avoid and minimise	**Rehabilitation type**	**Likely rehabilitation success**		**Type**	**Risk**	**Likely offset success**	**Time lag**	**Offset quantification**
Flora and Vegetation									
Clearing of up to 85 ha of native vegetation in Good to Excellent condition in the Pilbara IBRA region	The proposal footprint has undergone a number of refinements to reduce the amount of clearing, including removal of expansions to C3/C6, and haul road re-alignments.	BHP undertakes a site-specific rehabilitation approach with disturbed areas progressively rehabilitated in accordance with the Yandi Hub MCP	Can the environmental values be rehabilitated/evidence? Yes, native vegetation can be rehabilitated. The Marillana Creek (Yandi) is an operating mine and BHP has progressively rehabilitated available areas. BHP provides evidence on rehabilitation in its Annual Environmental Reports. Operator experience in undertaking rehabilitation? BHP started rehabilitation at its WA Iron Ore operations in the Pilbara in the 1990s. From the early 2000s onwards, BHP made landform improvements, including integrating OSAs into the landscape, altering slopes to minimise erosion and use of covers to prevent acid and gas hazards. From 2015 onwards, BHP made revegetation improvements including understanding of seed biology and improvements in collection, dormancy breaking, and seeding methods. What is the type of vegetation being rehabilitated? Detailed vegetation association mapping was completed for the proposed Development Envelope, with 42 vegetation associations mapped within the Development Envelope, 14 occur within the Indicative Footprint and will be directly impacted by clearing. The dominant vegetation associations of the proposed Development Envelope are *Triodia hummock grassland on hill crests (HC Tw AiAb InrSeao), which makes up 43% of the current extent of vegetation in the Development Envelope* Time lag? BHP's review of rehabilitation indicates that it will usually take 15-20 years after an area is rehabilitated before it can be assessed against completion criteria. This will depend on climatic conditions when rehabilitation commenced and during the rehabilitation period. Credibility of the rehabilitation proposed (evidence of demonstrated success) As discussed above, BHP has experience in rehabilitation and makes continual improvements in rehabilitation practices. BHP considers that the rehabilitation proposed in the Jimblebar Hub MCP is credible and the current Annual Environmental Reports provide evidence of rehabilitation success.	Extent Clearing of up to 85 ha is in Good to Excellent condition Quality Good to Excellent condition Significance Nil Land Tenure Unallocated crown land or pastoral Time Scale 15-20 years post closure, for areas able to be rehabilitated Applying the Residual Impact Significance Model in the WA Offsets Guidelines, significant residual impacts require an offset where the cumulative impact is already at a critical level; therefore, an offset is required for the cumulative clearing of native vegetation in the Pilbara (IBRA) region	Monetary contribution to the PEOF	Low The WA Government will make decisions on specific offsets projects proposed through the PEOF, focusing on on-ground projects. The operation of the fund will use relevant environmental information and knowledge from the WA and Commonwealth governments, natural resource management groups, Traditional Owners, conservation groups, industry and the research sector.	BHP will contribute funding to the PEOF. The PEOF allows for multiple offset payments to be combined to deliver larger conservation projects or expand successful initiatives in the region to maximise the value of financial offsets. This approach enables strategic landscape scale projects with much greater environmental benefits to be implemented, rather than multiple smaller activities.	N/A	Base rate of $986 AUD (excluding GST) per ha within the Hamersley IBRA subregion
Clearing of up to 48 ha riparian vegetation Clearing of up to 2 ha of riparian vegetation through groundwater drawdown impacts	Minimise impact through realignment of haul road to reduce impacts on riparian vegetation. Mitigate impacts through supplementation and reduction of dewatering	BHP undertakes a site-specific rehabilitation approach with disturbed areas progressively rehabilitated in accordance with the Yandi Hub MCP	Can the environmental values be rehabilitated/evidence? Yes, native vegetation can be rehabilitated. The Marillana Creek (Yandi) is an operating mine and BHP has progressively rehabilitated available areas. BHP provides evidence on rehabilitation in its Annual Environmental Reports. Operator experience in undertaking rehabilitation? BHP started rehabilitation at its WA Iron Ore operations in the Pilbara in the 1990s. From the early 2000s onwards, BHP made landform improvements, including integrating OSAs into the landscape, altering slopes to minimise erosion and use of covers to prevent acid and gas hazards. From 2015 onwards, BHP made revegetation improvements including understanding of seed biology	Extent Clearing of up to 48 ha of riparian. Quality Good to Excellent condition Significance Nil Land Tenure Unallocated crown land or pastoral Time Scale	Monetary contribution to the PEOF	Low The WA Government will make decisions on specific offsets projects proposed through the PEOF, focusing on on-ground projects. The operation of the	BHP will contribute funding to the PEOF. The PEOF allows for multiple offset payments to be combined to deliver larger conservation projects or expand successful initiatives in the	N/A	Higher rate of $1,972 AUD (excluding GST) per ha within the Hamersley IBRA subregion

Marillana Creek (Yandi) Significant Amendment (the Proposal)									
Existing environment/ impact	**Mitigation**			**Significant residual impact**	**Offsets calculation methodology**				
	Avoid and minimise	**Rehabilitation type**	**Likely rehabilitation success**		**Type**	**Risk**	**Likely offset success**	**Time lag**	**Offset quantification**
			and improvements in collection, dormancy breaking, and seeding methods. What is the type of vegetation being rehabilitated? The Proposal will clear up to 48 ha of riparian vegetation, comprising eight vegetation associations, along Marillana Creek. Six of these vegetation associations potentially represent 'ecosystems at risk' as described by DBCA, and four of these also have the potential to contain GDV (Section 8.3.2.1). One of these; vegetation association MA EcrEvMa AcpAamAthe TydCyv is highly likely to contain GDV and will have up to 77% of its remaining extent in the Development Envelope cleared as a result of the Proposal. Within the Development envelope, this vegetation association only occurs in the south-eastern corner where the Indicative Footprint is located. This association has also been mapped outside the Development Envelope (8.4.1.1). In addition, the Approved Proposal has resulted in the loss of 2 ha of riparian vegetation along Marillana Creek through dewatering impacts. Time lag? BHP's review of rehabilitation indicates that it will usually take 15-20 years after an area is rehabilitated before it can be assessed against completion criteria. This will depend on climatic conditions when rehabilitation commenced and during the rehabilitation period. Credibility of the rehabilitation proposed (evidence of demonstrated success) As discussed above, BHP has experience in rehabilitation and makes continual improvements in rehabilitation practices. BHP considers that the rehabilitation proposed in the Jimblebar Hub MCP is credible and the current Annual Environmental Reports provide evidence of rehabilitation success.	15-20 years post closure, for areas able to be rehabilitated. Applying the Residual Impact Significance Model in the WA Offsets Guidelines, significant residual impacts require an offset where the cumulative impact is already at a critical level; therefore, an offset is required for the cumulative clearing of native vegetation in the Pilbara (IBRA) region.		fund will use relevant environmental information and knowledge from the WA and Commonwealth governments, natural resource management groups, Traditional Owners, conservation groups, industry and the research sector.	region to maximise the value of financial offsets. This approach enables strategic landscape scale projects with much greater environmental benefits to be implemented, rather than multiple smaller activities		
Terrestrial Fauna									
Clearing of 72 ha of critical Ghost Bat, Pilbara Olive Python and Grey Falcon foraging habitat	Refinement of proposal footprint minimising the amount of clearing required to support the Proposal. Implementation of the Yandi BEMP	BHP undertakes site specific rehabilitation approach with disturbed areas progressively rehabilitated and fauna habitats incorporated into the rehabilitation process in accordance with the Yandi MCP	Can the environmental values be rehabilitated/evidence? Yes, critical foraging habitat can be rehabilitated via the rehabilitation of native vegetation. BHP has progressively rehabilitated available areas at the Yandi mine site. BHP provides evidence on rehabilitation in its Annual Environmental Reports. Operator experience in undertaking rehabilitation? BHP started rehabilitation at its WA Iron Ore operations in the Pilbara in the 1990s. BHP has continued to make revegetation improvements including the incorporation of fauna habitats into rehabilitated areas. What is the type of vegetation being rehabilitated? Critical foraging habitat within the proposed Development Envelope comprises Drainage Area/ Floodplain, Major Drainage Line, Medium Drainage Line, Stony Plain, Undulating Low Hills, Hillcrest/Hillslope and Wetland. Time lag? BHP's review of rehabilitation indicates that it will usually take 15-20 years after an area is rehabilitated before it can be assessed against	Extent Clearing of 72 ha of critical habitat Quality Poor to Excellent condition Significance Threatened species (Pilbara Olive Python, Ghost Bat and Grey Falcon) habitat Land Tenure Unallocated crown land or pastoral Time Scale 15-20 years post closure, for areas able to be rehabilitated As per the significant framework, the residual impact is considered to be significant because it is habitat for a Threatened species	Monetary contribution to the PEOF	Low The WA Government will make decisions on specific offsets projects proposed through the PEOF, focusing on on-ground projects. The operation of the fund will use relevant environmental information and knowledge from the WA and Commonwealth governments, natural resource management	BHP will contribute funding to the PEOF. The PEOF allows for multiple offset payments to be combined to deliver larger conservation projects or expand successful initiatives in the region to maximise the value of financial offsets. This approach enables strategic landscape scale projects with much	N/A	Higher rate of $1,972 AUD (excluding GST) per ha within the Hamersley IBRA subregion

Marillana Creek (Yandi) Significant Amendment (the Proposal)									
Existing environment/ impact	**Mitigation**			**Significant residual impact**	**Offsets calculation methodology**				
	Avoid and minimise	**Rehabilitation type**	**Likely rehabilitation success**		**Type**	**Risk**	**Likely offset success**	**Time lag**	**Offset quantification**
			completion criteria. This will depend on climatic conditions when rehabilitation commenced and during the rehabilitation period. <u>Credibility of the rehabilitation proposed (evidence of demonstrated success)</u> As discussed above, BHP has experience in rehabilitation and has made improvements in rehabilitation practices. BHP considers that the rehabilitation proposed in the Yandi Hub MCP is credible and the current Annual Environmental Reports provide evidence of rehabilitation success.			groups, Traditional Owners, conservation groups, industry and the research sector.	greater environmental benefits to be implemented, rather than multiple smaller activities.		
Clearing of 72 ha of supporting habitat for Pilbara Leaf-nosed Bat, Pilbara Olive Python, Grey Falcon and Northern Quoll	Refinement of proposal footprint minimising the amount of clearing required to support the Proposal. Implementation of the Yandi BEMP	BHP undertakes site specific rehabilitation approach with disturbed areas progressively rehabilitated and fauna habitats incorporated into the rehabilitation process in accordance with the Yandi MCP	<u>Can the environmental values be rehabilitated/evidence?</u> Yes, supporting habitat can be rehabilitated via the rehabilitation of native vegetation. BHP has progressively rehabilitated available areas at the Yandi mine site. BHP provides evidence on rehabilitation in its Annual Environmental Reports. <u>Operator experience in undertaking rehabilitation?</u> BHP started rehabilitation at its WA Iron Ore operations in the Pilbara in the 1990s. BHP has continued to make revegetation improvements including the incorporation of fauna habitats into rehabilitated areas. <u>What is the type of vegetation being rehabilitated?</u> Supporting habitat within the proposed Development Envelope comprises Drainage Area/ Floodplain, Major Drainage Line, Medium Drainage Line, Stony Plain, Undulating Low Hills, Hillcrest/Hillslope and Wetland. <u>Time lag?</u> BHP's review of rehabilitation indicates that it will usually take 15-20 years after an area is rehabilitated before it can be assessed against completion criteria. This will depend on climatic conditions when rehabilitation commenced and during the rehabilitation period.	<u>Extent</u> Clearing of 72 ha of supporting habitat <u>Quality</u> Poor to Excellent condition <u>Significance</u> Threatened species (Pilbara Leaf-nosed Bat, Pilbara Olive Python, Grey Falcon, Northern Quoll) habitat <u>Land Tenure</u> Unallocated crown land or pastoral <u>Time Scale</u> 15-20 years post closure, for areas able to be rehabilitated As per the significant framework, the residual impact is considered to be significant because it is habitat for a Threatened species	Monetary contribution to the PEOF	Low The WA Government will make decisions on specific offsets projects proposed through the PEOF, focusing on on-ground projects. The operation of the fund will use relevant environmental information and knowledge from the WA and Commonwealth governments, natural resource management groups, Traditional Owners, conservation groups, industry and the research sector.	BHP will contribute funding to the PEOF. The PEOF allows for multiple offset payments to be combined to deliver larger conservation projects or expand successful initiatives in the region to maximise the value of financial offsets. This approach enables strategic landscape scale projects with much greater environmental benefits to be implemented, rather than multiple smaller activities.	N/A	Base rate of $986 AUD (excluding GST) per ha within the Hamersley IBRA subregion

BHP has considered the six principles in the *WA Environmental Offsets Policy* (Government of Western Australia 2011), to determine the proposed offset and to demonstrate that the proposed offset through the PEOF is appropriate to counterbalance the significant residual impact.

Table 14-3: Consideration of PEOF offset against offset policy principles

Offset principle	Consideration
1. **Environmental offsets will only be considered after avoidance and mitigation options have been pursued**	BHP has discussed avoidance and mitigation options in Sections 7.5, 8.5, 0 and 10.5 for potential significant impacts to the preliminary key environmental factors. These options include consolidation of mining operations aiding in minimising the amount of clearing required to support the Proposal. The significant residual impact that remains is the unavoidable impact of the clearing of native vegetation.
2. Environmental offsets are not appropriate for all projects	Consistent with other projects in the Pilbara, BHP considers that offsets (for the cumulative impact of clearing of vegetation in Good to Excellent condition, riparian vegetation, critical Ghost Bat, Pilbara Olive Python and Grey Falcon foraging habitat, and supporting habitat for Northern Quoll, Pilbara Leaf-nosed Bat, Pilbara Olive Python and Grey Falcon) are appropriate for this Proposal.
3. Environmental offsets will be cost-effective, as well as relevant and proportionate to the significance of the environmental value being impacted	Consistent with offsets applied to recent Pilbara mining projects, BHP's proposed offset is to contribute funds to the PEOF. BHP considers that the base contribution rates are appropriate and proportionate to counterbalance the significant residual impact of the cumulative clearing of native vegetation in Good to Excellent condition in the Pilbara bioregion, and supporting habitat for Northern Quoll, Pilbara Leaf-nosed Bat, Pilbara Olive Python and Grey Falcon The higher contribution rates are proposed for the clearing of critical Ghost Bat, Pilbara Olive Python and Grey Falcon foraging habitat and riparian vegetation (including groundwater dependent vegetation)
4. Environmental offsets will be based on sound environmental information and knowledge	The WA Government will make decisions on specific offsets projects proposed through the PEOF, focusing on on-ground projects. The operation of the fund will use relevant environmental information and knowledge from the WA and Commonwealth governments, Tradition Owners, natural resource management organisations, conservation groups, industry and the research sector. As outlined in the *Pilbara Environmental Offsets Implementation Plan* (DWER 2019b), a monitoring and evaluation process will involve annual reviews to ensure the latest science and lessons learnt from on-ground projects inform management priorities and appropriate implementation actions.
5. Environmental offsets will be applied within a framework of adaptive management	An adaptive management framework is outlined in the *Pilbara Environmental Offsets Implementation Plan*. BHP understands that this will ensure that offsets projects delivered through the PEOF improve native vegetation condition and habitat for threatened species, and deliver enhanced species and ecosystem resilience, consistent with the adaptive management principle in the *Pilbara Conservation Strategy* (Government of Western Australia 2017).
6. Environmental offsets will be focused on longer term strategic outcomes	BHP will contribute funding to the PEOF. As outlined in the *Pilbara Environmental Offsets Implementation Plan*, the PEOF allows for the combining of money from multiple offset to deliver larger and more strategic landscape-scale projects, leading to better biodiversity conservation outcomes. Projects will be designed so that outcomes endure in the longer term (DWER 2019b).

BHP proposes to contribute funds to the PEOF at the rates detailed in Table 14-4, calculated on the 2023-2024 financial year.

- $1,972 AUD (excluding GST) per hectare of the following environmental values cleared as a result of the proposal within the Hamersley IBRA subregion (defined as Area A in Table 14-5):

  (a) riparian vegetation (including groundwater dependent vegetation)

  (b) critical habitat for Pilbara Olive Python (*Liasis olivaceus barroni*)

  (c) critical habitat for Ghost Bat (*Macroderma gigas*)

  (d) critical habitat for Grey Falcon (*Falco hypoleucos*).

- $986 AUD (excluding GST) per hectare (ha) of 'Good to 'Excellent' condition native vegetation cleared within Development Envelope within the Hamersley IBRA subregion and supporting habitat for significant fauna species (defined as Area B in Table 14-5).

BHP has proposed a condition relating to Offsets for this Proposal, which is included in the draft set of proposed implementation conditions for the Combined Proposal in Appendix 3. A draft Impact Reconciliation Procedure is provided in Appendix 18.

As part of the Commonwealth strategic validation process, if required, BHP will also prepare an Offsets Proposal to address residual adverse impacts on relevant Program Matters (MNES).

Table 14-4: Environmental values relevant to the Proposal that require offset

Environmental value/s	IBRA Subregion	Proposed offset rate ($/ha) for 2023-2024 financial year
Native vegetation in Good to Excellent condition within the proposed Development Envelope	Hamersley	Base rate of $986 AUD (excluding GST) per ha, or the contribution rate for the relevant financial year as published for the Pilbara Environmental Offsets Fund
Riparian vegetation (including groundwater dependent vegetation)	Hamersley	Higher rate of $1,972 AUD (excluding GST) per ha, or the contribution rate for the relevant financial year as published for the Pilbara Environmental Offsets Fund
Critical foraging habitat for the Ghost Bat, Pilbara Olive Python and Grey Falcon within the proposed Development Envelope	Hamersley	Higher rate of $1,972 AUD (excluding GST) per ha, or the contribution rate for the relevant financial year as published for the Pilbara Environmental Offsets Fund

Environmental value/s	IBRA Subregion	Proposed offset rate ($/ha) for 2023-2024 financial year
Supporting habitat for Northern Quoll, Pilbara Leaf-nosed Bat, Pilbara Olive Python and Grey Falcon	Hamersley	Base rate of $986 AUD (excluding GST) per ha, or the contribution rate for the relevant financial year as published for the Pilbara Environmental Offsets Fund

14.1.2 Significant residual impacts for the Approved Proposal

The following significant residual impacts were identified and quantified for the Approved Proposal:

- Marillana Creek (Yandi) Life of Mine Proposal: clearing of up to 508 ha of native vegetation, in the Pilbara IBRA region (Hamersley IBRA subregion) (EPA Report 1577, EPA 2016c). Of this, 350 ha has been cleared and an offset paid to the Pilbara Environmental Offset Fund. The remaining amount of clearing that may attract an offset for the Approved Proposal is 157 ha.

14.1.3 Significant residual impacts for the Combined Proposal

Table 14-5: Combined Proposal significant residual impacts presents the extent of the significant residual impacts from the Approved Proposal, the Proposal and the Combined Proposal, and the proposed extent of the offset for the Combined Proposal.

Different offset payment rates apply depending on the value impacted, with higher payment rates required for critical habitat for listed threatened species. In order to avoid duplication of offsets, the extent of residual impact to be offset for clearing of native vegetation in Good to Excellent condition will be excluded where there is an overlap in extent to be offset for critical foraging habitat (where the habitats align to vegetation that is in Good to Excellent condition, i.e. 85 ha.

Table 14-5: Combined Proposal significant residual impacts

Significant residual impact	Values	Approved Proposal significant residual impact (ha)	Proposal significant residual impact (ha)	Combined extent to be offset (ha)
Area A Clearing of critical foraging habitat for Pilbara Olive Python, Ghost Bat and Grey Falcon Clearing of riparian vegetation (including groundwater dependent vegetation) Clearing of riparian vegetation – impacts from dewatering	Drainage Area/ Floodplain, Major Drainage Line, Medium Drainage Line, Stony Plain, Undulating Low Hills, Hillcrest/Hillslope and Wetland.	2	78	80[2]
	Riparian vegetation (including groundwater dependent vegetation)			
	Riparian vegetation (including groundwater dependent vegetation)			
Area B	Vegetation in Good to Excellent condition in Indicative Footprint	157[1]	17	174[2]

Significant residual impact	Values	Approved Proposal significant residual impact (ha)	Proposal significant residual impact (ha)	Combined extent to be offset (ha)
Clearing of native vegetation in Good to Excellent condition Clearing of supporting habitat for Pilbara Olive Python, Northern Quoll, Pilbara Leaf-nosed Bat and Grey Falcon	Drainage Area/ Floodplain, Major Drainage Line, Medium Drainage Line, Stony Plain, Undulating Low Hills, Hillcrest/Hillslope and Wetland.			
Total extent to be offset		**159**	**95**	**254**

1. This clearing extent excludes the 4,050 ha of clearing of native vegetation previously authorised on 1 April 2015, as detailed in Attachment 5 to MS 679, and as detailed by condition 13 of MS 1039. Of the 508 ha for the Approved Proposal that is subject to offsets, this clearing extent also excludes the 350 ha which has been cleared and reported to the PEOF to the end of the 2022 IRR reporting period.
2. To avoid duplication, the extent to be offset has removed areas where good to excellent vegetation and/or habitat overlap.

BHP has prepared an Impact Reconciliation Procedure (Revision 2.0. BHP 2025d), provided in Appendix 18.

As part of the Commonwealth strategic validation process, if required, BHP will also prepare an Offsets Proposal to address residual adverse impacts on relevant Program Matters (MNES) and implement the Offsets Proposal in accordance with the approved *Pilbara Strategic Assessment Assurance Plan and Offsets Plan* (BHP 2023e).

14.2 Greenhouse Gas Emissions factor

Offsets will be sourced, held and retired from the portfolio as needed to meet our anticipated demand for offsets over time, as we work to decarbonise our business. The specific volumes sourced from each approach will be responsive to the prevailing offset landscape, both domestically and internationally (if the use of internationally sourced credits is allowed under the Safeguard Mechanism in the future, given the implementation of Article 6.4 of the Paris Agreement (A6.4 of PA)), to ensure we have continued access to security of supplies.

In the context of BHP's operations in Western Australia, including the Combined Proposal, the preference is to source offsets in line with our operational footprint in Western Australia and in recognition of the WA state government's preference for locally generated offsets. BHP may also source offsets from international markets, in accordance with EPA guidance on the use of offsets within WA, if the use of international credits to meet Safeguard Mechanism obligations becomes allowed in the future, given the implementation of A6.4 of PA. Domestic sourcing of offsets may be from the domestic market or through offset generation from BHP's tenure or other locations in WA, in partnership with reputable project developers under ERF methodologies. BHP is currently undertaking an opportunity assessment to better understand the potential to generate offsets on our tenure (including mineral carbonation and natural climate solutions), as well as exploring opportunities outside of our tenure with project developers in WA.

Considering the types of offsets that are currently available on the market (i.e. predominantly avoidance type) and the value in mobilising carbon finance to incentivise offset supply, BHP source offsets from solutions that remove atmospheric carbon as well as avoid emissions where these have high integrity, with a planned shift towards removal offsets over time. Whilst BHP prioritise the acquisition of offsets from nature-based solutions that deliver long-term environmental, social and economic value (i.e. sustainability co-benefits), the sourcing of offsets from engineered solutions is also considered. The specific offset types sourced and used within the WA context and for the Yandi Hub, will depend on the acceptable offset criteria set by the WA EPA, the prevailing market dynamics and the availability and accessibility of offsets.

BHP's procurement of carbon credits, includes due diligence to ensure that we invest in carbon offsets that meet the following minimum quality standards:

- Satisfies national carbon offset standards for compliance offsets (i.e. Australian Carbon Credit Units and other eligible regulatory offset instruments), including ACCUs that are established under (and meet the integrity standards of) the *Carbon Credits (Carbon Farming Initiative) Act 2011* (Cth) and/or Registered in an internationally recognised standard that independently verifies and issues voluntary carbon credits (including but not limited to Verra and Gold Standard) that is accredited by and compliant to the ICROA Code of Best Practice.
- Adheres to a robust emissions reduction accounting methodology, to provide assurance of the volume of emissions reduced through a project.
- Meets additionally criteria to ensure that the emissions reduction would not have occurred in the absence of a carbon offset market.
- Has a high likelihood of permanence to ensure that the emissions reduction is ongoing and not reversed (e.g. in the case of forestry projects, the trees are not cut down or destroyed by a natural disaster).
- Provides robust mitigation against leakage, ensuring an offsetting project does not increase emissions elsewhere (e.g. an area is protected from deforestation through offsetting, but another forest area is destroyed).
- Demonstrates high environmental and social integrity, ensuring no broader social or environmental harm (e.g. hydropower projects that require forest clearing and community displacement).
- Limit offset vintage to the last five years of offset generation, to avoid claiming emissions reduction from activities that occurred a long time ago.

BHP regularly review the minimum sourcing standards and sourcing strategy to verify alignment with global best practice, including the outcomes of initiatives such as The Integrity Council for the Voluntary Carbon Market's (IC-VCM) Core Carbon Principles and the Chubb review into the integrity of ACCUs (DCCEEW 2022b).

BHP supports action to increase the availability of carbon offsets in the near-term and long-term, by addressing barriers to offset supply through grant funding, research and development, and market and policy advocacy. For example, in 2022 BHP launched a grants program to help drive the development of the Australian blue carbon market and have provided over $5 million Australian dollars to support emerging blue carbon methods and projects.

15 Holistic impact assessment

This Environmental Review Document has identified the following environmental factors relevant to the Proposal in conjunction with the Combined Proposal:

- Inland Waters
- Flora and Vegetation
- Terrestrial Fauna
- Subterranean Fauna
- Social Surroundings
- Greenhouse Gas Emissions.

BHP has assessed the impacts of the Proposal for the above relevant environmental factors and environmental values individually (Sections 7 to 12). Given the link between Inland Waters, Flora and Vegetation, Terrestrial Fauna, Subterranean Fauna, Social Surroundings and Greenhouse Gas Emissions, consistent with the EPA's *How to prepare an Environmental Review Document: Instructions* (EPA 2024b), BHP has considered connections and interactions between the relevant environmental factors to inform a holistic view of impacts to the environment. Figure 15 1 illustrates the connections and interactions between the key environmental factors to inform the holistic assessment.

Groundwater abstraction (dewatering) and surplus water discharge for the Proposal has the potential to change groundwater levels and quality localised to E8, which has the potential to affect the ecosystems, beneficial uses and cultural and Aboriginal cultural heritage values that are dependent on these hydrological systems. BHP considers that the proposed mitigation and regulation (proposed conditions, environmental management measures and other statutory decision-making processes) for Inland Waters will minimise further impacts to the inter-related key environmental values of Marillana Creek.

There are inherent links between the Flora and Vegetation and Terrestrial Fauna factors. Vegetation provides habitat for terrestrial fauna, including significant fauna (including fauna listed under the BC Act and EPBC Act), and SRE species. These factors, and Subterranean Fauna, also interact with the Inland Waters factor, in that flora, vegetation, terrestrial fauna and stygofauna rely on water to sustain and maintain growth. It is considered that the proposed mitigation and regulation (limits on clearing, environmental management plans) will ensure further impacts to the inter-related key environmental values of flora and vegetation, terrestrial fauna and water are minimised.

Implementation of the Proposal will avoid, where possible, and minimise direct disturbance to Aboriginal cultural heritage sites within the Development Envelope. However, it is acknowledged that there are other potential impacts to social, cultural and heritage values (traditional bush tucker and medicine plant species, water values, changes to landscape and access). BHP is committed to ongoing engagement with the Banjima People (the Traditional Owners) and BNTAC in relation to surplus water management, access, rehabilitation, and closure of the Yandi mine and other matters relevant to Social Surroundings via implementation of the SCHMP and the management plans associated with the Yandi Combined Proposal. The Combined Proposal will be decommissioned and rehabilitated so that the impacts to Social Surroundings, Inland Waters, Terrestrial Fauna, Flora and Vegetation and Subterranean Fauna are mitigated and minimised.

There is an established link between GHG emissions and the risk of climate change (EPA 2023 [75]). Climate change has the potential impact on the environmental values of Western Australia. Implementation of the reduction strategies outlined in this ERD and regulation under the Safeguard Mechanism will also mean that the other environmental

factor values (Flora and Vegetation, Terrestrial Fauna, Subterranean Fauna, Inland Waters, and Social Surroundings) will be protected.

BHP considers that when the links between the key environmental factors are taken into account as part of the holistic impact assessment, the Proposal is still consistent with the EPA's objectives.

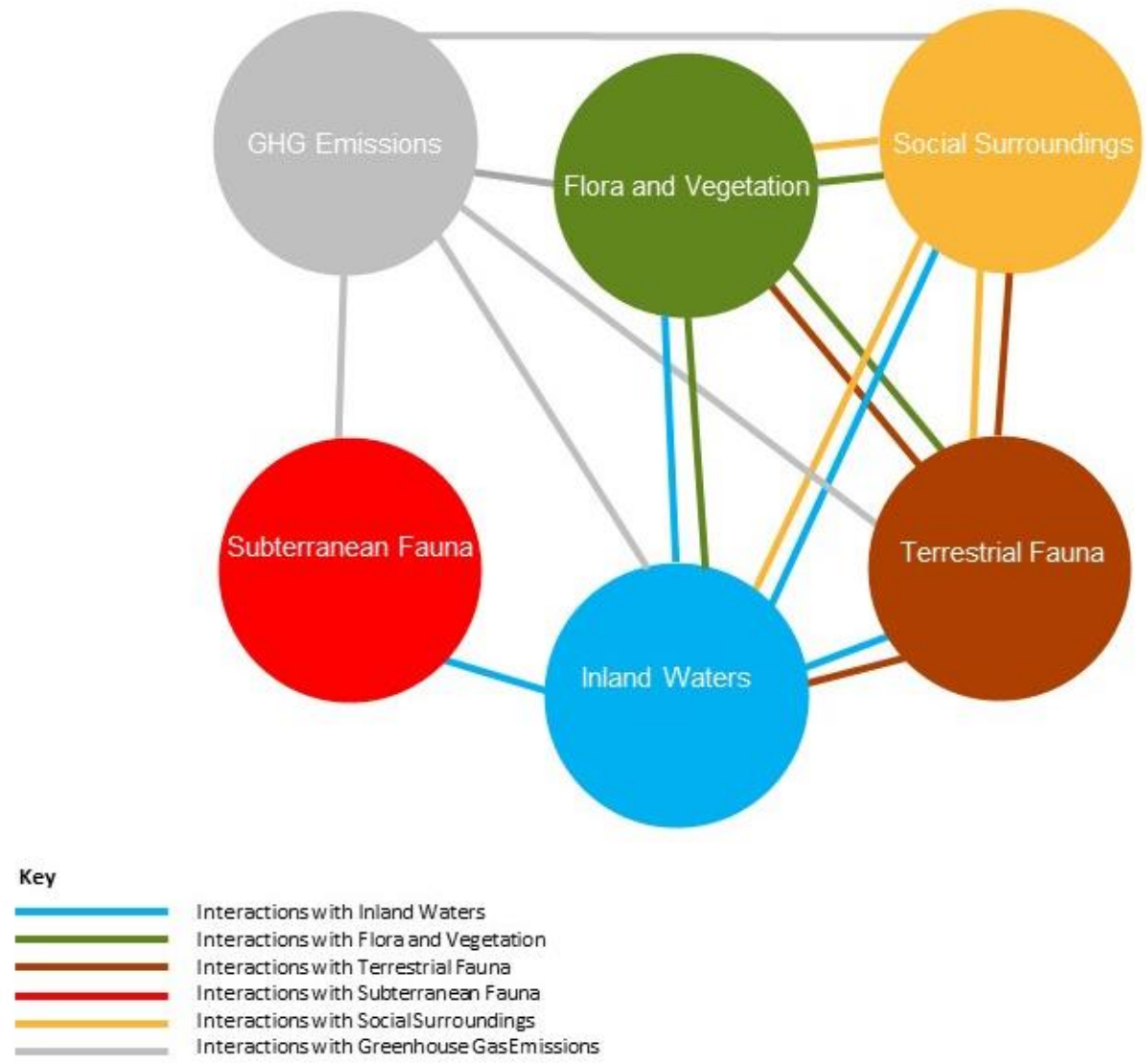


Figure 15-1: Interactions between environmental factors

16 Cumulative environmental impact assessment

The Combined Proposal is located within the WAIO Central Pilbara Hub (CPH), within the Central Pilbara region (Figure 16-1). Major projects in the CPH area include BHP and RTIO operations (Figure 16-1). BHP has focused the cumulative impact assessment (of successive, incremental and interactive impacts on the environment of the Proposal with one or more past, present and reasonably foreseeable future activities) on existing, known and potential future projects in the CPH, where data is available. It should be noted that this may differ according to each environmental factor and availability of publicly available data.

16.1 Inland Waters

The cumulative impact assessment for Inland Waters has considered cumulative impacts associated with the Approved Proposal, this Proposal and nearby existing third-party operations at Yandicoogina, as these are the only existing or potential future operations that influence surface water and groundwater within the Development Envelope.

16.1.1 Cumulative impacts to groundwater regimes

The cumulative impact assessment for Inland Waters has been provided as part of the Combined Proposal in Section 7 as the predicted groundwater drawdown and modelling results for the Combined Proposal alone were unable to be generated due to the proximity and influence of third-party dewatering on existing and proposed operations.

As described in Section 7.3.3.2 and Section 7.4.2.1, a numerical groundwater model was developed to quantify impacts to groundwater levels from dewatering for below water table mining. The *BHP Yandi E8 Groundwater Model* (INTERA 2023) is included in Appendix 4. As detailed in Section 7.3.3.2, the regional model is developed outside the conventional conceptualization of the region's hydrogeology and is based on the precautionary assumption that dewatering in the CID could be connected to groundwater levels in the Minsters North Aquifer.

The model predicted drawdown in the CID and Basement Formation. The predicted drawdown as a result of the Cumulative Proposal (Approved Proposal, Proposal and third-party operation) in each aquifer is summarised below:

- A maximum vertical drawdown in the CID is predicted to be 60 m at the end of 2029. Drawdown in the CID is predicted to migrate to the west and to the east away from the boundary of the Development Envelope.
- Groundwater drawdown (in the Basement Formation and Ministers North aquifer) is shown in Figure 7-8 in Section 7.4.2.1. The results indicate that drawdown extends laterally at various distances away from the Development Envelope, with the maximum lateral extent approximately 6 km south of the Development Envelope with an estimated drawdown of 1 m.

The predicted unmitigated impacts to environmental receptors are as follows:

- Groundwater levels in Yandicoogina Gorge are predicted to further decline by approximately 5-6 m by 2029 compared with pre-2018 levels.

As discussed in Section 7.3.3.2 and 7.5.2.3, BHP are currently working with Traditional Owners, Rio Tinto, EPA and DWER to mitigate any further decline in the Gorge through initiating a groundwater supplementation trial authorised under existing environmental approvals.

16.1.2 Cumulative impacts to Marillana Creek Catchment

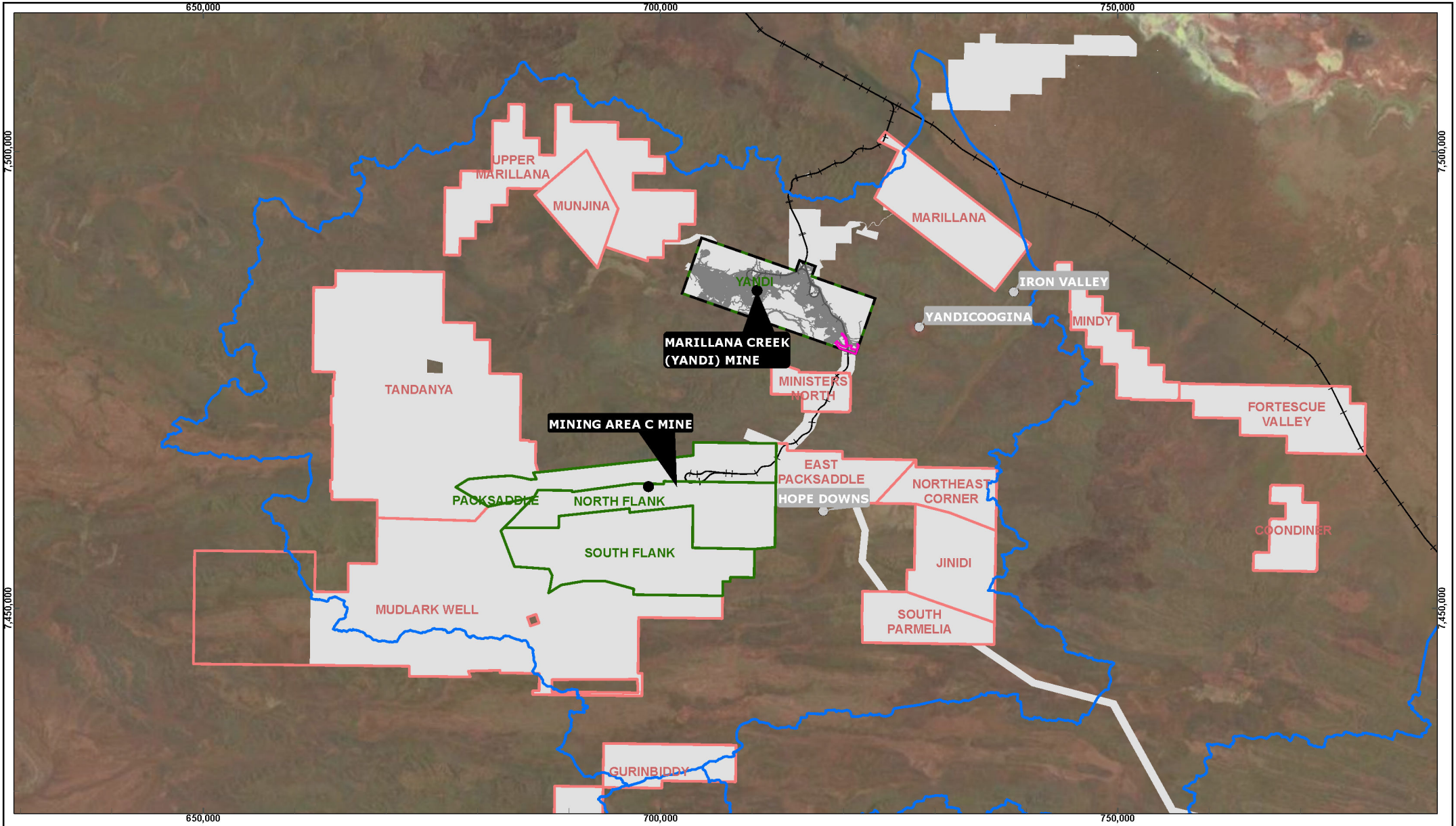
The excavation of pits and construction of infrastructure has the potential to change surface water regimes by altering natural surface water flows and reducing the availability of surface water runoff downstream. Mining creates internally

draining mine pits and can reduce the volume of rainfall runoff downstream. Marillana Creek is an ephemeral creek which flows after rainfall events and flow is contributed predominantly through diffuse overland flow within this part of the Marillana Creek catchment.

The Combined Proposal includes 1,310 ha of mine pit area which corresponds to 0.64% of the Marillana Creek catchment. An analysis of aerial photography in the Marillana Creek catchment has been undertaken to provide an estimate of mine pit area by third party operations. Approximately an additional 2,070 ha of third party mine pit area is within the Marillana Creek Catchment not related to the Proposal. Therefore, the Combined Proposal plus third-party operations comprise an approximate total of 3,380 ha of mine pit area which corresponds to 1.6% of the catchment. Given the high variability of streamflow in the Pilbara it is unlikely that this will cause any significant impacts to surface water flow downstream.

16.1.3 Cumulative impacts to Water Quality

Cumulative impacts to water quality are subject to monitoring and mitigation under the RiWi Act by all parties in the resource area.



- BHP Operations
- Other Mining Operations
- BHP Rail
- WAIO Central Catchment
- Development Envelope
- Current Projects
- Future Projects
- Indicative Footprint
- BHP Tenements - Granted
- Existing Disturbance

N

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KILOMETRES

GDA 1994 MGA ZONE 50

BHP

PUBLIC

MARILLANA CREEK (YANDI) SIGNIFICANT AMENDMENT

CENTRAL PILBARA HUB AND NEARBY PROJECTS

WAIO PLANNING, TECHNICAL & ENVIRONMENT

SCALE @A4:	1:560,000	PREPARED:	GEOMATICS	FIGURE:	16-1
DATE:	5/05/2025	REQUESTOR:	ENV APPROVALS		

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16.2 Flora and Vegetation

The cumulative impact assessment for Flora and Vegetation has considered cumulative impacts associated with the Approved Proposal, approved projects in operations (RTIO Yandicoogina, Pocket/Billiards South and Hope Downs, and BHP's Mining Area C [MAC] and South Flank), and future proposals including this Proposal and Hope Downs 2 (currently under assessment [2316]) (Figure 16-1).

16.2.1 Cumulative impacts of clearing vegetation

As discussed in Section 8.6.1.2, the Proposal has the potential to impact one significant flora species, *Rostellularia adscendens* var*. latifolia* (Priority 3). This species has been recorded at several other BHP projects, or exploration areas in the central Pilbara (including Mining Area C, Packsaddle, Tandanya, Central Pilbara West, Mindy and along the BHP to Port Hedland railway line). It is not considered possible to undertake an accurate cumulative impact assessment for *Rostellularia adscendens* var*. latifolia* across BHP tenure in the Pilbara, given the varied age of records and therefore varying levels of information attached to those records. BHP considers that the Proposal will not result in a significant impact to this species locally or regionally, based on the wide distribution and number of populations (64) and records (357) of this species known from the Pilbara. The representation and viability of the Priority flora known from the proposed Development Envelope will be maintained in the Pilbara bioregion.

The Proposal occurs within the Hamersley and Fortescue Botanical Districts, which are part of the Eremaean Botanical Province (EPA 2016b). Broad scale regional mapping of Western Australia was undertaken by Beard (1975) to map the pre-European state of the vegetation. Shepherd et al. (2002) later refined and updated the vegetation association mapping to account for the extensive clearing that had occurred since the Beard (1975) mapping was completed. Two regional vegetation associations from the Pilbara bioregion are located within the Development Envelope (Associations 18 and 82). Association 18 will not be impacted by the Proposal. However, based only on the cumulative impacts of the Approved Proposal and nearby existing and reasonably foreseeable future projects 2.5% of the current extent of this association will be cleared (Table 16-1). Association 82 will be impacted by the Proposal, and cumulatively with the Approved proposal and nearby existing and reasonably foreseeable future projects will result in the clearing of 1.2% of this association (Section 8.4.1).

As outlined in the cumulative environmental impacts of development in the Pilbara region (EPA 2014), the EPA considers that the clearing of vegetation in Good to Excellent condition in the Pilbara is a significant residual impact due to the cumulative impacts of clearing. Based on this, clearing of vegetation in Good to Excellent condition for the Proposal has been identified as a significant residual impact. The Proposal is estimated to contribute to the cumulative impact of clearing of vegetation in Good to Excellent condition within the Pilbara region. As a result, BHP has proposed an offset for the clearing of up to 85 ha of native vegetation in Good to Excellent condition from the Proposal.

Table 16-1: Cumulative impacts to Beard vegetation units

Beard vegetation unit	Current extent in bioregion[1]	Proposed extent of loss within the Indicative Footprint	Extent of loss from Approved Proposal (ha)	Extent of loss from existing and reasonably foreseeable future projects[2] (ha)			Cumulative loss of current extent	
				Hope Downs 2	Yandicoogina – Revised proposal	MAC-SF	ha	%
18	671,843	0	693	3,067	-	13,167	16,927	2.5
82	2,550,888	95	3,987	1,790	1,909	22,864	30,645	1.2

[1] Pre-European Extent and Current Extent based on current DBCA data for the Pilbara bioregion (Government of Western Australia 2019a)
[2] Existing and reasonably foreseeable future projects include MAC-SF (BHP Billiton 2017b), Yandicoogina Revised Proposal (Hamersley Iron; Rio Tinto 2015) and Hope Downs 2 (Hamersley HMS 2023).

16.2.2 Cumulative impacts to vegetation from changes to groundwater/surface water regimes

16.2.2.1 Marillana Creek riparian vegetation

As discussed in Section 8.4.2, vegetation health decline and tree deaths have been recorded along Marillana Creek within the Development Envelope and off-tenure at Flat Rocks since monitoring of riparian vegetation began at Yandi mine in 1991. A total of 30 ha of deceased riparian vegetation was included in the total disturbance reported for the mine in the FY2020 AER. For the purpose of this cumulative impact assessment the 30 ha represents the indirect impact to riparian vegetation from cumulative dewatering inside the Development Envelope, to date. It is acknowledged indirect impacts to riparian vegetation and tree deaths have also occurred outside the Development Envelope at Flat Rocks; however, this is likely due to BHP activities alone and is addressed in Section 8.6.2.

Groundwater modelling predicts that the proposed cumulative dewatering (associated with the Proposal, the Approved Proposal and nearby existing operations including RTIO Yandicoogina) will result in a maximum vertical drawdown in the CID of up to approximately 60 m in the Development Envelope and a maximum vertical drawdown of 50 m within the Indicative Footprint. As described in Section 8.4.2, groundwater drawdown in the CID aquifer will result in drawdown in the alluvium and therefore the CID contours have been used to determine the potential impacts to riparian vegetation/GDV from the drawdown for the Proposal (Section 8.4.2) as well cumulative groundwater drawdown as discussed below.

The predicted cumulative CID groundwater drawdown contours in relation to the location of potential GDV in the Development Envelope are shown on Figure 16-2. The extent of potential GDV located in each of the drawdown contour bands within the Development Envelope but outside of the Indicative Footprint and existing disturbance, represents the potential cumulative impact to vegetation over and above the extent that will be impacted by direct clearing. The corresponding areas are presented in Table 16-2.

Table 16-2: Potential cumulative impacts to GDV in the Development Envelope from groundwater drawdown

Vegetation association	Likelihood of containing GDV	Extent of GDV within drawdown band (ha)*				TOTAL
		0-2 m	2-5 m	5-20 m	20-60 m	
MA EcrEvMa AcpAamAthe TydCyv	Highly likely	0.1	0.1	0.1	0.6	**0.9**
MA MaEcrEv MgAcpAtr Cyv	Highly likely	0.5	0.7	5.3	3.2	**9.7**
MA EvAciEcr TercCocrApyp CcEuaTt	Likely	7.9	14.1	30.0	31.0	**83.1**
MA EcrEv AcpAtheEv TpTl	Likely	3.1	4.1	9.0	2.2	**18.5**
	TOTAL	**11.6**	**19.0**	**44.5**	**37.0**	**112.1**

* Includes potential cumulative impacts within the Development Envelope (excluding the Indicative Footprint as this will be subject to clearing) from the Proposal, the Approved Proposal and nearby existing operations including RTIO Yandicoogina.

As discussed in Section 8.4.2, indirect impacts to groundwater dependent vegetation from changes to groundwater level have the potential to increase based on the extent of drawdown. Vertical drawdown between 0-2 m is within the approximate natural seasonal variation expected for the Pilbara and is therefore considered minor and unlikely to impact Moderate potential GDV. However, it could impact High likelihood GDV which contains *Melaleuca argentea*. Drawdown greater than 2 m is considered likely to impact High and Moderate likelihood GDV. A total of 100.5 ha of potential GDV in the Development Envelope occurs within the modelled cumulative groundwater drawdown zone of between 2-60 m, and 11.6 ha occurs within the 0-2 m drawdown zone (Table 16-2, Figure 16-2). However, these areas are highly conservative estimates of what areas of Marillana Creek may be subject to future cumulative impacts, as the majority of groundwater drawdown for the Approved Proposal has already taken place which is described further below.

Tree health decline from the effects of drawdown has been observed in the Development Envelope since the early 2000s, with maximum groundwater abstraction from the Approved Proposal having occurred during the period 2012-2015. Groundwater abstraction across the Development Envelope has continued to reduce in recent years as several pits have reached their target depth. As described in Section 7.3.2.7, the timing of when drawdown reaches its maximum varies depending on location, but the maximum observed groundwater drawdown (within the Development Envelope) has reached approximately 50 m to 60 m in the CID in the Eastern / Central and Western pits. In the west of the Development Envelope, groundwater levels were roughly stable until 2011, then declined between 2011 and 2022 (in response to dewatering), and then recovered slightly between 2022 and 2024 (in response to a reduction in local dewatering). In the east of the Development Envelope, water levels have declined to approximately 500 mAHD (within bore HYE1513M in the Indicative Footprint) since dewatering began in this area in 2013.

The cumulative drawdown as a result of the Approved Proposal, Proposal and existing third-party operations predicts the maximum vertical drawdown in the CID will be 60 m at the end of 2029 and drawdown in the CID is predicted to migrate to the west and to the east away from the boundary of the Development Envelope. Minimal additional drawdown throughout the Development Envelope outside of the Indicative Footprint is predicted to occur between now and 2029, given that cumulative drawdown in the CID is predicted to migrate to the west and to the east away from the boundary of the Development Envelope, and a drawdown of 50-60 m has already occurred at some locations as part of the Approved Proposal (Figure 16-2).

Although Figure 16-2 shows up to 112 ha of GDV in the Development Envelope occurring within the modelled cumulative groundwater drawdown zone of between 0-60 m, this area represents vegetation that has not been affected by drawdown to date, and is highly unlikely to be in future, given the maximum drawdown of up to 60 m has already occurred for the Approved Proposal. Further to this, the majority of the GDV mapped within the cumulative contours in the Development Envelope consists of the vegetation with a lower likelihood of containing GDV (MA EvAciEcr TercCocrApyp CcEuaTt and MA EcrEv AcpAtheEv TpTl). Potential further impacts to Flat Rocks outside of the Development Envelope are assessed as part of the Combined Proposal in Section 8.4.2 and 8.6.2.

Further along Marillana Creek to the south-east, RTIO are approved to impact riparian vegetation through potential impacts from groundwater drawdown and discharge for the Yandicoogina Iron Ore Project. Their existing dewatering operations have been accounted for in the groundwater modelling which produced the drawdown contours shown on Figure 16-2. No information is publicly available on the health status of vegetation along Marilla Creek within Rio Tinto's tenement immediately east of the Development Envelope.

Overall, cumulative impacts to riparian vegetation from groundwater drawdown are unlikely to occur in the Development Envelope outside the Indicative Footprint. This is based on the prediction that the cumulative drawdown in the CID will migrate to the west and to the east away from the boundary of the Development Envelope, and groundwater abstraction is continually decreasing for the Approved Proposal, with the maximum drawdown level of 60 m having already occurred in parts of the Development Envelope.

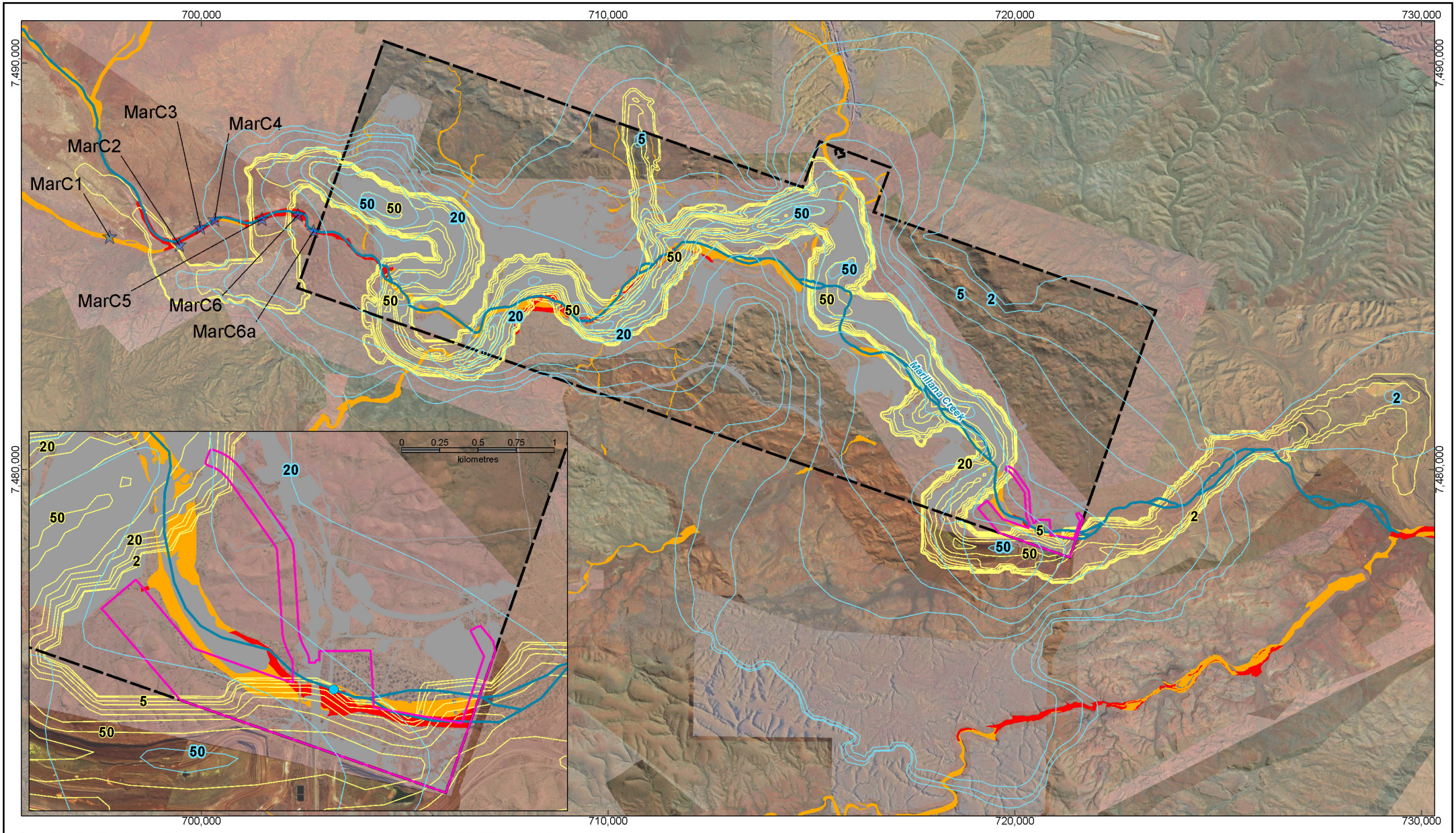
16.2.2.2 Yandicoogina Gorge

Evidence of riparian vegetation stress and tree deaths has been recorded to the south-east of the Development Envelope at Yandicoogina Gorge. Tree health monitoring of *M. argentea* and *E. camaldulensis* (with digital canopy photography) has been undertaken at four sites within Yandicoogina Gorge since September 2020. Foliage cover of *M. argentea* declined at all four monitoring sites up until the most recent reported monitoring event in April 2024 (Biologic 2024f). A number of trees were observed to have died, including the majority of monitoring trees at one site. The foliage cover of *E. camaldulensis* declined at two sites and remained relatively stable at two sites within Yandicoogina Gorge between 2020 and 2024. Over the same time period, understorey monitoring showed decreased cover of taxa classified as hydrophytic and mesophytic, and increased cover of weed species (Biologic 2024f). Monitoring at a GDE within an upstream tributary of Yandicoogina Creek commenced in May 2023, to provide some regional context to the trends seen within Yandicoogina Gorge. Foliage cover of *M. argentea* at the upstream site did not decline up to the last reported monitoring event in April 2024, in comparison to the large decline recorded over

the same period at all sites within Yandicoogina Gorge. The foliage cover of *E. camaldulensis* was also relatively stable at the upstream site (Biologic 2024f).

As described in Section 7.6.2.1 it has been observed by BHP that the hydrological regime at Yandicoogina Gorge has been influenced to date by either climate variability, or a combination of climate variability and cumulative groundwater drawdown associated with the Approved Proposal and third-party operations. Assuming a hydraulic connection between the CID and Ministers North aquifers (i.e. a precautionary approach), the current measured drawdown in the Ministers North aquifer in the vicinity of Yandicoogina Gorge is approximately 3.5 m. Based on groundwater modelling, an additional 5-6 m reduction in groundwater levels within Yandicoogina Gorge is predicted to occur as a result of cumulative drawdown and/or climate variability (refer to Section 7.3.3; Figure 7-8). This drawdown is predicted to occur as a result of cumulative drawdown and/or climate variability (refer to Section 7.4.2.1) which has the potential to result in further decline or loss of riparian vegetation within the gorge, including GDV.

BHP are currently working with Traditional Owners, RTIO, EPA and DWER to mitigate further groundwater decline within the Gorge through a groundwater supplementation trial, which is described in detail in Section 7.5.2.3. The trial aims to stabilise groundwater levels within the Ministers North aquifer at the head of the Gorge, specifically to abate further groundwater decline, and to improve understanding of the interactions between the Ministers North Aquifer and the environmental values of the Gorge (including GDV). BHP also proposes to investigate long-term solutions for reinjection at the Gorge (if required).



BHP

PUBLIC

MARILLANA CREEK (YANDI)
SIGNIFICANT AMENDMENT
CUMULATIVE GROUNDWATER
DRAWDOWN CONTOURS AND GDV

WAIO PLANNING, TECHNICAL & ENVIRONMENT

SCALE @A4:	1:125,000	PREPARED:	GEOMATICS	FIGURE:	16-2
DATE:	1/05/2025	REQUESTOR:	ENV APPROVALS		

A1205-077-RevD

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16.3 Terrestrial Fauna

16.3.1 Cumulative impacts of clearing fauna habitat

The cumulative impact assessment for clearing fauna habitats has considered cumulative impacts associated with the Approved Proposal, approved projects in operations (RTIO Yandicoogina, and BHP's MAC and South Flank), and future proposals including this Proposal and Hope Downs 2 (currently under assessment [2316]) depending on availability of data (Figure 16-1).

Cumulative impacts to terrestrial fauna have been considered in terms of habitat loss given that datasets on species' records are not publicly available for all nearby projects. Detailed fauna habitat mapping has been completed by BHP in the Development Envelope but is not available for the entire Pilbara region, and can be difficult to obtain from nearby projects, many of which have a long history of clearing. Land System mapping at a regional level by DPIRD (2022) provides an opportunity to assess cumulative impacts on broad landscape units as a surrogate for fauna habitat. The cumulative impacts on land systems have been considered for the Proposal, based on an assessment of nearby existing operations including RTIO Yandicoogina and BHP's MAC-SF, and future operations including RTIO Hope Downs 2.

It should be noted that estimates of the land system occurrence within each project area was estimated by calculating the total area of each land system within the development envelope for each project. Given this approach, the estimates are likely to be conservative considering that clearing doesn't usually occur across an entire development envelope.

Following the implementation of the Proposal the direct impact on each of the land systems will not exceed 1% of their extent in the wider bioregion (Table 16-3). The cumulative impacts of this Proposal as well as current/future operations are not predicted to exceed 6.0% for any of the Land Systems (Table 16-3) and is therefore not anticipated to represent a significant residual impact.

16.3.2 Cumulative impacts to fauna from changes to groundwater regimes

The impact assessment for cumulative impacts to fauna habitats from changes to groundwater regimes has considered cumulative impacts associated with the Approved Proposal, this Proposal, and existing operations (i.e. RTIO Yandicoogina). as a result of cumulative drawdown and/or climate variability (refer to Section 7.4.2.1).

16.3.2.1 Marillana creek

As described in Section 16.2.2.1, up to 112 ha of riparian vegetation/GDV occur within the 0-60 m cumulative drawdown contours where it has the potential to be impacted by a decline in groundwater levels associated with cumulative dewatering. These areas correspond to Wetland (artificial) and Major and Medium Drainage Line fauna habitats which are critical and/or supporting habitat for significant fauna species such as the Pilbara Olive Python, Northern Quoll, Grey Falcon, Ghost Bat and Pilbara Leaf-nosed Bat. Any decline in the health or condition of riparian vegetation or GDV has the potential to result in the subsequent degradation or loss of the associated fauna habitats.

The groundwater modelling predicts that the proposed cumulative dewatering (i.e., the Proposal, the Approved Proposal and nearby existing operations) will result in a maximum vertical drawdown in the CID of up to approximately 60 m in the Development Envelope and a maximum vertical drawdown of 50 m within the Indicative Footprint. However, this level of drawdown has already occurred in many parts of the Development Envelope due to the Approved Proposal with dewatering requirements having reached their peak in 2015 (see Section 7.3.2.7). In addition, the cumulative drawdown is predicted to migrate to the east and west, away from the boundary of the Development Envelope. As such, minimal additional drawdown throughout the Development Envelope, outside of the Indicative Footprint, is predicted to occur between now and 2029. Based on the above, there will be limited additional cumulative impacts to those fauna habitats associated with riparian vegetation or GDV, and as such cumulative impacts from changes to groundwater regimes are unlikely to be significant.

16.3.2.2 Yandicoogina Gorge

As described in Section 7.3.3.2and Section 8.6.2, a decline in the groundwater levels and a decline in GDV health (and the associated fauna habitats) has recently been observed at Yandicoogina Gorge. In addition, the water level in one of the permanent pools within the Gorge has declined by approximately 1 m since 2020 (AQ2 2022; Section 7.3.3.2). Whilst the exact cause of this decline is currently unknown, it is considered likely to be a result of either climate variability, or a combination of climate variability and cumulative groundwater drawdown associated with the Approved Proposal and third-party operations (noting that the predicted drawdown of the Proposal alone does not intersect with sensitive environmental receptors at Yandicoogina Gorge). Assuming a hydraulic connection between the CID and Ministers North aquifers (i.e. a precautionary approach), the current measured drawdown in the Ministers North aquifer in the vicinity of Yandicoogina Gorge is approximately 3.5 m. Based on groundwater modelling, an additional 5-6 m reduction in groundwater levels within Yandicoogina Gorge is predicted to occur as a result of cumulative drawdown and/or climate variability (refer to Section 7.3.3; Figure 7-8**Error! Reference source not found.**). This drawdown has the potential to result in the decline or loss of terrestrial and aquatic fauna habitats, including critical and/or supporting habitat for significant terrestrial fauna and aquatic fauna habitat in groundwater dependant surface water pools (described in Section 9.3.2.6). At the time of publication, BHP have initiated a supplementation trial in Yandicoogina Gorge in consultation with DWER, RTIO, EPA and Traditional Owners (the Banjima People). The trial's objectives are to stabilise groundwater levels and abate further groundwater decline, as well as improve the understanding of interactions between regional groundwater values and GDV (and associated fauna habitats) which will inform future mitigation strategies. Following the trial, BHP propose to investigate longer-term solutions for reinjection at the Gorge (if required). Cumulative impacts to terrestrial and aquatic fauna at Yandicoogina Gorge are therefore not expected to be significant.

Table 16-3: Cumulative impacts to landsystems

Landsystem	Current extent in bioregion[1]	Extent of loss within the Indicative Footprint		Extent of loss from Approved Proposal	Extent of loss from existing and reasonably foreseeable future projects [2] (ha)			Cumulative loss	
		ha	% of current extent	ha	Hope Downs 2	Yandicoogina – Revised proposal	MAC-SF	ha	%
Boolgeeda system	962,141.0	35.6	0.004	29.64	707	1,491	7,748	10,118.04	1.05
McKay system	425,967.0	15.8	0.004	2,359.79	0	499	0	2,921.99	0.69
River system	481,994.0	26.3	0.006	129.31	0	1,336	0	1,570.51	0.33
Robe system	128,680.0	47.1	0.04	1968.36	0	0	0	2,156.76	1.68

[1] source Astron (2023a)

[2] existing and reasonably foreseeable future projects include Yandicoogina Revised Proposal (Hamersley Iron; Rio Tinto 2015), MAC-SF (BHP 2017b) and Hope Downs 2 (Hamersley HMS 2023)

16.4 Subterranean Fauna

16.4.1 Stygofauna

The cumulative impact assessment for stygofauna has been assessed as part of the Combined Proposal in Section 10.6 as the groundwater drawdown modelling includes cumulative impacts associated with the Approved Proposal, this Proposal and nearby existing third-party operations at RTIO Yandicoogina (see Section 10.4.1 and 10.6.1).

Cumulative impacts to regional stygofauna values at Yandicoogina Gorge are discussed here as an additional 5-6 m reduction in groundwater levels within Yandicoogina Gorge is predicted to occur as a result of cumulative drawdown associated with the Combined Proposal, third-party operators and/or climate variability (refer to Section 7.3.3 and Section 7.4.2; Figure 10-5 in Section 10.3.2.2). This has the potential to result in loss or modification of stygofauna habitat and/or species assemblages within this area.

As described in Section 10.3.2.4, Yandicoogina Gorge supports a high diversity of aquatic and hyporheic fauna including potentially restricted stygofauna species that are currently only known from the gorge (see Table 9-8 in Section 9.3.2.6; Biologic 2023d; 2024c).

Yandicoogina Gorge has already experienced a 1 m decline in groundwater levels. Whilst the cause is unknown and cannot be attributed to a single source, it is likely an influence of either climate variability, or a combination of climate variability and regional groundwater dewatering activities. BHP are currently working collaboratively with Traditional Owners, RTIO, EPA and DWER to abate further groundwater decline to the Gorge through implementation of a groundwater supplementation trial (described in detail in Section 7.5). The trial's objectives are to abate further groundwater decline and improve the understanding of the interactions between GDV and groundwater levels within the region, which will assist in informing future mitigation strategies, should they be required. Following implementation of the trial and ongoing mitigation, no further decline in groundwater levels associated with the Combined Proposal is anticipated. Cumulative impacts to stygofauna at Yandicoogina Gorge are therefore not expected to be significant and can be managed to meet the EPA''s objectives.

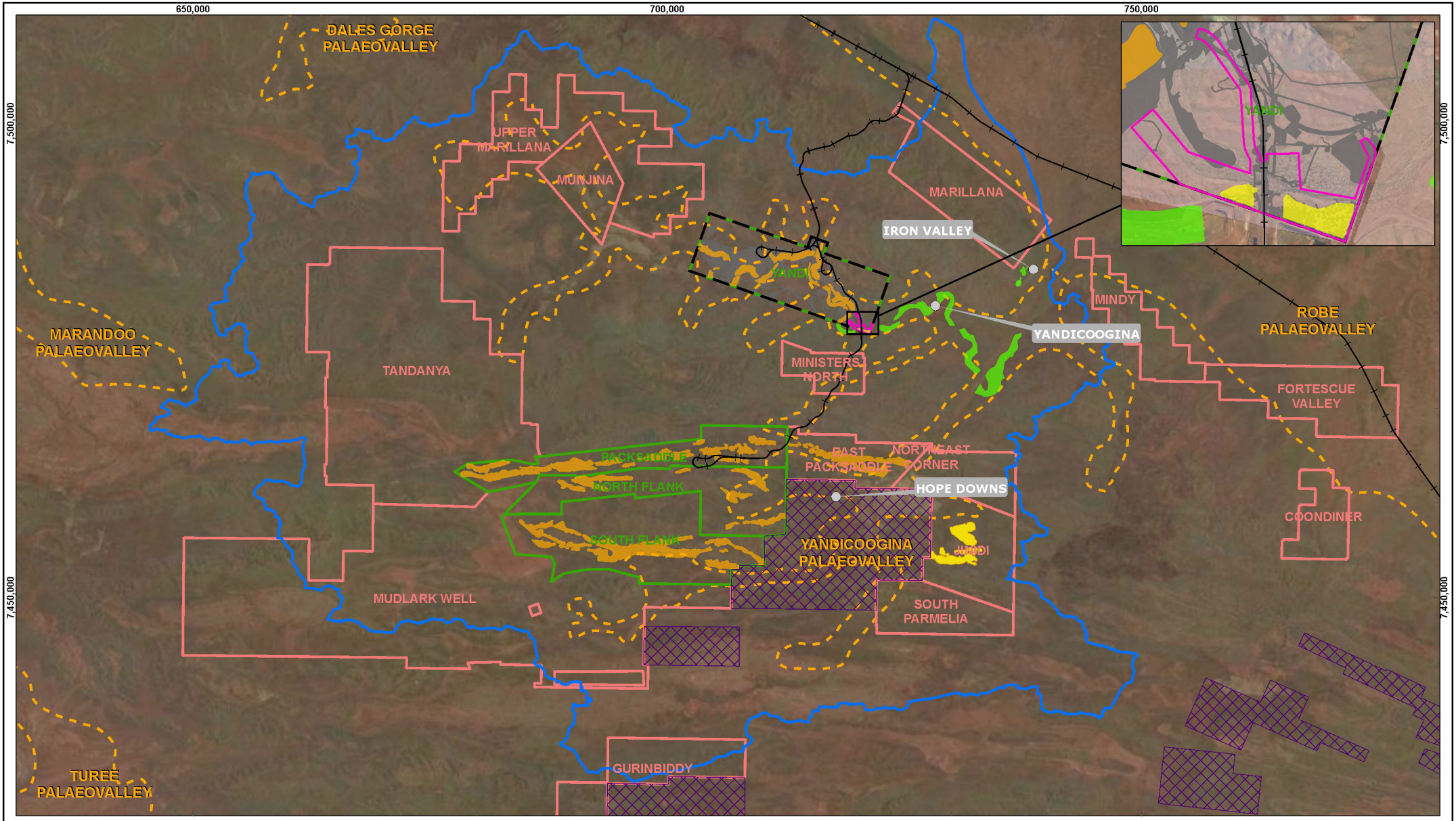
16.4.2 Troglofauna

Cumulative impacts to troglofauna are difficult to quantify given that regional mapping of suitable troglofauna habitat and mine pit volumes are not publicly available. This is further exacerbated by the differences in troglofauna assemblages between areas.

Studies for RTIO's Yandicoogina mine, located directly east of the Development Envelope, demonstrated that the troglofauna assemblage throughout this area was depauperate and concluded that the Yandicoogina Development Envelope does not contain primary habitat for troglofauna (Rio Tinto 2015). The greatest limiting factors for troglofauna at the Yandicoogina mine were found to be the seasonal flooding events which completely submerge the alluvial deposits, rendering them unsuitable for troglofauna (Rio Tinto 2015). In contrast, a relatively rich troglofauna assemblage has recently been recorded within the Yandi Development Envelope, with at least 15 potentially restricted troglofauna species having been recorded (Bennelongia 2024b). At Ministers North, a total of 48 potentially restricted troglofauna species have been recorded, all of which differ to those recorded at Yandi (Bennelongia 2024b, c, 2025). Based on current knowledge, the potentially restricted species are not known from outside their prospective study areas, and therefore cumulative impacts to these species associated with cumulative habitat loss are limited.

Whilst there are some shared species of troglofauna between Minister North and Yandi, these are widespread species or are those known from multiple catchments. Based on recent 3D habitat modelling for Yandi, the surface geology, and extent of the Yandicoogina Palaeovalley that runs through the Development Envelope and into the wider region, areas of suitable troglofauna habitat will continue to persist within the local and regional area (Figure 10-3 and Figure 16-3; Biologic 2024d). Cumulative impacts to widespread or species known from multiple catchments are therefore unlikely to be significant.

The Proposal's contribution toward cumulative impacts to troglofauna is likely to be relatively minor given that two pits at E8 are proposed for excavation. Whilst the Combined Proposal's contribution is larger and extends across the Development Envelope, this is unlikely to be significant given the extent of suitable habitat that remains throughout the Development Envelope and wider region. This is demonstrated by the rich troglofauna assemblage that has recently been recorded at Yandi, with over 84% of the assemblage persisting in areas where habitat has already been lost through mine pit excavation. This is further demonstrated by recent 3D habitat modelling which predicts that suitable habitat will remain beneath the proposed pit shelves of the Proposal, as well as areas that extend beyond the pit area (Biologic 2024d; see Section 10.3.2.1).



- BHP Rail
- Development Envelope
- Indicative Footprint
- Existing Disturbance
- WAIO Central Catchment
- Current Projects
- BHP tenements
- Other Mining Operations
- BHP proposed future pit
- Third party operations estimated current pit locations
- Palaeovalleys (Bell et. al. 2012)
- BHP pits
- RTIO - Hope Downs

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BHP

PUBLIC

MARILLANA CREEK (YANDI) SIGNIFICANT AMENDMENT

CURRENT AND PLANNED MINE PITS IN THE CENTRAL PILBARA HUB

WAIO PLANNING, TECHNICAL & ENVIRONMENT

SCALE @A4:	1:540,000	PREPARED:	GEOMATTICS	FIGURE:	16-3
DATE:	6/05/2025	REQUESTOR:	ENV APPROVALS		

A1205-076-RevE

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16.5 Social Surroundings

The cumulative impact assessment for Social Surroundings has focussed on the Banjima Native Title determination area (WCD2014/001; Figure 11-1 in Section 11.3) and includes consideration of existing BHP operations (this Proposal, the Approved Proposal, Mining Area C/South Flank) and existing and potential future third-party operations (Yandicoogina, Koodaideri, Hope Downs and Hope Downs 2).

BHP recognises that the implementation of the Combined Proposal, in association with other existing BHP projects and nearby operational and future third-party proposals has the potential to cumulatively affect social, cultural and heritage values. These impacts include the cumulative loss of cultural heritage sites and values, loss of access to sacred sites and other places of cultural significance, loss of cultural integrity of cultural places, degradation of cultural heritage values through indirect effects such as increased dust, vibration, noise, and a loss of amenity.

BHP notes that Banjima representatives through BNTAC have expressed concerns regarding the reliability of cumulative impact assessments to Country and Culture. Cumulative impacts to Country and Culture are often further compounded by the confidentiality of data and lack of publicly available data.

Overall, all of the above-mentioned existing and potential future operations have taken impacts to social surroundings into consideration, with extensive survey effort and Traditional Owner consultation having been undertaken. Many of these operators have management plans in place to enable works to be carried out in a manner that is sensitive to the heritage and cultural values of the Traditional Owners, with ongoing engagement and consultation factored into the management strategies.

BHP has designed this Proposal to minimise impacts to native vegetation, heritage sites and water values in consultation with the Traditional Owners (refer to Section 11.6.1). BHP have refined the design of the Proposal footprint several times to avoid impacts to Aboriginal heritage sites and minimise additional vegetation clearing to a total disturbance of 95 ha, taking total clearing for the Yandi mine to 4,653 ha of native vegetation within the 13,158 ha Development Envelope. Based on a review of existing and potential future proposals currently being assessed (including the Combined Proposal), a total cumulative clearing of approximately 41,672 ha of native vegetation will have occurred within the Banjima Native Title determination area within the foreseeable future. This represents approximately 5% of the Banjima Native Title determination area which covers an area of approximately 826,300 ha. The Combined Proposal's contribution toward this cumulative clearing is approximately 0.6% of the Banjima Native Title determination area, whereas this Proposal's contribution to the cumulative clearing is approximately 0.2% of the Banjima Native Title determination area. BHP considers that the refinement of the Proposal has minimised the cumulative impacts to native vegetation as far as possible.

The Proposal will produce approximately 25 Mt of iron ore over a 5-year period, contributing to a total overall production for the Combined Proposal of approximately 70 Mt over a 5-year period, well below the authorised 87 Mt/pa. As such, the cumulative contribution of the Combined Proposal on dust, vibration and noise will be less than when the Yandi Project was running at full production. The Combined Proposal will not require an increase in existing groundwater abstraction limits or dewater discharge, ensuring minimal cumulative impacts when considered in relation existing nearby projects.

Through the development and implementation of the SCHEMP, BHP will ensure access to areas of significance to the Banjima Traditional Owners are maintained with cumulative impacts to access minimised. Through the implementation of the SCHEMP and CHMP and the other related environmental management plans (EMPs), it is expected that impacts from the Combined Proposal will be appropriately managed so that cumulative impacts to social, cultural and heritage values will be minimised.

Banjima representatives through BNTAC have expressed concerns regarding ongoing impacts to the culturally significant water values at the Yandi mine. BHP has been consulting with the Banjima Traditional Owners, through BNTAC and with DWER, on proposed measures to abate ongoing impacts to Flat Rocks (refer to Section 7.5.2.2). After the implementation mitigation measures, including groundwater reinjection and rehabilitation, BHP considers

the Combined Proposal will not significantly contribute to existing impacts to culturally significant water values at the Yandi mine (refer to Section 7).

BHP has also considered the potential for cumulative impacts from the Combined Proposal on other places of significance to the Banjima People. Yandicoogina Gorge is located approximately 4 km south of the Development Envelope and contains cultural heritage values (archaeological sites) significant to the Banjima Traditional Owners. Monitoring has identified groundwater decline in the Minister's North aquifer and a corresponding decline in groundwater dependent vegetation condition in the gorge. The current measured drawdown in the Ministers North aquifer in the vicinity of Yandicoogina Gorge is approximately 3.5 m; this drawdown is predicted to increase to approximately 6.1 m as a result of cumulative groundwater drawdown, see Section 7.5.2.3 and Figures 7-9 and 7-10 for further information. Whilst the exact cause is unknown, it is considered likely to be a result of either climate variability, or a combination of climate variability and regional cumulative groundwater dewatering activities. Modelling indicates the Proposal is unlikely to contribute towards cumulative impacts to groundwater additional to those identified for the Approved Proposal and nearby third-party mining operations, and it is considered that implementation of the Proposal alone is unlikely to cause drawdown in the Ministers North Aquifer (refer to Section 16.1.1). BHP have, nevertheless, committed to mitigating the observed decline in groundwater levels at Yandicoogina Gorge and have commenced a hydrological investigation into better understanding the cause of the decline. BHP acknowledges that Yandicoogina Gorge is place of significance to the Banjima Traditional Owners and has consulted with the Banjima People on these observations and presented a mitigation strategy for consideration. BHP proposed a short-term mitigation trial to stabilise groundwater levels within the gorge, which BHP believe will assist to stabilise ecosystem health. The trial will also obtain additional data to improve the understanding of the local hydrogeology mechanisms and gorge functions, this will aim to further support the development of longer-term strategies should they be required. The trial data will also be supported by additional regional hydrogeological investigations that are being planned by BHP and other stakeholders. The Banjima People endorsed the implementation of the mitigation strategy at the Banjima HAC meeting held in Perth on 6-7 December 2023 (see Table 11-2 in Section 11.3.2). At the time of publication, BHP have initiated a 6-month supplementation trial in Yandicoogina Gorge in consultation with DWER, EPA and Traditional Owners (the Banjima People) as described in Section 16.2.2.2 and will provide regular updates to all stakeholders and provide a report at the end of the 6-month trial period.

The subject of mine closure has featured heavily during social surroundings engagements and is of concern to the Banjima Traditional Owners. BHP also notes that the Banjima Traditional Owners have shown an interest in mine closure and rehabilitation, including cumulative impacts, and have expressed a clear preference for the avoidance of pit lakes at closure. It is unknown how many pit lakes currently occur within the Banjima Native Title determination area; however, there are estimated to be 97 pit lakes in the Pilbara (EPA 2014). The proposed E8 pit will be backfilled to above water table, preventing pit lake formation as a result of implementation of this Proposal. BHP's progressive closure philosophy for the Yandi Hub includes a priority focus on progressive backfilling into mined-out pits as much as possible; however, based on the current mine plan, and due to availability of resource for backfill, pit lakes would be expected to form in several pits at Yandi. This will be in addition to the two mine pit lakes predicted to occur at nearby third-party operations at Yandicoogina. This is a major consideration in planning for the closure of the Yandi mine as Yandicoogina mine is extracting ore from the same CID aquifer as the Yandi mine. BHP are currently progressing a project to explore alternative closure strategies in consideration of Traditional Owner preference for no pit lakes and anticipate that cumulative impacts associated with pit lake formation will be appropriately managed in accordance with the Yandi MCP.

BHP considers that the cumulative impact to Social Surroundings from implementation of the Combined Proposal when considered in conjunction with past, present and/or reasonably foreseeable future activities has the potential to be significant. The impacts associated with the Combined Proposal will be minimised and managed through the implementation of the SCHEMP, the CHMP, EMPs, the MCP and the implementation of the mitigation strategies outlined within these documents. The outcomes of the mitigation measures that are being implemented to manage impacts to water values will be incorporated into the closure strategy for the Yandi mine. BHP acknowledges that there is further work to be undertaken to better understand the cumulative impacts observed at Yandicoogina Gorge.

BHP is in the early stages of investigating mid to long-term options to mitigate the observed cumulative impacts at Yandicoogina Gorge which will be further informed by the outcomes of the supplementation trial and the outcomes of the additional regional investigations. BHP will continue to provide updates on the outcomes of these investigations to all stakeholders.

16.6 Greenhouse Gas Emissions

Cumulative GHG emissions are a contributor to climate change. The cumulative emissions from the Combined Proposal have the potential to contribute to WA's GHG emissions. As discussed in Section 12, the estimated percentage contribution of the Combined Proposal average Scope 1 emissions to State and National GHG emission is 0.06% and 0.011% respectively. BHP will implement the decarbonisation strategy outlined in the Section 12.5, including progressive reduction of Scope 1 emissions in accordance with the Safeguard Mechanism.

17 References

Advisian (2023) *Marillana Creek Baseline Hydrology Study: Yandi Closure Landform SPS*. August 2023.

ANZECC & ARMCANZ (2000) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Australia and New Zealand Environment and Conservation Council and the Agriculture and Resource Management Council of Australia and New Zealand. Paper No. 4. Canberra.

APA Group (APA) (2024) Port Hedland Solar and Battery Project. Port Hedland Solar and Battery Project.

Aquaterra (2008) *RGP5 Yandi LOM Dewatering Requirements and Discharge Projections*. Memo to BHPBIO, 9 May 2008.

AQ2 (2022) *Ministers North Ecohydrology*. Prepared for BHP Iron Ore, March 2022.

Astron Environmental Services (Astron) (2011) *Yandi Mine Site Weed Inspection, August 2010*. Letter to BHP, 22 March 2011.

Astron Environmental Services (Astron) (2019) *Area C West to Yandi Flora and Vegetation Assessment*. Prepared for BHP WAIO, March 2019.

Astron Environmental Services (Astron) (2020) *Technical Tree Health Report for Marillana Creek. Prepared for BHP*, November 2020.

Astron Environmental Services (Astron) (2022) *Riparian Vegetation Monitoring Program, Marillana Creek Annual Report 2021-2022*. Prepared for BHP Western Australia Iron ore, July 2022.

Astron Environmental Services (Astron) (2023a) *Yandi 45c Targeted Significant Vertebrate Fauna Survey*. Prepared for BHP Western Australian Iron Ore.

Astron Environmental Services (Astron) (2023b) *Ministers North Targeted Significant Vertebrate Fauna Survey*. April 2023. Prepared for BHP Western Australian Iron Ore.

Astron Environmental Services (Astron) (2024a) *Marillana Creek RVMP Annual Summary 2023-2024*. Prepared for BHP WAIO, 28 June 2024.

Astron Environmental Services (Astron) (2024b) *Ministers North Consolidated Targeted Significant Vertebrate Fauna Surveys.*

Astron Environmental Services (Astron) (2025) *Marillana Creek RVMP Report Card May 2024 to November 2024*. Prepared for BHP WAIO, 12 March 2025.Ball, J., Babister, M., Nathan, R., Weeks, W., Weinmann, E., Retallick and M., Testoni, I. (2019) *The Australian Rainfall and Runoff: A Guide to Flood Estimation*, Commonwealth of Australia (Geoscience Australia).

Bat Call WA (2021b) *A review of Pilbara leaf-nosed bat ecology, threats and survey requirements*, report prepared for the Department of Agriculture, Water and the Environment, Canberra, November. CC BY 4.0.

Bat Call WA (2021a) *A review of Ghost Bat ecology, threats and survey requirements*. Report prepared for the Department of Agriculture, Water and the Environment, Canberra, November. CC BY 4.0.

Beard, J. S. (1975) *The vegetation of the Nullarbor Area: 1:1,000,000 vegetation series, map and explanatory notes to sheet 4*. Nedlands, Western Australia: University of Western Australia Press.

Bell, J.G., Kilgour, P.L., English, P.M., Woodgate, M.F., Lewis, S.J. (2012). *WASANT Palaeovalley Map - Distribution of Palaeovalleys in Arid and Semi-arid WA-SA-NT*. Geoscience Australia, Canberra.

Bennelongia Environmental Consultants (Bennelongia) (2013) *Yandi stygofauna – continuation of monitoring program*.

Bennelongia Environmental Consultants (Bennelongia) (2015) Strategic Environmental Assessment: Description of Regional Subterranean Fauna. Prepared for BHP Billiton Iron Ore.

Bennelongia Environmental Consultants (Bennelongia) (2022) *Central Pilbara Stygofauna Desktop Assessment Prepared for BHP, November 2022*.

Bennelongia Environmental Consultants (Bennelongia) (2024a) *Yandi Operations Short-Range Endemic Fauna Survey Report*.

Bennelongia Environmental Consultants (Bennelongia) (2024b) *Yandi Operations Subterranean Fauna Survey Report. Prepared for BHP*.

Bennelongia Environmental Consultants (Bennelongia) (2024c) *Ministers North Subterranean Fauna Survey*. Prepared for: BHP Western Australian Iron Ore, December 2024.

Bennelongia Environmental Consultants (Bennelongia) (2024d) *Ministers North Short-Range Endemic (SRE) Desktop and Field Survey.* Prepared for: BHP Western Australian Iron Ore.

Bennelongia Environmental Consultants (Bennelongia) (2025) Yandi Targeted Subterranean Fauna Survey Report.

BHP (2016) *Marillana Creek Diversion Management Plan.* Rev 0. BHP 2016.

BHP (2018) *Vegetation and Flora Survey Procedure*, Document number: 0124627, Version 2.0, February 2018.

BHP (2019) *BHP Iron Ore Annual Environmental Report* (July 2018-June 2019).

BHP (2019a) *Memorandum Flat Rocks Pool Hydrological Conceptualisation*. Prepared by BHP.

BHP (2020a) *BHP Iron Ore Annual Environmental Report* July 2019-June 2020.

BHP (2020b) *Yandi Biodiversity Environmental Management Plan* Rev 0 BHP 2020.

BHP (2021) *BHP Iron Ore Annual Environmental Report* July 2020-June 2021.

BHP (2022a) *BHP Iron Ore Annual Environmental Report* July 2021-June 2022.

BHP (2022b) *Yandi Borefields TAR*. September 2022. BHP, Perth, Western Australia.

BHP (2022c) *Short-range Endemic Invertebrate Fauna Assessment Methods Procedure*.

BHP (2022d) *Short-range endemic invertebrate fauna assessment methods: technical process instruction*. Version 4.0.BHP WAIO: Perth.

BHP (2023a) *BHP Iron Ore Annual Environmental Report* July 2022-June 2023.

BHP (2023b) *Environmental Weed Management in Western Australia Procedure*. Version 4.0.

BHP (2023c) *Operational Decarbonisation*. Presentation and Speech 21 June 2023 [online]. Available from: Operational decarbonisation.

BHP (2023d) *Guidance for Terrestrial Vertebrate Fauna Surveys in the Pilbara*, BHP, Western Australia.

BHP (2023e) *Pilbara Strategic Assessment Assurance Plan and Offsets Plan*. Revision 2.3, May 2023.

BHP (2023f) *Impact Reconciliation Procedure: Ministerial Statement 1012 Orebody 18, Ministerial Statement 1021 Orebody 31, Ministerial Statement 1037 Eastern Ridge, Ministerial Statement 1039 Marillana Creek-Yandi, Ministerial Statement 1126 Jimblebar, Document number 0147312*, Version 2.3. February 2023.

BHP (2024a) *Annual Environmental Review July 2023-June 2024.* October 2024

BHP (2024b) *Yandi Borefields Annual Aquifer Review 2024.*

BHP (2024c) *Yandi Conceptual Hydrogeological Model*. May 2024.

BHP (2024d) *Ministers North Aquifer Numerical groundwater modelling.* May 2024

BHP (2024e) *GWL Operating Strategy for Yandi – Version 3.1.* April 2024

BHP (2024f) *BHP GHG Emissions Calculation Methodology 2024.*

BHP (2024g) Climate Transition Action Plan (CTAP) (2024). Available from: Climate Transition Action Plan | BHP.

BHP (2024h) *Toyota Australia and BHP to trial first-ever battery electric HiLux Double Cab*. 29 October 2024. Available from: https://www.bhp.com/news/media-centre/releases/2024/10/toyota-australia-and-bhp-to-trial-first-ever-battery-electric-hilux-double-cab.

BHP (2025a) *Yandi Biodiversity Environmental Management Plan Revision* 2. BHP 2025.

BHP (2025b) *Marillana Creek (Yandi) Mine Closure Plan Revision* 6. BHP 2025.

BHP (2025c) *Marillana Creek Water Resource Management Plan Revision 2*. BHP 2025.

BHP (2025d). *Yandi Impact Reconciliation Procedure Revision* 2.0. BHP 2025.

BHP (2025e). *Yandi Life of Mine Proposal Social Cultural Heritage Environment Management Plan Revision 2*. BHP 2025.

BHP (2025f). *Mining Area C-Southern Flank Significant Amendment: Environmental Review Document.* February 2025

BHP Billiton (2008) *Two Phase Assessment of the Flora and Vegetation of the Proposed Marillana Creek (Yandi) Mine Extension Areas RGP5-KBR*. June 2008.

BHP Billiton (2010) *Memorandum: Declared Rare Flora (DRF) and Priority flora search at Yandi - Proposed haul road crossing at Marillana Creek*. 30 September 2010.

BHP Billiton (2014) *Marillana Creek (Yandi) Mine Surface Water and Groundwater Management Plan* Rev 3 BHP (2014).

BHP Billiton (2015) *Yandi Additional Disturbance Application under Section 45C of the Environmental Protection Act 1986*. November 2015.

BHP Billiton (2017a) *BHP Billiton Iron Ore Pilbara Strategic Assessment Program*. May 2017.

BHP Billiton (2017b) *Mining Area C Southern Flank Public Environmental Review*.

BHP Billiton (2018) *GWL Operating Strategy for Yandi. Document ID 0021252*, Version 2.0. BHP Billiton Iron Ore, Perth, Western Australia.

Biologic Environmental Survey (Biologic) (2011a) *Area C to Yandi Fauna Survey*. BHP Billiton Iron Ore Pty Ltd August 2011.

Biologic Environmental Survey (Biologic) (2011b) *Yandi Vertebrate Fauna Review*. BHP Billiton Iron Ore Pty Ltd March 2011.

Biologic Environmental Survey (Biologic) (2013) *Yandi Mine, Short-range Endemic Invertebrate Survey and Impact Assessment*. BHP Billiton Iron Ore Pty Ltd.

Biologic Environmental Survey (Biologic) (2014) *Consolidated Fauna Habitat Mapping*. BHP Billiton Iron Ore Pilbara Tenure May 2014.

Biologic Environmental Survey (Biologic) (2015) *Yandi Tenement Short-range Endemic Invertebrate Survey*. BHP Billiton Iron Ore Pty Ltd.

Biologic Environmental Survey (Biologic) (2017) *Ministers North Level 2 Vertebrate Fauna Survey*.

Biologic Environmental Survey (Biologic) (2018a) *Updated Consolidated Fauna Habitat Mapping*.

Biologic Environmental Survey (Biologic) (2018b) *Ministers North to Yandi Corridor Single Phase Level 2 Fauna and Detailed Flora/Vegetation Survey*. BHP Pty Ltd December 2017.

Biologic Environmental Survey (Biologic) (2020a) *Ministers North Miscellaneous Licence Area Amendment Surveys and Yandicoogina Creek Detailed Flora and Vegetation Assessment*. Report to BHP Western Australian Iron Ore, December 2020.

Biologic Environmental Survey (Biologic) (2020b) *Ministers North: Yandicoogina Creek Aquatic Ecosystem Surveys*.

Biologic Environmental Survey (Biologic) (2021) *Ministers North and Yandicoogina Creek Short-Range Endemic Invertebrate Fauna Survey*. Report to BHP Western Australia Iron Ore. April 2021.

Biologic Environmental Survey (Biologic) (2022a) *MAC Phase 4: Marillana Creek Baseline Aquatic Ecosystem Survey Dry 2020 & Wet 2021.*

Biologic Environmental Survey (Biologic) (2022b) *Ministers North: Yandicoogina Creek Aquatic Ecosystem Surveys Dry 2020 and Wet 2021.*

Biologic Environmental Survey (Biologic) (2023a) *Yandi E8 Targeted Flora Survey*. Report to BHP Western Australian Iron Ore. February 2023.

Biologic Environmental Survey (Biologic) (2023b) *CPH Targeted MNES Survey*. Report to BHP WAIO.

Biologic Environmental Survey (Biologic) (2023c) *Yandicoogina Gorge Mitigation Water Quality Desktop Review*. Report prepared for BHP WAIO.

Biologic Environmental Survey (Biologic) (2023d) *Ministers North, Yandicoogina Creek Aquatic Ecosystem Survey Dry 2021 and Wet 2022.* Unpublished report prepared for BHP Western Australian Iron Ore.

Biologic Environmental Survey (Biologic) (2023e) *MAC Phase 4: Marillana Creek Baseline Aquatic Ecosystem Survey Dry 2021 & Wet 2022.* Report to BHP Western Australia Iron Ore.

Biologic Environmental Survey (Biologic) (2024a) *Central Pilbara Hub Detailed and Targeted Flora Survey*. Unpublished report prepared for BHP Western Australian Iron Ore.

Biologic Environmental Survey (Biologic) (2024b) *MAC Phase 4: Marillana Creek Aquatic monitoring Dry 2022 and Wet 2023.* Report to BHP Western Australia Iron Ore.

Biologic Environmental Survey (Biologic) (2024c) *Ministers North Yandicoogina Creek Aquatic Ecosystem Survey Dry 2022 and Wet 2023.* Report to BHP Western Australia Iron Ore.

Biologic Environmental Survey (Biologic) (2024d) *Jugari East 8 Subterranean Fauna Habitat Modelling*. Unpublished report prepared for BHP Western Australian Iron Ore.

Biologic Environmental Survey (Biologic) (2024e) *Breakaway and Marillana South Basic Terrestrial Vertebrate Fauna Survey*. Report to BHP WAIO.

Biologic Environmental Survey (Biologic) (2024f) *Yandicoogina Gorge Riparian Vegetation Monitoring 2023–2024*. Unpublished report prepared for BHP Western Australian Iron Ore. October 2024.

Biota Environmental Sciences (Biota) (2002) *Mining Area C Rail Corridor Rare Flora Survey*. Prepared for BHP Billiton, February 2002.

Biota Environmental Sciences (Biota) (2003) *Mining Area C Rail Corridor Seasonal Rare Flora Survey Phase 2*. Prepared for BHP Billiton, February 2003.

Biota Environmental Sciences (Biota) (2006) *BHP Billiton Iron Ore Regional Subterranean Fauna Study*. Prepared for BHP Billiton.

Biota Environmental Sciences (Biota) (2008) *BHP Billiton Regional Subterranean Fauna Study (stygofauna).*

Biota Environmental Sciences (Biota) (2010) *Yandicoogina Junction South West Oxbow Fauna Survey.*

Biota Environmental Sciences (Biota) (2013) *Area C West to Yandi Level 2 Vertebrate Fauna Survey*. BHP Billiton Iron Ore Pty Ltd September 2013.

Biota Environmental Sciences (Biota) (2014) *A Survey of the Short Range Endemic Invertebrate Fauna of Area C West to Yandi*. Prepared for BHP Billiton Iron Ore, January 2014.

Biota Environmental Sciences (Biota) (2015) *Yandi operations stygofauna data consolidation 2003-2014*. BHP Billiton Iron Ore Pty Ltd.

Biota Environmental Sciences (Biota) (2022) *MAC Phase 4 Marillana Creek Targeted MNES Fauna Survey*. Prepared for BHP WAIO.

BirdLife International (2024) *Species factsheet: Falco hypoleucos*. Downloaded from http://datazone.birdlife.org/species/factsheet/grey-falcon-falco-hypoleucos on 16/01/2024.

Butler, R. (2009) *Vulnerability of Plant Functional Types to Dust Deposition in the Pilbara, NW Australia*. School of Plant Biology, University of Western Australia, Perth, October 2009.

Canning, Dr S., Sutherland, F., Connolly, P., Colman, R. and Taylor, C. (2023) *Social Surroundings Assessment Section 38 Yandi Continuing Operations: a Report to Karijini Developments Pty Ltd*. Australian Cultural Heritage Management. 18 June 2023.

Caterpillar (2022) *Caterpillar Successfully Demonstrates First Battery Electric Large Mining Truck and Invests in Sustainable Proving Ground* [online]. Available from: https://www.caterpillar.com/en/news/corporate-press-releases/h/caterpillar-succesfully-demonstrates-first-battery-electric-large-mining-truck.html.

Caterpillar (2024) *Cat 793 XE Early Learner Battery Electric Trucks Begin Testing and Validation at Global Customer Sites.* Published 20 Sept 2024. Available from: Cat 793 XE Early Learner battery electric trucks begin validation | Cat | Caterpillar.

Clark, H.L.; Buzatto, B.A.; Halse, S.A. (2021) *A Hotspot of Arid Zone Subterranean Biodiversity: The Robe Valley in Western Australia*. Diversity 2021, 13, 482. https://doi.org/ 10.3390/d13100482.

Department of Biodiversity, Conservation and Attractions (DBCA) (2023) *Priority Ecological Communities for Western Australia.* Version 35*.* Species and Communities Program, Department of Biodiversity, Conservation and Attractions. 19 June 2023

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2020) *Interim Biogeographic Regionalisation for Australia (IBRA)*, Version 7.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2022a) *National Recovery Plan for the Australian Painted Snipe (Rostratula australis).* Available from: http://www.dcceew.gov.au/environment/biodiversity/threatened/publications/recovery/australian-painted-snipe-2022. In effect under the EPBC Act from 08-Mar-2023 as Rostratula australis

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2022b) *Independent Review of Australian Carbon Credit Units – Executive Summary Final Report: Recommendations and Key Findings*, December 2022 [online] Available at: https://www.dcceew.gov.au/sites/default/files/documents/independent-review-accu-final-report.pdf.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2023a) *Draft PFAS National Environmental Management Plan*: Version 3. Commonwealth of Australia 2023.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2023b) *Toxicant default guideline values for ecosystem protection: Perfluorooctane sulfonate (PFOS) in freshwater*. Commonwealth of Australia 2023.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2023c) *Liasis olivaceus barroni — Olive Python (Pilbara subspecies)*. Species Profile and Threats Database (SPRAT).

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2023d) *Guidance on supplementary approaches to determine default emissions intensity values: Companion document to the Safeguard Mechanism Framework for developing production variables and default emissions-intensity values document*. Available online: https://www.dcceew.gov.au/sites/default/files/documents/guidance-supplementary-approaches-determine-default-emissions-intensity-values.pdf, accessed 14 March 2024.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2024a) *Safeguard Mechanism*. Australian Government, May 2024.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2024b) *National Inventory Report 2022* [online]. Available from https://www.dcceew.gov.au/climate-change/publications/national-inventory-report-2022. Accessed May 2025.

Department of Mines, Industry Regulation and Safety (DMIRS) (2023a) *Statutory Guidelines for Mine Closure Plans: Mining Act 1978*. Version 4.0, January 2023.

Department of Mines, Industry Regulation and Safety (DMIRS) (2023b) *Mine Closure Plan Guidance - How to prepare in accordance with Part 1 of the Statutory Guidelines for Mine Closure Plans*. Version 4.0, January 2023.

Department of the Environment (DoE) (2013) *Matters of National Environmental Significance: Significant Impact Guidelines 1.1*. Australian Government, Canberra.

Department of Primary Industries and Regional Development (DPIRD) (2022) *Soil Landscape Mapping - Systems (DPIRD-064).* Available from: https://catalogue.data.wa.gov.au/dataset/soil-landscape-mapping-systems. Accessed January 2024.

Department of Water (DoW) (2009) *Operational Policy 5.12- Hydrogeological reporting associated with a groundwater well licence*. Government of Western Australia.

Department of Water (DoW) (2013) *Western Australian Water in Mining Guideline*. Water licensing delivery series, Report no. 12.

Department of Water and Environmental Regulation (DWER) (2019a) *A guide to the exemptions and regulations for clearing native vegetation: Under Part V of the Environmental Protection Act 1986*. August 2019.

Department of Water and Environmental Regulation (DWER) (2019b) *Pilbara Environmental Offsets Fund Implementation Plan*. November 2019.

Department of Water and Environmental Regulation (DWER) (2020) *Use of mine dewatering surplus*. December 2020.

Department of Water and Environmental Regulation (DWER) (2022) *DRAFT Procedure for environmental offsets metric inputs For use with the WA environmental offsets metric*.

Department of Water and Environmental Regulation (DWER) (2023a) *Water Information Reporting*. www.wir.water.gov.au Accessed 28 November 2023

Department of Water and Environmental Regulation (DWER) (2023b) *The Water Register*. https://maps.water.wa.gov.au Accessed 29 November, 2023

Department of Water and Environmental Regulation (DWER) (2024) *Water Information Reporting*. www.wir.water.gov.au Accessed 17 July 2024

Dunlop, J. (2017) *Pilbara Northern Quoll Research Program: Annual Report 2016*, Department of Parks and Wildlife, Perth.

Eamus, D., Hatton, T., Cook, P. and Colvin, C. (2006) *Ecohydrology: Vegetation Function, Water and Resource Management.* CSIRO Publishing, 2006.

Ecologia Environment (Ecologia) (1995) *Yandi Stage 2 Biological Assessment Survey*.

Ecologia Environment (Ecologia) (1996) Y*andi Stage 2 Iron Ore Project - Pebble-mound Mouse Pseudomys chapmani Site Survey*. BHP Iron Ore.

Ecologia Environment (Ecologia) (1998a) *Yandi Vegetation and Soil Survey*. December 1998.

Ecologia Environment (Ecologia) (1998b) *Mining Area C Biological Survey*. BHP Iron Ore.

Ecologia Environment (Ecologia) (2001) *Mining Area C to yandi Rail Line Baseline Weed Survey*. Prepared for BHP Billiton, October 2001.

Ecologia Environment (Ecologia) (2003) *IOWA Conveyor: Amendment to Rare and Priority Flora Survey*. Prepared for BHP Billiton iron ore, August 2003.

Ecologia Environment (Ecologia) (2004) *Yandi Stockyard and Overland Conveyor Fauna and Flora Assessment*. BHP Iron Ore.

Ecologia Environment (Ecologia) (2005) *Upper Marillana Exploration Project Biological Survey*. BHP Iron Ore.

Ecologia Environment (Ecologia) (2006) *MPD JV Rail Corridor Survey: BHP BIO Yandi Rail Corridor DRF and Priority Flora Assessment*. June 2006.

Ecologia Environment (Ecologia) (2007) *Yandi Mine Extension RGP5 - EIA Flora Survey Interim Report Post Phase 1 Survey*. December 2007.

Ecologia Environment (Ecologia) (2008a) *RGP5 Yandi to Kurrajura Siding and Yandi Repeater One Flora and Vegetation Report*. Version 3. October 2008.

Ecologia Environment (Ecologia) (2008b) *Marillana Creek (Yandi) Iron Ore Mine Modification Level 2 Fauna Survey*. Report to BHPBIO.

Ecologia Environment (Ecologia) (2008c) *RGP5 Fauna Survey Kurrajura Siding to Yandi Wye (incl. Yandi Repeater 1).* BHPBIO rail duplication project.

Elliott CP and Stevens J (2025) *Flat Rock Springs Tree Restoration Program: Guidelines for Melaleuca argentea restoration*. Kings Park Science, Department of Biodiversity, Conservation and Attractions for BHP Group Ltd.

ENV Australia (ENV) (2008a) *Summary of important findings from Rapid Growth Project 5 Railway Project - Biological Assessments*. June 2008.

ENV Australia (ENV) (2008b) *Summary of Important Findings from RGP5 Railway Project Biological Assessments*. Letter Report to BHP Iron Ore.

ENV Australia (ENV) (2009a) *Newman to Yandi Transmission Line Flora and Vegetation Assessment*. November 2009.

ENV Australia (ENV) (2009b) *Western 6, 7 & 8 Flora and Vegetation Assessment*. Prepared for BHP Billiton Iron ore Pty. Ltd. October 2009.

ENV Australia (ENV) (2009c) *Western 2 and Western 1 Waste Dump Flora and Vegetation Assessment*. Prepared for BHP Billiton Iron Ore Pty. Ltd.

ENV Australia (ENV) (2009d) *Central 3 Flora and Vegetation Assessment*. prepared for BHP Billiton Iron ore Pty. Ltd. October 2009.

ENV Australia (ENV) (2009e) *Rapid Growth Project 5: Yandi Flora Survey and Assessment of Barimunya Airport and a Potential Borrow Area*. prepared for Fast JV. April 2009.

ENV Australia (ENV) (2009f) *RGP5 Yandi Flora Survey and Assessment of Barimunya Airport and a Potential Borrow Area*. Prepared for FAST JV.

ENV Australia (ENV) (2009g) *Newman to Yandi Transmission Line Terrestrial Vertebrate Fauna Assessment*. Prepared for WorleyParsons.

Environmental Protection Authority (EPA) (2000). *Environmental Protection of Native Vegetation in Western Australia: Clearing of Native Vegetation with Particular Reference to the Agricultural Area*, Position Statement No. 2. December, 2000.

Environmental Protection Authority (EPA) (2002) *Terrestrial Biological Surveys as an Element of Biodiversity Protection*, Position Statement No. 3, EPA, Perth.

Environmental Protection Authority (EPA) (2003) *Guidance Statement 54 Consideration of subterranean fauna in groundwater and caves during environmental impact assessment in Western Australia.*

Environmental Protection Authority (EPA) (2004a) *EPA Guidance for the Assessment of Environmental Factors: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia*, No. 51, EPA, Perth.

Environmental Protection Authority (EPA) (2004b) *Guidance for the Assessment of Environmental Factors: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia*, No. 56.

Environmental Protection Authority (EPA) (2007b) *Sampling Methods and Survey Considerations for Subterranean Fauna in Western Australia*. Guidance Statement No. 54a (Technical Appendix to Guidance Statement No.54).

Environmental Protection Authority (EPA) (2009) *Guidance Statement No. 20 – Sampling of short range endemic invertebrate fauna for environmental impact assessment in Western Australia*.

Environmental Protection Authority (EPA) (2014) *Cumulative environmental impacts of development in the Pilbara region*. Advice of the Environmental Protection Authority to the Minister for Environment under Section 16(e) of the *Environmental Protection Act 1986*.

Environmental Protection Authority (EPA) (2016a) *Environmental Factor Guideline: Flora and Vegetation*. EPA, Western Australia.

Environmental Protection Authority (EPA) (2016b) *Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment*. Perth, Western Australia. December 2016

Environmental Protection Authority (EPA) (2016c) *Environmental Factor Guideline: Terrestrial Fauna*. EPA, Western Australia. December 2016.

Environmental Protection Authority (EPA) (2016d) *Technical Guidance: Sampling of short range endemic invertebrate fauna*. EPA, Western Australia.

Environmental Protection Authority (EPA) (2016e) *Environmental Factor Guideline: Subterranean Fauna.*

Environmental Protection Authority (EPA) (2016f) *Environmental Factor Guideline: Terrestrial Environmental Quality*.

Environmental Protection Authority (EPA) (2016g) *Marillana Creek (Yandi) life-of-mine proposal - inquiry under section 46 of the Environmental Protection Act 1986 to amend Ministerial Statement 679*, EPA Report 1577. August 2016.

Environmental Protection Authority (EPA) (2016h) *Technical Guidance Sampling Methods for Terrestrial Vertebrate Fauna.*

Environmental Protection Authority (EPA) (2016i) *Technical Guidance Terrestrial Fauna Surveys.*

Environmental Protection Authority (EPA) (2018a) *Environmental Factor Guideline: Inland Waters*. EPA, Western Australia.

Environmental Protection Authority (EPA) (2018b) *Environmental Factor Guideline – Landforms*, EPA, Western Australia. Version 2.0. June 2018.

Environmental Protection Authority (EPA) (2020a) *Technical Guidance: Terrestrial vertebrate fauna surveys for environmental impact assessment*. EPA, Western Australia.

Environmental Protection Authority (EPA) (2020b) *Environmental Factor Guideline: Air Quality*.

Environmental Protection Authority (EPA) (2021a) *Environmental Impact Assessment (Part IV Divisions 1 and 2) Procedures Manual: Requirements under the Environmental Protection Act 1986 (Procedures Manual).*

Environmental Protection Authority (EPA) (2021b) *Taking decision making processes into account in EIA Interim Guidance*, EPA, Perth, Western Australia. Version 1.0. 22 October 2021.

Environmental Protection Authority (EPA) (2021c) *Technical guidance – Subterranean fauna surveys for environmental impact assessment*.

Environmental Protection Authority (EPA) (2021d) *How to prepare an Environmental Review Document Instructions. EPA, Western Australia.*

Environmental Protection Authority (EPA) (2021e) *Instructions for the preparation of data packages for the Index of Biodiversity Surveys for Assessments*. EPA, Western Australia. 15 November 2021.

Environmental Protection Authority (EPA) (2023a) *Statement of Environmental Principles, Factors and Objectives*. EPA, Western Australia. April 2023.

Environmental Protection Authority (EPA) (2023b) *Environmental Factor Guideline – Social Surroundings*, EPA, Western Australia. Version 3.0. November 2023

Environmental Protection Authority (EPA) (2023c) *Technical Guidance - Environmental impact assessment of Social Surroundings – Aboriginal cultural heritage* - EPA, Western Australia. Version 2.0. November 2023

Environmental Protection Authority (EPA) (2024a) *Referral of a proposal under section 38 of the Environmental Protection Act 1986: Instructions.*

Environmental Protection Authority (EPA) (2024b) *How to prepare an Environmental Review Document: Instructions (ERD Instructions).*

Environmental Protection Authority (EPA) (2024c) *How to identify the content of a Proposal: Instructions and template (Proposal Content Instructions).*

Environmental Protection Authority (EPA) (2024d) *How to prepare Environmental Protection Act 1986 Part IV Environmental Management Plans: Instructions.*

Environmental Protection Authority (EPA) (2024e) *Environmental Factor Guideline - Greenhouse Gas Emissions*.

GHD (2010) *Report for Yandi W1 and W4 OSA - Targeted Rare and Priority Flora Survey*. February 2010.

GHD (2021) *Ministers North Fauna Survey Level 1 Survey*. BHP Western Australia Iron Ore. February 2021.

GHD (2022) *Targeted Flora Surveys of Pipeline Corridors*. BHP Western Australian Iron Ore. February 2022.

GHD and 360 Environmental (2015) *BHP Billiton Iron Ore's Strategic Proposal - Landscape and Visual Impact Risk Assessment*. Internal Report for BHP Billiton Iron Ore.

Golder Associates (2020) *Yandi Closure Identification Phase Study*. Rehabilitation and Revegetation Strategy. Unpublished report by Golder Associates Pty Ltd.

Golder Associates (2015) *Ecohydrological Conceptualisation of the Marillana Creek Region*. Prepared for BHP Billiton Iron Ore. September 2015.

Government of Australia (2024) *National Greenhouse and Energy Reporting Act 2007*. Last version 14 October 2024.

Government of India (2023) *Energy & Environment Management in Steel Sector* [online] Available at: https://steel.gov.in/energy-environment-management-steel-sector).

Government of Western Australia (2011) *WA Environmental Offsets Policy*. Environmental Protection Authority, Western Australia. September 2011.

Government of Western Australia (2014) *WA Environmental Offsets Guidelines*. Environmental Protection Authority, Western Australia. August 2014.

Government of Western Australia (2017) *Pilbara Conservation Strategy*. Available online: https://library.dbca.wa.gov.au/static/FullTextFiles/628083.pdf.

Government of Western Australia (2019a) *2018 State-wide Vegetation Statistics incorporating the CAR Reserve Analysis (full report)*, current as of March 2019, Western Australian Department of Biodiversity, Conservation and Attractions, Perth, Western Australia.

Government of Western Australia (2020) *Western Australian Climate Policy*. Government of Western Australia 2020, Perth, WA. Published 30 November 2020.

Government of Western Australia (2024) *Greenhouse Gas Emissions Policy for Major Projects*. Government of Western Australia. Updated October 2024.

Grierson, P. (2015) *Dust Deposition and Likelihood of Adverse Impact on Acacia sp. East Fortescue at Orebody 31*. School of Plant Biology, University of Western Australia, Perth, July 2015.

Halpern Glick Maunsell (1997) *Marillana Creek Iron Ore Project: Survey for Goodenia stellata and Flora of Interest*. Flora survey E4351B.

Halpern Glick Maunsell (1999) *Marillana Creek Western Access Corridor - Biological Assessment*. Survey ES995458, August 1999.

Hamersley HMS (2023) *Hope Downs 2 Proposal: Environmental Review Document.*

Hill B.M. and Ward S.J. (2010) *National Recovery Plan for the Northern Quoll Dasyurus hallucatus*. Department of Natural Resources, Environment, The Arts and Sport, Darwin.

INTERA (2023) *BHP Yandi E8 Groundwater Model*. Prepared for BHP Novemeber 2023.

International Climate Action Partnership (2024) *China National ETS Working Guidance 2024*. Available: https://icapcarbonaction.com/system/files/ets_pdfs/icap-etsmap-factsheet-55.pdf.

International Energy Agency (IEAGHG) (2013) *Iron and Steel CCS Study (Techno-Economics Integrated Steel Mill).* Available from: Iron and Steel CCS Study (Techno-Economics Integrated Steel Mill) - IEAGHG.

Kendrick, P. (2001) *Pilbara 3 (PIL3 - Hamersley subregion). In J. May & N. McKenzie (Eds.), A biodiversity audit of Western Australia's 53 biogeographical subregions in 2002 (pp. 568-580).* Kensington, Western Australia: Department of Conservation and Land Management.

King, D. R. (1989) *An assessment of the hazard posed to northern quolls (Dasyurus hallucatus) by aerial baiting with 1080 to control dingoes*. Australian Wildlife Research, 16(5), 569-574.

Matsuki M., Gardener, M., Smith, A., Howard, R. and Gove, A. (2016) *Impacts of dust on plant health, survivorship and plant communities in semi-arid environments*, vol 41 issue 4, Austral Ecology June 2016.

Maunsell Australia (Maunsell) (2003) *Yandi Life of Mine Flora and Fauna*. BHP Iron Ore.

Maunsell Australia (Maunsell) (2004) *Flora and Vegetation Survey: Lease M47/292 and E4 Drill Lines*. Prepared for BHP Billiton Iron ore Pty Ltd. January 2004.

Mine Waste Management (2022) *Yandi IPS Phase 2 Environmental Geochemistry Source Assessment*. Memorandum prepared for BHP.

Ministry of Environment, Forest and Climate Change (MoEFCC) (2023) Annual report 2023-2024. Available from: https://www.moef.gov.in/uploads/2023/05/Annual-Report-English-2023-24.pdf.

Ministry of Steel (MoS) (2024). Green steel focus: Ministry to launch roadmap for sustainable steel production. Available from: https://energy.economictimes.indiatimes.com/news/coal/green-steel-focus-ministry-to-launch-roadmap-for-sustainable-steel-production/113141373.

Northover, A., Palmer, R., Burbidge, A.H., Pearson, D., Dziminski, M., Ottewell, K., Prada, D.,Umbrello, L., and Gibson, L. (2023) *Summary of knowledge for six faunal species that are Matters of National Environmental Significance in the Pilbara, Western Australia.* Department of Biodiversity, Conservation and Attractions, Perth.

Onshore Environmental (Onshore) (2011) *Flora and Vegetation Review: Yandi ML 270SA*. Prepared for BHP Western Australia Iron Ore, July 2011.

Onshore Environmental (Onshore) (2014a) *Consolidation of Regional Vegetation Mapping, BHP Billiton Iron Ore Pilbara Tenure*. Report prepared for BHP Billiton Iron Ore Pty Ltd, June 2014, Western Australia.

Onshore Environmental (Onshore) (2014b) *Area C West to Yandi: Level 2 Flora and Vegetation Survey*. prepared for BHP Billiton iron ore, May 2014.

Onshore Environmental (Onshore) (2015) *Marillana Creek Riparian Flora and Vegetation Survey*. Prepared for BHP Billiton Iron Ore, October 2015.

Onshore Environmental (Onshore) (2018) *Marillana to Yandi Corridor Targeted Flora and Vegetation Survey*. Prepared for BHP Western Australia Iron Ore, June 2018.

Onshore Environmental (Onshore) (2020) *Ministers North and Yandi Vegetation Association and Condition Mapping*. Prepared for BHP Billiton Iron Ore, June 2020.

People's Republic of China 2022, People's Republic of China (2022) China's Achievements, New Goals and New Measures for Nationally Determined Contributions [online] Available at: https://unfccc.int/sites/default/files/NDC/2022-06/China%E2%80%99s%20Achievements%2C%20New%20Goals%20and%20New%20Measures%20for%20Nationally%20Determined%20Contributions.pdf

People's Republic of China (2021a) Working Guidance for Carbon Dioxide Peaking and Carbon Neutrality in Full and Faithful Implementation of the New Development Philosophy [online] Available at: https://en.ndrc.gov.cn/policies/202110/t20211024_1300725.html. Department of Resource Conservation and Environmental Protection.

People's Republic of China (2021b) Action Plan for Carbon Dioxide Peaking Before 2030 [online] Available at: https://en.ndrc.gov.cn/policies/202110/t20211027_1301020.html. Department of Resource Conservation and Environmental Protection.

Rio Tinto (2015) *Yandicoogina Iron Ore Project – Revised Proposal Public Environmental Review*.

Rio Tinto (2018) *Environmental Review Document Mesa A Hub Revised Proposal*, Assessment Number: 2107. Report prepared for Rio Tinto by Eco Logical Australia.

Shepherd, D.P., Beeston, G.R. and Hopkins, A.J.M. (2002) *Native Vegetation in Western Australia – extent, type and status, Resource Management Technical Report 249*, Western Australian Department of Agriculture, Perth, Western Australia.

Specialised Zoological (2008) *Survey for conservation significant bats between Kurrajura siding and the Yandi Wye*. Prepared for ecologia Environment | Calibre Engenium Joint Venture.

Subterranean Ecology (2010) *BHPBIO Regional Subterranean Fauna Study: Yandi Stygofauna Monitoring Review*.

Threatened Species Scientific Committee (TSSC) (2005) *Conservation listing advice for the Northern Quoll (Dasyurus hallucatus)*. Advice to the Minister for the Environment and Heritage from the Threatened Species Scientific Committee (TSSC) on Amendments to the list of Threatened Species under the *Environment Protection and Biodiversity Conservation Act 1999 (*EPBC Act).

Threatened Species Scientific Committee (TSSC) (2016a) *Conservation Advice Macroderma gigas (ghost bat).* Canberra, ACT: Commonwealth of Australia.

Threatened Species Scientific Committee (TSSC) (2016b) *Conservation Advice Rhinonicteris aurantia (Pilbara form) (Pilbara Leaf-nosed Bat).* Canberra: Department of the Environment. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/82790-conservation-advice-10032016.pdf. In effect under the EPBC Act from 10-Mar-2016.

Wetland Resource Management (WRM) (2015) *Yandi Aquatic Fauna Survey: Wet & Dry Season Sampling 2014*. Unpublished report by Wetland Research & Management to BHP Billiton Iron Ore. January 2015.

Wetland Research and Management (WRM) (2018) *Yandi: Marillana Creek Aquatic Fauna Survey. Wet and Dry 2017 Sampling*. Final Report.

World Bank (2021) *State and Trends of Carbon Pricing 2021* [online] Available at: https://openknowledge.worldbank.org/entities/publication/7d8bfbd4-ee50-51d7-ac80-f3e28623311d.

World Resources Institute (2013) *Nitrogen Trifluoride Now Required in GHG Protocol Greenhouse Gas Emissions Inventories* [online] Available at: https://www.wri.org/insights/nitrogen-trifluoride-now-required-ghg-protocol-greenhouse-gas-emissions-inventories.

Appendices

Appendix 1 Proposal Content Document

The *Marillana Creek (Yandi) Life of Mine Proposal Significant Amendment - Proposal Content Document* (Version 3.0, 6/05/2025) is provided separately.

Appendix 2 Analysis of Approved Proposal Ministerial Statements

As required by the Referral Instructions (EPA 2024a) and ERD Instructions (EPA 2024b), BHP has undertaken an analysis of the existing implementation conditions relating to the Approved Proposal.

Analysis of authorised extents

BHP does not seek any changes to the following extents for the Approved Proposal (see Appendix 1):

- Groundwater abstraction limit, as assessed under Part IV of the EP Act and authorised under the RiWI Act 5C Groundwater Licence GWL89501
- Surplus water management, as assessed under Part IV of the EP Act and authorised under Part V EP Act Operating Licence L6168/1991/11

Where BHP proposes to retain an existing authorised extent of an Approved Proposal for the Combined Proposal (if approved), see the proposed conditions for the Combined Proposal (Appendix 3).

Table A2-1: Marillana Creek (Yandi) Life of Mine Proposal – MS679 (Schedule 1)

Element	Authorised Extent	Combined Proposal
Project Life	Approximately 17 years	Included in total in **Condition A1 Limitations and Extent of Proposal**
Overall production rate	Approximately 87 Mt per year	Included in total in **Condition A1 Limitations and Extent of Proposal**
Marillana Creek diversion	Diversion of sections of Marillana Creek in order to maximise resource use in W5 mine area and the E1 to E6 mine area will be designed and constructed in accordance with the Marillana Creek Diversion Management Plan.	Included in total in **Condition A1 Limitations and Extent of Proposal** Included as outcomes in **Condition B1**
Pit depth	Typically, 60 metres (ranges from 55 to 80 metres)	Included in total in **Condition A1 Limitations and Extent of Proposal**
Mine and associated infrastructure	Clearing of no more than 4,558 hectares of native vegetation within the Development Envelope of 13,158 hectares including: No more than 393 hectares for Marillana Creek Diversion; and No more than 18 hectares for Marillana Creek Crossings.	Included in **Condition A1 Limitations and Extent of Proposal**

Analysis of existing implementation conditions

BHP has analysed the existing implementation conditions. Where changes are proposed, BHP has evaluated the proposed changes to ensure that the Combined Proposal can be implemented consistently with the EPA's objectives (Tables 2-4, 2-5 and 2-6). Where BHP proposes to retain an existing condition for an Approved Proposal for the Combined Proposal, see the proposed conditions for the Combined Proposal (Appendix 3).

Table A2-2: Marillana Creek (Yandi) Life of Mine Proposal (MS679 & MS1039)

Condition	Environmental factor	Proposed change	Proposed Combined Proposal condition (and evaluation of proposed changes)
1 Implementation	N/A	Delete and replace with contemporary condition	**Condition A1 Limitations and Extent of Proposal** Revised to include relevant Proposal extents, consistent with the contemporary condition setting approach recommended by the EPA.
2 Proponent Nomination and Contact Details	N/A	Delete and replace with contemporary condition	**Condition D3 Contact Details** The requirements of this condition are still relevant and are proposed to be retained, as the requirements are consistent with the contemporary condition setting approach recommended by the EPA.
3 Commencement and Time Limit of Approval	N/A	Delete	The requirements of this condition are no longer required as BHP has substantially commenced the Project. This condition is not required.
4 Compliance Audit and Performance Review	N/A	Delete and replace with contemporary conditions	**Condition D1 Non-compliance Reporting, Condition D2 Compliance Reporting** The requirements of this condition are still relevant and are proposed to be retained, as the requirements are consistent with the contemporary condition setting approach recommended by the EPA.
6 Progressive Rehabilitation	Inland Waters Flora and Vegetation Terrestrial Fauna Subterranean Fauna Social Surroundings	Delete and replace with contemporary condition	**Condition B6 Rehabilitation and Decommissioning** The requirements of this condition are still relevant and are retained consistent with the contemporary condition setting approach recommended by the EPA. BHP proposes to manage rehabilitation, decommissioning and closure according to the measures in the submitted Yandi Mine Closure Plan (but not yet endorsed) (Revision 3.0), which BHP has amalgamated and updated into the new Yandi Mine Closure Plan for the Combined Proposal (BHP 2025b; Appendix 5). BHP has prepared the Yandi Mine Closure Plan consistent with the Statutory Guidelines for Mine Closure Plans: Mining Act 1978 (DMIRS 2023a) and Mine Closure Plan Guidance - How to prepare in accordance with Part 1 of the Statutory Guidelines for Mine Closure Plans (DMIRS 2023b).
7 Marillana Creek Diversion	Inland Waters Flora and Vegetation	Delete and replace with contemporary condition	**Condition B1 Inland Waters** The requirements of this condition are still relevant and are proposed to be retained, as the requirements are consistent with the contemporary condition setting approach recommended by the EPA. BHP proposes to manage impacts from the diversion of Marillana Creek according to outcomes (Conditions B1-3(1) and (3)) and the outcomes-based provisions in the endorsed Marillana Creek Diversion Management Plan (BHP Billiton 2016) (Appendix 17).

Condition	Environmental factor	Proposed change	Proposed Combined Proposal condition (and evaluation of proposed changes)
8 Surface Water and Groundwater	Inland Waters Flora and Vegetation	Delete and replace with contemporary condition	**Condition B1 Inland Waters** The requirements of this condition are still relevant and are proposed to be retained, as the requirements are consistent with the contemporary condition setting approach recommended by the EPA. BHP proposes to manage potential impacts to Riparian Vegetation and Ground Water Dependent Ecosystems from groundwater abstraction and surplus water discharge to Marillana Creek according to an outcome (Condition B1-1(1)) and the outcomes-based provisions in the MCWRMP (Condition B1-2) and has updated the MCWRMP for the Combined Proposal (Version 2.0, BHP 2025c; Appendix 6). Groundwater abstraction and discharge volumes will not change from the limits currently authorised under the GWL Licence or the Part V operating Licence. To avoid regulatory duplication these limits will not be included in Condition A1-1.
9 Pit Lake Salinity	Inland Waters Flora and Vegetation Terrestrial Fauna Subterranean Fauna Social Surroundings	Delete and replace with contemporary condition	**Condition B6 Decommissioning and Rehabilitation** The requirements of this condition are still relevant and are proposed to be retained, as the requirements are consistent with the contemporary condition setting approach recommended by the EPA. BHP proposes to manage rehabilitation, decommissioning and closure according to the measures in the submitted Yandi Mine Closure Plan (Revision 6.0), which BHP has amalgamated and updated into the new Yandi Mine Closure Plan for the Combined Proposal (BHP 2025b; Appendix 5). BHP has prepared the Yandi Mine Closure Plan consistent with the Statutory Guidelines for Mine Closure Plans: Mining Act 1978 (DMIRS 2023a) and Mine Closure Plan Guidance - How to prepare in accordance with Part 1 of the Statutory Guidelines for Mine Closure Plans (DMIRS 2023b).
10 Stygofauna	Subterranean Fauna Inland Waters	Delete and replace with contemporary condition	**Condition B1 Inland Waters** The requirements of this condition are still relevant and are proposed to be retained, as the requirements are consistent with the contemporary condition setting approach recommended by the EPA. BHP proposes to continue to manage potential impacts to subterranean fauna and habitat from dewatering and surplus water discharge to Marillana Creek according to an outcome (Condition B1-1(1)) and the outcomes-based provisions in the MCWRMP (Condition B1-2(1)) and has updated the MCWRMP for the Combined Proposal (Version 2.0, BHP 2025c; Appendix 6).
11 Conservation of Significant Flora	Flora and Vegetation	Delete and replace with contemporary condition	**Condition B2 Flora and Vegetation** The requirements of this condition are still relevant and are proposed to be retained, as the requirements are consistent with the contemporary condition setting approach recommended by the EPA.

Condition	Environmental factor	Proposed change	Proposed Combined Proposal condition (and evaluation of proposed changes)
			BHP proposes to manage Flora and Vegetation according to outcomes (Condition B2-1) and has updated the objective-based components (provisions) and measures in the endorsed Biodiversity Environmental Management Plan (BHP 2025a; Appendix 10) to be outcomes-based (Condition B2-2).
11 Conservation of Significant Fauna	Terrestrial Fauna	Delete and replace with contemporary condition	**Condition B3 Terrestrial Fauna** The requirements of this condition are still relevant and are retained consistent with the contemporary condition setting approach recommended by the EPA. BHP proposes to manage Terrestrial Fauna according to an objective (Condition B3-1) and has updated the objective-based components (provisions) and measures in the endorsed Biodiversity Environmental Management Plan (BHP 2025a; Appendix 10) to be outcomes-based (Condition B3-2).

Table A2-3: Marillana Creek (Yandi) Life of Mine Proposal (MS1039)

Condition	Environmental factor	Proposed change	Proposed Combined Proposal condition (and evaluation of proposed changes)
5 Decommissioning and Final Rehabilitation	Inland Waters Flora and Vegetation Terrestrial Fauna Subterranean Fauna Social Surroundings	Delete and replace with contemporary condition	**Condition B6 Decommissioning and Rehabilitation** The requirements of this condition are still relevant and are proposed to be retained, as the requirements are consistent with the contemporary condition setting approach recommended by the EPA. BHP proposes to continue to manage rehabilitation, decommissioning and closure according to the measures in the submitted Yandi Mine Closure Plan (Revision 3.0), which BHP has amalgamated and updated into the new Yandi Mine Closure Plan for the Combined Proposal (BHP 2025b; Appendix 5). BHP has prepared the Yandi Mine Closure Plan consistent with the Statutory Guidelines for Mine Closure Plans: Mining Act 1978 (DMIRS 2023a) and Mine Closure Plan Guidance - How to prepare in accordance with Part 1 of the Statutory Guidelines for Mine Closure Plans (DMIRS 2023b).
12 Weeds	Flora and Vegetation	Delete and replace with contemporary condition	**Condition B2 Flora and Vegetation** The requirements of this condition are still relevant and are proposed to be retained, as the requirements are consistent with the contemporary condition setting approach recommended by the EPA. BHP proposes to manage weeds in according to an outcome (Condition B2-1(1)) and has updated the objective-based components (provisions) and measures in the endorsed Biodiversity Environmental Management Plan (BHP 2025a; Appendix 10) to be outcomes-based (Condition B2-2).

Condition	Environmental factor	Proposed change	Proposed Combined Proposal condition (and evaluation of proposed changes)
13 Offsets	Flora and Vegetation	Delete and replace with contemporary condition	**Condition B7 Offsets** The requirements of this condition are still relevant and are proposed to be retained, as the requirements are consistent with the contemporary condition setting approach recommended by the EPA. BHP proposes to continue to manage the requirements for offsets (for clearing authorised from 4 May 2016 onwards) according to the measures in the endorsed WAIO Impact Reconciliation Procedure (BHP 2023f), which BHP has separated out and updated for the Combined Proposal (BHP (2025d). Yandi Impact Reconciliation Procedure Revision 3.0. BHP 2025, **Error! Reference source not found.**). Under MS1039 C ondition 13-2, 4,050 hectares of clearing of native vegetation previously authorised on 1 April 2015, as detailed in Attachment 5 to MS 679 does not apply in respect of the requirement to offset under Condition 13-1. BHP has included this requirement in Condition B7-12.

Appendix 3 Combined Proposal: Proposed implementation conditions

As provided for in the EPA's Instructions: How to prepare an Environmental Review Document (EPA 2024b), BHP has provided a draft set of proposed implementation conditions for the Combined Proposal for the EPA's consideration, which contain the following:

- Short description of proposal
- Proposed limitations and maximum extents of relevant proposal elements (Condition 1)
- The proposed environmental conditions for each of the relevant key environmental factors in the Environmental outcomes Sections (7.7, 8.7, 9.7, 10.7, 11.7, 12.7) (Part B: Environmental Outcomes, Prescriptions and Objectives and Part C: Environmental Management Plans and Monitoring)
- Proposed general/administrative conditions. (Part D: Compliance, time limits, audits and other conditions).

DRAFT PROPOSED CONDITIONS

STATEMENT THAT SIGNIFICANT AMENDMENTS TO APPROVED PROPOSALS MAY BE IMPLEMENTED

(*Environmental Protection Act 1986*)

MARILLANA CREEK (YANDI) LIFE OF MINE PROPOSAL (SIGNIFICANT AMENDMENT)

Proposal: The proposal is to mine the entire Yandi orebody within Mining Lease 270SA and subsequently rehabilitate all the disturbed areas. The Yandi orebody occurs within an ancient channel iron deposit, which is subdivided into a series of mine areas known as the central mesa pits (C1 to C5), eastern mesa pits (E1 to E8) and the western mesa pits (W1 to W6). The proposal is located 90 kilometres north-west of the town of Newman.

The Combined Proposal is a proposal to amend:

- Total disturbance
- Project Life

Proponent: BHP Iron Ore Pty Ltd
Australian Company Number: 008 700 981

Proponent address: 125 St Georges Terrace, PERTH WA 6000

Assessment number: XXXX

Report of the Environmental Protection Authority: XXXX

Previous Assessment numbers: 069, 712, 875, 969, 1555,

Previous Reports of the Environmental Protection Authority: 323, 622, 738, 802, 1166, 1577

Previous Statement numbers: 029, 259, 357, 405, 679 and 1039

Introduction: The Proposal is a significant amendment to the existing Marillana Creek (Yandi) Life of Mine Proposal which was agreed to be implemented under Ministerial Statements 679 and 1039. The EPA's Report for the existing Marillana Creek (Yandi) Life of Mine Proposal is Report 1166, EPA Assessment Number 1555.

Pursuant to section 45 of the *Environmental Protection Act 1986*, it is now agreed that:

1. the significant amendment proposal described and documented in the proponent's Proposal Content Document (6 May 2025), may be implemented;

2. Ministerial Statement 679 and 1039 for the existing Marillana Creek (Yandi) Life of Mine Proposal is superseded under section 40AA (6) (b) of the *Environmental Protection Act 1986*; and

3. the implementation of the significantly Combined Proposal (the existing approved proposal as amended by the significant amendment proposal) is subject to the following implementation conditions and procedures.

Conditions and procedures

Part A: Proposal extent

Part B: Environmental outcomes, prescriptions, and objectives

Part C: Environmental management plans and monitoring

Part D: Compliance and other conditions

PART A: PROPOSAL EXTENT

A1 Limitations and extent of proposal

A1-1 The proponent must ensure that the proposal is implemented in such a manner that the following limitation or maximum extents / capacities / ranges are not exceeded:

Proposal Element	Location	Maximum extent
Physical elements		
Development Envelope will not be subject to significant amendment	Figure 1	Development Envelope not to exceed 13,158 hectares
Disturbance footprint	Figure 1	Disturbance footprint not to exceed 4,653 hectares within the 13,158 hectare development envelope
Direct disturbance of native vegetation	Figure 1	Clearing of no more than 4,653 hectares of vegetation including: Clearing of no more than 393 hectares for Marillana Creek Diversion; Clearing of no more than 18 hectares for Marillana Creek Crossings; and Clearing of no more than 48 ha of riparian vegetation for the E8 Proposal
Marillana Creek diversion	Figure 1	Diversion of sections of Marillana Creek in order to maximise resource use in W5 mine area and the E1 to E6 mine area will be designed and constructed in accordance with the Marillana Creek Diversion Management Plan.
Operational elements		
Overall production rate	-	Approximately 87 megatonnes per year
Timing elements		
Project life	-	Approximately five years (5) from the date of issue of the Ministerial Statement Decommissioning Phase up to approximately ten (10) years following cessation of mining

PART B – ENVIRONMENTAL OUTCOMES, PRESCRIPTIONS AND OBJECTIVES

B1 Inland Waters

B1-1 The proponent must ensure the implementation of the proposal achieves the following environmental objectives:

(1) minimise adverse impact to surface water flow rates, water levels or water quality in the Marillana Creek as a result of implementation of the proposal;

(2) minimise significant changes to the health, extent or diversity of riparian vegetation communities within the development envelope as a result of changes to groundwater regimes or groundwater quality associated with the implementation of the proposal;

(3) ensure that diverted sections of Marillana Creek function as a fluvial system in a similar manner to the existing creek system.

B1-2 The proponent must:

(1) implement the Marillana Creek Water Resource Management Plan (MCWRMP; Rev 2.0, submitted May 2025), with the purpose of ensuring the riparian vegetation communities and habitat environmental objectives in condition B1-1 (1) and B1-1 (2) are achieved, monitored, substantiated and satisfy the requirements of conditions C2 and condition C3; and

(2) implement the Marillana Creek Diversion Management Plan (MCDMP; Rev 0) with the purpose of ensuring the environmental outcomes in condition B1-1 (3) are achieved, monitored, substantiated.

B2 Flora and Vegetation

B2-1 The proponent must implement the proposal to achieve the following environmental outcomes:

(1) no adverse impacts to flora and vegetation from the introduction or spread of environmental weeds compared with pre-construction condition outside of the development envelopes; and

(2) no adverse impacts to flora and vegetation outside of the development envelopes through generation of dust from construction activities.

B2-2 The proponent must implement the Yandi Biodiversity Environmental Management Plan (April 2025, Rev 2) with the purpose of ensuring the flora and vegetation environmental objective in condition B2-1(1) is achieved.

B2-3 The proponent must review and update the Yandi Biodiversity Environmental Management Plan (April 2025, Rev 2) to ensure it demonstrates how achievement of the vegetation environmental outcomes in condition B2-1 will be monitored and substantiated, and how the environmental objective in condition B2-1(2) will be achieved and submit it to the **CEO**.

B3 Terrestrial Fauna

B3-1 The proponent must implement the proposal to meet the following environmental objectives:

(1) minimise the risk of physical injury or mortality from construction activities and operations on native fauna; and

(2) minimise the risk of adverse impacts and indirect disturbance to native fauna including physical injury or mortality, behavioural changes, and health impacts.

B3-2 The proponent must:

(1) implement the Biodiversity Environmental Management Plan (BEMP; Rev 2.0, submitted May 2025), with the purpose of ensuring the environmental objectives detailed in condition B3-1(1) and B3-1(2) are achieved, monitored, substantiated and satisfy the requirements of conditions C2 and condition C3.

B4 Social Surroundings

B4-1 The proponent must implement the proposal to achieve the following environmental outcomes:

(1) avoid, where practicable, and otherwise minimise direct and indirect impacts to Aboriginal cultural heritage values within and surrounding the Development Envelope unless consent is granted to disturb that site under WA legislation which specifically relates to Aboriginal heritage and has required informed consultation with relevant Traditional Owners; and

(2) subject to reasonable health and safety requirements, no interruption of ongoing access to land utilised for traditional use or custom by relevant traditional owners.

B4-2 The proponent must implement the proposal to meet the following environmental objective:

(1) avoid, where practicable, and otherwise minimise direct and indirect impacts to Aboriginal cultural heritage values within and surrounding and surrounding the Development Envelope.B5-3 The proponent must undertake ongoing consultation and engagement with relevant Traditional Owners about the achievement of the outcomes and objectives in condition B4-1 and condition B4-2 and condition B1-1, B2-1 and B3-1 for the life of the proposal. The proponent must take reasonable steps to consult with relevant Traditional Owners when revising the following environmental management plans under condition C2-2:

(1) the Marillana Creek Water Resource Management Plan required under condition B1-2; and

(2) the Biodiversity Environmental Management Plan required under condition B2-2 and 3-2.

B5 Greenhouse Gas Emissions

B5-1 The proponent must notify the CEO in writing within one month of it becoming aware that implementation of the proposal will not be or is not expected to be regulated under the Safeguard Legislation as a designated large facility (the notifiable event) and such notice must briefly describe the reasons for and expected duration of the notifiable event.

B5-2 The proponent must, if requested in writing by the CEO, provide the CEO with a report on the implications for the proposal of any amendment or proposed amendment to the Safeguard Legislation, or a decision or proposed decision made under the Safeguard Legislation that is specified in the CEO's request.

B5-3 The report required by condition B5-2 must:

(1) be submitted to the CEO within three months of the date of the CEO's request or such longer period as the CEO agrees to in writing; and

(2) explain the implications that the specified amendment or decision has had or is expected to have on:

(a) the obligation to reduce net Scope 1 greenhouse gas emissions from implementation of the proposal under the Safeguard Legislation; and

(b) the quantity of actual and net Scope 1 greenhouse gas emissions likely to result from the future implementation of the proposal.

B6 Decommissioning and Rehabilitation

B6-1 The proponent must implement the proposal to ensure the following environmental outcomes are achieved:

(1) rehabilitated landforms are stable and do not cause pollution or environmental harm;

(2) rehabilitated areas are capable of sustaining achievement of the other environmental outcomes in Part B during the life of the proposal;

(3) rehabilitated vegetation is self-sustaining; and

(4) rehabilitated areas are consistent with species diversity and abundance consistent with native vegetation adjacent to the proposal and achieves a cover and composition of locally native species such that weed cover and abundance is no greater than undisturbed reference sites, and soil is protected from erosion.

B6-2 The proponent shall implement the Mine Closure Plan (Rev 6, 2025), that satisfies the requirements of condition C1 and demonstrates how decommissioning and rehabilitation environmental outcomes in condition B6-1 will be achieved, monitored and substantiated, and submit it to the **CEO**.

B7 Offsets

B7-1 The proponent must contribute funds to the Pilbara Environmental Offsets Fund calculated pursuant to condition B7-2, to achieve the objective of counterbalancing the significant residual impacts by the proposal to:

(1) 'Good' to 'Excellent' condition native vegetation;

(2) riparian vegetation (including groundwater dependent vegetation) within the Hamersley IBRA subregion;

(3) Pilbara Olive Python *(Liasis olivaceus barroni*) critical habitat, Ghost Bat (*Macroderma gigas*) critical habitat, and Grey Falcon (*Falco hypoleucos*) critical habitat, subject to any reduction approved by the **CEO** under condition B7-8; and

(4) Northern Quoll (*Dasyurus hallucatus*) supporting habitat, Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*) supporting habitat, Pilbara Olive Python (*Liasis olivaceus barroni*) supporting habitat and Grey Falcon (*Falco hypoleu*cos) supporting habitat, subject to any reduction approved by the **CEO** under condition B7-8.

B7-2 The proponent's contribution to the Pilbara Environmental Offsets Fund must be paid biennially, with the amount to be contributed calculated based on the clearing of native vegetation undertaken in each year of the biennial reporting period in accordance with the rates in condition B7-3. The first biennial reporting period must commence from ground disturbing activities of the environmental value(s) identified in condition B7-3.

B7-3 Calculated on the 2023-2024 financial year, the contribution rates are:

(1) $986 AUD (excluding GST) per ha of the following environmental values cleared as a result of the proposal within the Hamersley IBRA subregion:

(a) Good to Excellent condition native vegetation.

(2) $1,972 AUD (excluding GST) per ha of the following environmental values cleared as a result of the proposal within the Hamersley IBRA subregion:

(a) riparian vegetation (including groundwater dependent vegetation);

(b) critical habitat for Pilbara Olive Python (*Liasis olivaceus barroni*);

(c) critical habitat for Ghost Bat (*Macroderma gigas*); and

(d) critical habitat for Grey Falcon (*Falco hypoleucos*).

(3) $986 AUD (excluding GST) per ha of the following environmental values cleared as a result of the proposal within the Hamersley IBRA subregion:

(a) Northern Quoll (*Dasyurus hallucatus*) supporting habitat;

(b) Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*) supporting habitat;

(c) Pilbara Olive Python (*Liasis olivaceus barroni*) supporting habitat; and

(d) Grey Falcon (*Falco hypoleucos*) supporting habitat.

B7-4 The rates in condition B7-3 change annually each subsequent financial year in accordance with the percentage change in CPI applicable to that financial year.

B7-5 To achieve the objective in condition B7-1 the proponent must prepare an Impact Reconciliation Procedure and submit to the **CEO**. This procedure must:

(1) spatially define the environmental value(s) identified in condition B7-1;

(2) spatially define the areas where offsets required by condition B7-1 are to be exempt;

(3) include a methodology to calculate the amount of clearing undertaken during each year of the biennial reporting period for each of the environmental values identified in condition B7-3;

(4) state that clearing calculation for the first biennial reporting period will commence from ground disturbing activities in accordance with condition B7-2 and end on the second 30 June following commencement of ground disturbing activities;

(5) state that clearing calculations for each subsequent biennial reporting period will commence on 1 July of the required reporting period, unless otherwise agreed by the **CEO**;

(6) indicate the timing and content of the Impact Reconciliation Reports; and

(7) be prepared in accordance with Instructions on how to prepare *Environmental Protection Act 1986* Part IV Impact Reconciliation Procedures and Impact Reconciliation Reports (or any subsequent revisions).

B7-6 The proponent must submit an Impact Reconciliation Report in accordance with the confirmed Impact Reconciliation Procedure in condition B7-5.

B7-7 The Impact Reconciliation Report required pursuant to condition B7-6 must provide the location and spatial extent of the ground disturbing activities undertaken as a result of the proposal during each year of each biennial reporting period.

B7-8 The proponent may apply in writing and seek the written approval of the **CEO** to reduce all or part of the contribution payable under condition B7-2 where:

(1) a payment has been made to satisfy a condition of an approval under the *Environment Protection and Biodiversity Conservation Act 1999* in relation to the proposal; and

(2) the payment is made for the purpose of counterbalancing impacts of the proposal on matters of national environmental significance.

B7-9 The **CEO** may grant approval to discount the amount payable under condition B7-1(4) if the **CEO** is satisfied that the payment will offset the significant residual impacts of the proposal.

B7-10 Condition C1 applies to the confirmed Impact Reconciliation Procedure required by condition B7-5 as if it were an environmental management plan.

B7-11 Failure to implement a confirmed Impact Reconciliation Procedure or submit an Impact Reconciliation Report as required by condition B7-6 represents a non-compliance with these conditions.

B7-12 The clearing of 4,050 hectares of native vegetation previously authorised under Ministerial Statement 679 prior to 4 May 2016 is exempt from the requirement to offset under condition B7-1.

PART C – ENVIRONMENTAL MANAGEMENT PLANS AND MONITORING

C1 Environmental Management Plans: Conditions Relating to Approval, Implementation, Review and Publication

C1-1 Upon being required to implement an environmental management plan under Part B, or after receiving notice in writing from the **CEO** that the environmental management plan required in Part B satisfies the relevant requirements, the proponent must:

(1) implement the most recent version of the confirmed environmental management plan; and

(2) continue to implement the confirmed environmental management plan referred to in condition C1-1(1), other than for any period which the **CEO** confirms by notice in writing that it has been demonstrated that the relevant requirements for the environmental management plan have been met, or are able to be met under another statutory decision-making process, in which case the implementation of the environmental management plan is no longer required for that period.

C1-2 The proponent:

(1) may review and revise a confirmed environmental management plan provided it meets the relevant requirements of that environmental management plan, including any consultation that may be required when preparing the environmental management plan; and

(2) must review and revise a confirmed environmental management plan and ensure it meets the relevant requirements of that environmental management plan, including any consultation that may be required when preparing the environmental management plan, as and when directed by the **CEO**.

C1-3 Despite condition C1-1, but subject to condition C1-4, the proponent may implement minor revisions to an environmental management plan if the revisions will not result in new or increased adverse impacts to the environment or result in a risk to the achievement of the limits, outcomes or objectives which the environmental management plan is required to achieve.

C1-4 If the proponent is to implement minor revisions to the environmental management plan under condition C1-3, the proponent must provide the **CEO** with the following at least twenty (20) business days before it implements the revisions:

(1) the revised environmental management plan clearly showing the minor revisions;

(2) an explanation of and justification for the minor revisions; and

(3) an explanation of why the minor revisions will not result in new or increased adverse impacts to the environment or result in a risk to the achievement of the limits, outcomes or objectives which the environmental management plan is required to achieve.

C1-5 The proponent must cease to implement any revisions which the **CEO** notifies the proponent (at any time) in writing may not be implemented.

C1-6 The confirmed environmental management plan, and any revised environmental management plan under conditions C1-2 and C1-4, must be published on the proponent's website and provided to the **CEO** in electronic form suitable for online publication by the Department of Water and Environmental Regulation within twenty (20) business days of being implemented, or being required to be implemented (whichever is earlier).

C2 Conditions Related to Monitoring

C2-1 The proponent must undertake monitoring capable of:

(1) substantiating whether the proposal limitations and extents in Part A are exceeded.

C2-2 The proponent must submit as part of the Compliance Assessment Report required by condition D2 and to the other decision-making authority, a compliance monitoring report that:

(1) outlines the monitoring that was undertaken during the implementation of the proposal;

(2) identifies why the monitoring was capable of substantiating whether the proposal limitation and extents in Part A are exceeded;

(3) outlines the results of the monitoring;

(4) reports whether the proposal limitations and extents in Part A were exceeded, based on analysis of the results of the monitoring; and

(5) reports any actions taken by the proponent to remediate any potential noncompliance.

C3 Environmental Management Plans: Conditions Related to Management Actions and Targets for Objective Based Conditions

C3-1 The environmental management plans required under conditions B1-2, B2-2 and B3-2 must contain provisions which enable the achievement of the relevant objectives of those conditions and substantiation of whether the objectives are reasonably likely to be met, and must include:

(1) management actions;

(2) management targets;

(3) contingency measures if management targets are not met; and

(4) reporting requirements.

C3-2 Without limiting condition C1-1, the failure to achieve an environmental objective, or implement a management action, regardless of whether contingency measures have been or are being implemented, represents a noncompliance with these conditions.

PART D – COMPLIANCE, TIME LIMITS, AUDITS AND OTHER CONDITIONS

D1 Non-compliance Reporting

D1-1 If the proponent becomes aware of a potential non-compliance, the proponent must:

(1) report this to the **CEO** within seven (7) days of being aware of the potential non-compliance;

(2) implement contingency measures;

(3) investigate the cause;

(4) investigate environmental impacts;

(5) advise rectification measures to be implemented;

(6) advise any other measures to be implemented to ensure no further impact; and

(7) provide a report to the **CEO** within twenty-one (21) days of being aware of the potential non-compliance, detailing the measures required in conditions D1-1(1) to D1-1(6) above.

D1-2 Failure to comply with the requirements of a condition, or with the content of an environmental management plan required under a condition, constitutes a non-compliance with these conditions, regardless of whether the contingency measures, rectification or other measures in condition D1-1 above have been or are being implemented.

D2 Compliance Reporting

D2-1 The proponent must provide an annual Compliance Assessment Report to the **CEO** for the purpose of determining whether the implementation conditions are being complied with.

D2-2 Unless a different date or frequency is approved by the **CEO**, the first annual Compliance Assessment Report must be submitted within fifteen (15) months of the date of this Statement, and subsequent reports must be submitted annually from that date.

D2-3 Each annual Compliance Assessment Report must be endorsed by the proponent's Chief Executive Officer, or a person approved by proponent's Chief Executive Officer to be delegated to sign on the Chief Executive Officer's behalf.

D2-4 Each annual Compliance Assessment Report must:

(1) state whether each condition of this Statement has been complied with, including:

(a) exceedance of any proposal limits and extents;

(b) achievement of environmental outcomes;

(c) achievement of environmental objectives;

(d) requirements to implement the content of environmental management plans;

(e) monitoring requirements;

(f) implement contingency measures;

(g) requirements to implement adaptive management; and

(h) reporting requirements;

(2) include the results of any monitoring (inclusive of any raw data) that has been required under Part C in order to demonstrate that the limits in Part A, and any outcomes or any objectives are being met;

(3) provide evidence to substantiate statements of compliance, or details of where there has been a non-compliance;

(4) include the corrective, remedial and preventative actions taken in response to any potential non-compliance;

(5) be provided in a form suitable for publication on the proponent's website and online by the Department of Water and Environmental Regulation;

(6) be prepared and published consistent with the latest version of the Compliance Assessment Plan required by condition D2-5 which the **CEO** has confirmed by notice in writing satisfies the relevant requirements of Part C and Part D.

D2-5 The proponent must prepare a Compliance Assessment Plan which is submitted to the **CEO** at least six (6) months prior to the first Compliance Assessment Report required by condition D2-2, or prior to implementation of the proposal, whichever is sooner.

D2-6 The Compliance Assessment Plan must include:

(1) what, when and how information will be collected and recorded to assess compliance;

(2) the methods which will be used to assess compliance;

(3) the methods which will be used to validate the adequacy of the compliance assessment to determine whether the implementation conditions are being complied with;

(4) the retention of compliance assessments;

(5) the table of contents of Compliance Assessment Reports, including audit tables; and

(6) how and when Compliance Assessment Reports will be made publicly available, including usually being published on the proponent's website within sixty (60) days of being provided to the **CEO**.

D3 Contact Details

D3-1 The proponent must notify the **CEO** of any change of its name, physical address or postal address for the serving of notices or other correspondence within twenty-eight (28) days of such change. Where the proponent is a corporation or an association of persons, whether incorporated or not, the postal address is that of the principal place of business or of the principal office in the State.

D4 Public Availability of Data

D4-1 Subject to condition D4-2, within a reasonable time period approved by the **CEO** upon the issue of this Statement and for the remainder of the life of the proposal, the proponent must make publicly available, in a manner approved by the **CEO**, all validated environmental data collected before and after the date of this Statement relevant to the proposal (including sampling design, sampling methodologies, monitoring and other empirical data and derived information products [e.g. maps]), environmental management plans and reports relevant to the assessment of this proposal and implementation of this Statement.

D4-2 If:

(1) any data referred to in condition D4-1 contains trade secrets; or

(2) any data referred to in condition D4-1 contains particulars of confidential information (other than trade secrets) that has commercial value to a person that would be, or could reasonably be expected to be, destroyed or diminished if the confidential information were published, the proponent may submit a request for approval from the **CEO** to not make this data publicly available and the **CEO** may agree to such a request if the **CEO** is satisfied that the data meets the above criteria.

D4-3 In making such a request the proponent must provide the **CEO** with an explanation and reasons why the data should not be made publicly available.

D5 Independent Audit

D5-1 The proponent must arrange for an independent audit of compliance with the conditions of this statement, including achievement of the environmental outcomes and/or the environmental objectives and/ or environmental performance with the conditions of this statement, as and when directed by the **CEO**.

D5-2 The independent audit must be carried out by a person with appropriate qualifications who is nominated or approved by the **CEO** to undertake the audit under condition D5-1.

D5-3 The proponent must submit the independent audit report with the Compliance Assessment Report required by condition D2, or at any time as and when directed in writing by the **CEO**. The audit report is to be supported by credible evidence to substantiate its findings.

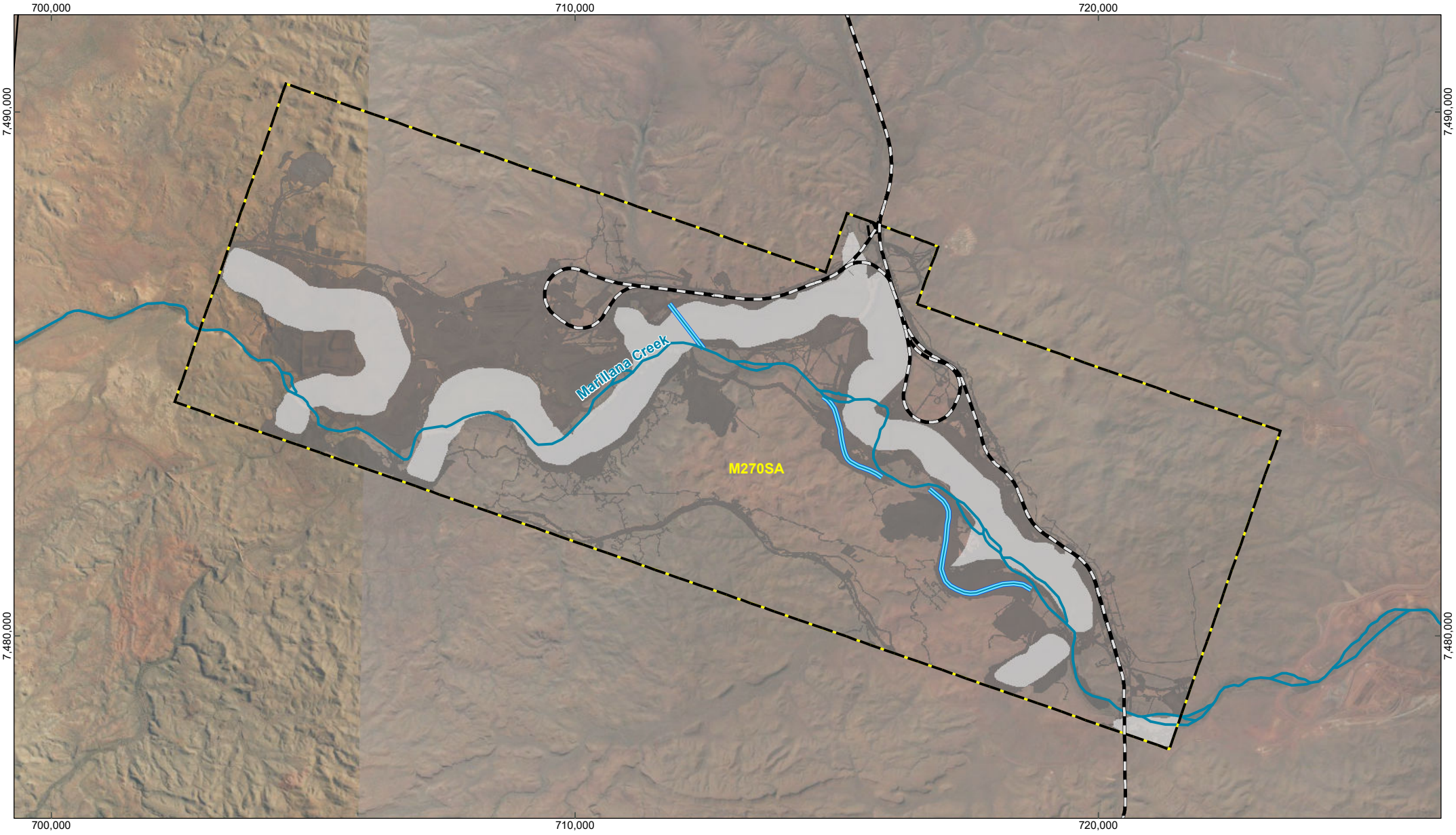
D5-4 The independent audit report required by condition D5-1 is to be made publicly available in the same timeframe, manner and form as a Compliance Assessment Report, or as otherwise directed by the **CEO**.

Figures (attached)

Figure 1 Development Envelope

Schedule 1

Coordinates defining the Development Envelope are provided electronically.



- BHP rail
- Marillana Creek
- Constructed Creek Diversion
- Development Envelope
- BHP Tenement
- Indicative Location of Deposits
- Existing Disturbance

N

0 1 2 3 4

kilometres

GDA 1994 MGA ZONE 50

BHP

PUBLIC

YANDI
SIGNIFICANT AMENDMENT
Development Envelope

PLANNING & STANDARDS - IRON ORE

SCALE @ A4:	1:98,000	PREPARED:	SPATIAL DATA	FIGURE:	1
DATE:	23/04/2024	REQUESTOR:	ENV APPROVALS		

A1205-009-RevC

Document Path: Y:\Jobs\A1001_A1500\A1205\3Project\A1205_009_E_Yandi_S38_Approvedproposal_RevC.mxd

Appendix 4 Inland Waters study reports

The following studies undertaken to support the assessment of Inland Waters for the Proposal are provided:

- Marillana Creek Baseline Hydrology Study: Yandi Closure Landform SPS (Advisian 2023)
- Yandi Conceptual Hydrogeological Model (BHP 2024c)
- BHP Yandi E8 Groundwater Model: Yandi Western Australia (INTERA 2023)
- Annual Environmental Review July 2023-June 2024 (BHP 2024a)
- Yandi Borefields Annual Aquifer Review 2024 (BHP 2024b)

Appendix 5 Marillana Creek (Yandi) Mine Closure Plan

The Marillana Creek (Yandi) Mine Closure Plan (Version 6, May 2025) (BHP 2025b) is provided separately.

Appendix 6 Marillana Creek Water Resource Management Plan

The Marillana Creek Water Resource Management Plan (Version 2.0, May 2025) (BHP 2025c) is provided separately.

Appendix 7 Summary of Flora and Vegetation studies and surveys

Table A7 presents a summary of Flora and Vegetation information used in the assessment of the Proposal.

Table A7: Summary of historic Flora and Vegetation studies and surveys

Title/ Reference	Survey Level	Survey Effort	Timing	Season	EPA Guidance (Referred to in survey report and applicable at time of survey)	Vegetation	Significant Flora[26]	Introduced Flora	Appendix
Area C West to Yandi Flora and Vegetation Assessment (Astron 2019)	Single season detailed	67 quadrats 24 releves	13-22 November 2018	Poor	Terrestrial Biological Surveys as an Element of Biodiversity Protection, Position Statement No. 3 (EPA 2002) Guidance for the Assessment of Environmental Factors: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia, No. 51 (EPA 2004a) Environmental Factor Guideline Flora and Vegetation (EPA 2016a) Technical Guidance Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016b)	38 vegetation associations classified into 16 broad floristic formations None aligned with Federal or State listed TECs or State listed PECs.	No plant taxa gazetted as Threatened Flora pursuant to the BC Act or listed under EPBC Act. One Priority flora was recorded: *Eremophila naaykensii* (Priority 3).	Three introduced species were recorded, none listed as a Declared Pest under the BAM Act.	Not attached
Marillana to Yandi Corridor Targeted Flora and Vegetation Survey (Onshore 2018)	Targeted/refinement of vegetation mapping	Releves (undefined number)	10-13 February 2018	Good	Terrestrial Biological Surveys as an Element of Biodiversity Protection, Position Statement No. 3 (EPA 2002) Technical Guidance Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016b)	Nine vegetation associations classified into four broad floristic formations. None aligned with Federal or State listed TECs or State listed PECs.	No plant taxa gazetted as Threatened Flora listed under EPBC Act. One Threatened flora pursuant to the BC Act was recorded: *Synostemon hamersleyensis* (Endangered). Two priority flora were recorded: *Isotropis parviflora* (Priority 3) and *Sida* sp. Barlee Range (S. van Leeuwen 1642) (Priority 3).	Four introduced species were recorded, none listed as a Declared Pest under the BAM Act.	Not attached

[26] Based on current conservation status of taxa.

Title/ Reference	Survey Level	Survey Effort	Timing	Season	EPA Guidance (Referred to in survey report and applicable at time of survey)	Vegetation	Significant Flora[26]	Introduced Flora	Appendix
Area C West to Yandi Level 2 Flora and Vegetation Survey (Onshore 2014b)	Two season detailed	170 quadrats Releves (undefined number)	21 May-3 June 2011 19 July-1 August 2012 20-29 August 2013	Good	Terrestrial Biological Surveys as an Element of Biodiversity Protection, Position Statement No. 3 (EPA 2002) Guidance for the Assessment of Environmental Factors: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia, No. 51 (EPA 2004a) Environmental Protection of Native Vegetation in Western Australia: Clearing of Native Vegetation with Particular Reference to the Agricultural Area, Position Statement No. 2 (EPA 2000)	23 vegetation associations classified into eight broad floristic formations	No plant taxa gazetted as Threatened Flora pursuant to the BC Act or listed under EPBC Act. Ten Priority flora were recorded; *Acacia bromilowiana* (P4), *Acacia effusa* (P3), *Acacia subtiliformis* (P3), *Aristida jerichoensis* var. *subspinulifera* (P3), *Gymnanthera cunninghamii* (P3), *Goodenia* sp. East Pilbara (P3), *Rostellularia adscendens* var. *latifolia* (P3), *Rhynchosia bungarensis* (P4), *Sida* sp. Barlee Range (S. van Leeuwen 1642) (P3), and *Vittadinia* sp. Coondewanna Flats (P3).	12 introduced species were recorded, none listed as a Declared Pest under the BAM Act.	Not attached
Flora and Vegetation Review (Onshore 2011)	Targeted/review of vegetation mapping	115 releves	9-16 December 2010	Not stated	Terrestrial Biological Surveys as an Element of Biodiversity Protection, Position Statement No. 3 (EPA 2002) Guidance for the Assessment of Environmental Factors: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia, No. 51 (EPA 2004a) Environmental Protection of Native Vegetation in Western Australia: Clearing of Native Vegetation with Particular Reference to the Agricultural Area, Position Statement No. 2 (EPA 2000)	24 vegetation associations classified into 12 broad floristic formations	No plant taxa gazetted as Threatened Flora pursuant to the BC Act or listed under EPBC Act. Three Priority flora were recorded; *Lepidium catapycnon* (P4), *Acacia subtiliformis* (P3) and *Rostellularia adscendens* var. *latifolia* (P3)	14 introduced species were recorded, none listed as a Declared Pest under the BAM Act.	Not attached
Yandi Mine Site Weed Inspection (Astron 2011)	Weed Inspection	Not applicable	Not applicable	Poor	Not stated	Not applicable	Not applicable	10 introduced species were recorded, none listed as a Declared Pest under the BAM Act.	Not attached
Declared Rare Flora (DRF) and Priority flora search at Yandi - Proposed haul road crossing at Marillana Creek (BHP Billiton 2010)	Targeted	Not applicable	28 September 2010	Poor	Not stated	Not applicable	No plant taxa gazetted as Threatened or Priority Flora pursuant to the BC Act or listed under EPBC Act.	Two introduced species were recorded, none listed as a Declared Pest under the BAM Act.	Not attached
Report for Yandi W1 and W4OSA - Targeted Rare and Priority Flora Survey (GHD 2010)	Targeted	Not applicable	16-19 February 2010	Poor	Guidance for the Assessment of Environmental Factors: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia, No. 51 (EPA 2004a)	Five broad vegetation associations were identified.	No plant taxa gazetted as Threatened or Priority Flora pursuant to the BC Act or listed under EPBC Act.	Three introduced species were recorded, none listed as a Declared Pest under the BAM Act.	Not attached

Title/ Reference	Survey Level	Survey Effort	Timing	Season	EPA Guidance (Referred to in survey report and applicable at time of survey)	Vegetation	Significant Flora[26]	Introduced Flora	Appendix
Newman to Yandi Transmission Line Flora and Vegetation Assessment (ENV 2009a)	Single season detailed	150 quadrats 29 releves	5-15 May 2009	Excellent	Terrestrial Biological Surveys as an Element of Biodiversity Protection, Position Statement No. 3 (EPA 2002) Guidance for the Assessment of Environmental Factors: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia, No. 51 (EPA 2004a) Environmental Protection of Native Vegetation in Western Australia: Clearing of Native Vegetation with Particular Reference to the Agricultural Area, Position Statement No. 2 (EPA 2000)	30 vegetation associations classified into 13 broad floristic formations	No plant taxa gazetted as Threatened Flora pursuant to the BC Act or listed under EPBC Act. Four Priority flora were recorded; *Goodenia* sp. East Pilbara (P3), *Euphorbia australis* var. *glabra* (P3), *Acacia subtiliformis* (P3), *Rhagodia* sp. Hamersley (P3),	14 introduced species were recorded, none listed as a Declared Pest under the BAM Act.	Not attached
Western 6, 7 & 8 Flora and Vegetation Assessment (ENV 2009b)	Single season detailed	17 quadrats Releves (undefined number)	22-23 September 2007	Not stated	Terrestrial Biological Surveys as an Element of Biodiversity Protection, Position Statement No. 3 (EPA 2002) Guidance for the Assessment of Environmental Factors: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia, No. 51 (EPA 2004a) Environmental Protection of Native Vegetation in Western Australia: Clearing of Native Vegetation with Particular Reference to the Agricultural Area, Position Statement No. 2 (EPA 2000)	Eight vegetation associations	No plant taxa gazetted as Threatened or Priority Flora pursuant to the BC Act or listed under EPBC Act.	Six introduced species were recorded, none listed as a Declared Pest under the BAM Act.	Not attached
Western 2 and Western 1 Waste Dump Flora and Vegetation Assessment (ENV 2009c)	Single season detailed	16 quadrats Releves (undefined number)	22-23 September 2007	Not stated	Terrestrial Biological Surveys as an Element of Biodiversity Protection, Position Statement No. 3 (EPA 2002) Guidance for the Assessment of Environmental Factors: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia, No. 51 (EPA 2004a) Environmental Protection of Native Vegetation in Western Australia: Clearing of Native Vegetation with Particular Reference to the Agricultural Area, Position Statement No. 2 (EPA 2000)	Nine vegetation associations	No plant taxa gazetted as Threatened Flora pursuant to the BC Act or listed under EPBC Act. One Priority flora was recorded; *Rostellularia adscendens* var. *latifolia* (P3).	Three introduced species were recorded, none listed as a Declared Pest under the BAM Act.	Not attached

Title/ Reference	Survey Level	Survey Effort	Timing	Season	EPA Guidance (Referred to in survey report and applicable at time of survey)	Vegetation	Significant Flora[26]	Introduced Flora	Appendix
Central 3 Flora and Vegetation Assessment (ENV 2009d)	Single season detailed	Nine quadrats Releves (undefined number)	19-24 September 2007	Not stated	Terrestrial Biological Surveys as an Element of Biodiversity Protection, Position Statement No. 3 (EPA 2002) Guidance for the Assessment of Environmental Factors: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia, No. 51 (EPA 2004a) Environmental Protection of Native Vegetation in Western Australia: Clearing of Native Vegetation with Particular Reference to the Agricultural Area, Position Statement No. 2 (EPA 2000)	Six vegetation associations	No plant taxa gazetted as Threatened or Priority Flora pursuant to the BC Act or listed under EPBC Act.	Four introduced species were recorded, none listed as a Declared Pest under the BAM Act.	Not attached
Rapid Growth Project 5: Yandi Flora Survey and Assessment of Barimunya Airport and a Potential Borrow Area (ENV 2009e)	Single season detailed	27 quadrats Releves (undefined number)	24-27 November 2008	Not stated	Terrestrial Biological Surveys as an Element of Biodiversity Protection, Position Statement No. 3 (EPA 2002) Guidance for the Assessment of Environmental Factors: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia, No. 51 (EPA 2004a) Environmental Protection of Native Vegetation in Western Australia: Clearing of Native Vegetation with Particular Reference to the Agricultural Area, Position Statement No. 2 (EPA 2000)	Seven vegetation communities	No plant taxa gazetted as Threatened or Priority Flora pursuant to the BC Act or listed under EPBC Act.	One introduced species was recorded, none listed as a Declared Pest under the BAM Act.	Not attached
RGP5 Yandi to Kurrajura Siding and Yandi Repeater One Flora and Vegetation Report (Ecologia 2008a)	Single season detailed/Targeted	Nine quadrats	28-30 March 2008 14 May 2008	Not stated	Terrestrial Biological Surveys as an Element of Biodiversity Protection, Position Statement No. 3 (EPA 2002) Guidance for the Assessment of Environmental Factors: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia, No. 51 (EPA 2004a)	Ten vegetation associations	No plant taxa gazetted as Threatened or Priority Flora pursuant to the BC Act or listed under EPBC Act.	Nine introduced species were recorded, none listed as a Declared Pest under the BAM Act.	Not attached
Summary of important findings from Rapid Growth Project 5 Railway Project - Biological Assessments (ENV 2008a)	Single season detailed	141 quadrats 18 releves	15-23 April 2008	Not stated	Guidance for the Assessment of Environmental Factors: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia, No. 51 (EPA 2004a)	Not defined (preliminary summary report)	No plant taxa gazetted as Threatened Flora pursuant to the BC Act or listed under EPBC Act. One Priority flora was recorded; *Rostellularia adscendens* var. *latifolia* (P3).	Ten introduced species were recorded, none listed as a Declared Pest under the BAM Act.	Not attached

Title/ Reference	Survey Level	Survey Effort	Timing	Season	EPA Guidance (Referred to in survey report and applicable at time of survey)	Vegetation	Significant Flora[26]	Introduced Flora	Appendix
Two Phase Assessment of the Flora and Vegetation of the Proposed Marillana Creek (Yandi) Mine Extension Areas RGP5-KBR (BHP Billiton 2008)	Two season detailed	119 quadrats	13-19 November 2007 10-17 March 2008	Good	Terrestrial Biological Surveys as an Element of Biodiversity Protection, Position Statement No. 3 (EPA 2002) Guidance for the Assessment of Environmental Factors: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia, No. 51 (EPA 2004a)	Ten vegetation associations	No plant taxa gazetted as Threatened or Priority Flora pursuant to the BC Act or listed under EPBC Act.	Ten introduced species were recorded, none listed as a Declared Pest under the BAM Act.	Not attached
Yandi Mine Extension RGP5 - EIA Flora Survey Interim Report Post Phase 1 Survey (Ecologia 2007)	Two season detailed	60 quadrats	13-20 November 2007 March 2008	Not stated	Not stated	Interim report – associations not defined at time or reporting	No plant taxa gazetted as Threatened or Priority Flora pursuant to the BC Act or listed under EPBC Act.	One introduced species were recorded, none listed as a Declared Pest under the BAM Act.	Not attached
MPD JV Rail Corridor Survey: BHP BIO Yandi Rail Corridor DRF and Priority Flora Assessment (Ecologia 2006)	Targeted	Not applicable	19-20 May 2006	Not stated	Not stated	Six high level vegetation associations	No plant taxa gazetted as Threatened or Priority Flora pursuant to the BC Act or listed under EPBC Act.	Seven introduced species were recorded, none listed as a Declared Pest under the BAM Act.	Not attached
Yandi Stockyard and Overland Conveyor Fauna and Flora Assessment (Ecologia 2004)	Targeted	Not applicable	18-19 October 2004	Not stated	Not stated	High level description of vegetation	No plant taxa gazetted as Threatened Flora pursuant to the BC Act or listed under EPBC Act. One Priority flora was recorded; *Isotropis winneckei* (P1)	Two introduced species were recorded, none listed as a Declared Pest under the BAM Act.	Not attached
Flora and Vegetation Survey Lease M47/292 and E4 Drill Lines (Maunsell 2004)	Single season detailed	Not stated	15-16 December 2003	Poor	Survey undertaken prior to EPA guidelines being available	Seven vegetation associations	No plant taxa gazetted as Threatened or Priority Flora pursuant to the BC Act or listed under EPBC Act.	Not stated	Not attached
Yandi Life of Mine Flora and Fauna (Maunsell 2003)	Targeted	Not applicable	23-28 September 2003	Not stated	Survey undertaken prior to EPA guidelines being available	Not applicable	No plant taxa gazetted as Threatened or Priority Flora pursuant to the BC Act or listed under EPBC Act.	Five introduced species were recorded, none listed as a Declared Pest under the BAM Act.	Not attached
IOWA Conveyor: Amendment to Rare and Priority Flora Survey (ecologia 2003)	Targeted	Not applicable	8 August 2003	Not reported	Survey undertaken prior to EPA guidelines being available	Not applicable	No plant taxa gazetted as Threatened Flora pursuant to the BC Act or listed under EPBC Act, and no Priority flora taxa, were recorded.	Not reported	Not attached
Mining Area C Rail Corridor Rare Flora Survey (Biota 2002)	Targeted	Not applicable	12-18 November 2001	Poor	Survey undertaken prior to EPA guidelines being available	Not applicable	No plant taxa gazetted as Threatened Flora pursuant to the BC Act or listed under EPBC Act, and no Priority flora taxa, were recorded.	Not reported	Not attached
Mining Area C Rail Corridor Seasonal Rare Flora Survey Phase 2 (Biota 2003)	Targeted	Not applicable	21-31 March 2002	Good	Survey undertaken prior to EPA guidelines being available	Not applicable	No plant taxa gazetted as Threatened Flora pursuant to the BC Act or listed under EPBC Act, and no Priority flora taxa, were recorded.	Not reported	Not attached

Title/ Reference	Survey Level	Survey Effort	Timing	Season	EPA Guidance (Referred to in survey report and applicable at time of survey)	Vegetation	Significant Flora[26]	Introduced Flora	Appendix
Mining Area C to yandi Rail Line Baseline Weed Survey (Ecologia 2001)	Weed survey	Not applicable	16-17 October 2001	Not stated	Survey undertaken prior to EPA guidelines being available	Not applicable	No plant taxa gazetted as Threatened Flora pursuant to the BC Act or listed under EPBC Act, and no Priority flora taxa, were recorded.	Two introduced species were recorded, none listed as a Declared Pest under the BAM Act.	Not attached
Marillana Creek Western Access Corridor - Biological Assessment (Halpern Glick Maunsell 1999)	Single season detailed	22 quadrats	23-30 April 1999	Not stated	Survey undertaken prior to EPA guidelines being available	25 vegetation associations	No plant taxa gazetted as Threatened Flora pursuant to the BC Act or listed under EPBC Act, and no Priority flora taxa, were recorded.	Two introduced species were recorded, none listed as a Declared Pest under the BAM Act.	Not attached
Yandi Vegetation and Soil Survey (Ecologia 1998a)	Single season detailed	32 detailed sites plus supplementary transects	27 May-1 June 1998	Poor	Survey undertaken prior to EPA guidelines being available	Fourteen vegetation associations	No plant taxa gazetted as Threatened Flora pursuant to the BC Act or listed under EPBC Act, and no Priority flora taxa, were recorded.	Seven introduced species were recorded, none listed as a Declared Pest under the BAM Act.	Not attached
Marillana Creek Iron Ore Project: Survey for Goodenia stellata and Flora of Interest (Halpern Glick Maunsell 1997)	Targeted	Not applicable	28 May-1 June 1997	Poor	Survey undertaken prior to EPA guidelines being available	Not applicable	No plant taxa gazetted as Threatened Flora pursuant to the BC Act or listed under EPBC Act, and no Priority flora taxa, were recorded.	Not reported.	Not attached

Appendix 8 Flora and Vegetation survey reports

The following studies undertaken to support the assessment of Flora and Vegetation for the Proposal are provided:

- Central Pilbara Hub Detailed and Targeted Flora Survey (Biologic 2024a)
- Yandi E8 Targeted Flora Survey (Biologic 2023a)
- Targeted Flora Surveys of Pipeline Corridors (GHD 2022)
- Ministers North and Yandi Vegetation Association and Condition Mapping (Onshore 2020)
- Ministers North Miscellaneous Licence Area Amendment Surveys and Yandicoogina Creek Detailed Flora and Vegetation Assessment (Biologic 2020a)
- Marillana Creek Riparian Flora and Vegetation Survey (Onshore 2015).

Appendix 9 IBSA Data Package

BHP has provided biodiversity data and reports as part of the IBSA data package, prepared in consistence with the EPA's Instructions for the preparation of data packages for the Index of Biodiversity Surveys for Assessments (IBSA) (EPA 2021i). BHP has provided the following IBSA data packages via the online IBSA Submissions portal as listed in **Table A9**.

BHP is also in the process of compiling the survey data for the following biodiversity reports into the IBSA data format to allow submission via the online IBSA Submissions portal:

- Targeted Flora Surveys of Pipeline Corridors (GHD 2022)
- Ministers North Level 1 Fauna Survey (GHD 2021)
- Ministers North and Yandicoogina Creek Short-Range Endemic Invertebrate Fauna Survey (Biologic 2021)
- Ministers North Aquatic Ecosystem Survey: Dry 2021 – Wet 2022 (Biologic 2023d)
- Ministers North: Yandicoogina Creek Aquatic Ecosystem Surveys Dry 2020 and Wet 2021 (Biologic 2022b)
- MAC Phase 4: Marillana Creek Baseline Aquatic Ecosystem Survey Dry 2020 & Wet 2021 (Biologic 2022a).

Table A9: Biodiversity surveys and IBSA data numbers

Survey	IBSA number
Flora and Vegetation	
Central Pilbara Hub Detailed and Targeted Flora Survey (Biologic 2024a)	IBSA-2024-0443
Yandi E8 Targeted Flora Survey (Biologic 2023a)	IBSA-2025-0041
Marillana Creek Riparian Flora and Vegetation Survey (Onshore 2015)	IBSASUB-20250505-3A3DBB6D
Ministers North Miscellaneous Licence Area Amendment Surveys and Yandicoogina Creek Detailed Flora and Vegetation Assessment (Biologic 2020a)	IBSASUB-20250507-D8352304
Terrestrial Fauna	
Yandi 45C Targeted Significant Vertebrate Fauna Survey (Astron 2023a)	IBSA-2025-0038
Central Pilbara Hub Targeted MNES Survey (Biologic 2023b)	IBSA-2024-0319
Consolidated Fauna Habitat Mapping (Biologic 2014 and 2018a)	IBSA-2020-0345
Ministers North Consolidated Targeted Significant Vertebrate Fauna Surveys (Astron 2024b)	IBSASUB-20250508-D12971DD

Survey	IBSA number
Short Range Endemics	
Yandi Operations Short-Range Endemic Fauna Survey Report (Bennelongia 2024a)	IBSA-2025-0040
Ministers North Short-Range Endemic (SRE) Desktop and Field Survey (Bennelongia 2024d)	IBSA-2025-0046
Aquatic Ecosystem Surveys	
Ministers North Yandicoogina Creek Aquatic Ecosystem Survey Dry 2022 and Wet 2023 (Biologic 2024c)	IBSA-2025-0068
MAC Phase 4: Aquatic monitoring Dry 2022 and Wet 2023 (Biologic 2024b)	IBSA-2025-0065
MAC Phase 4: Marillana Creek Baseline Aquatic Ecosystem Survey Dry 2021 & Wet 2022 (Biologic 2023e)	IBSA-2025-0094
Ministers North Aquatic Ecosystem Survey: Dry 2021 – Wet 2022 (Biologic 2023d)	IBSA-2025-0073
Subterranean Fauna	
Yandi Operations Subterranean Fauna Survey Report (Bennelongia 2024b)	IBSASUB-20250506-500256FE
Ministers North Subterranean Fauna Survey (Bennelongia 2024c)	IBSASUB-20250507-F710D3C0
Yandi Targeted Subterranean Fauna Survey Report (Bennelongia 2025)	IBSASUB-20250506-F661E9D3

Appendix 10 Yandi Biodiversity Environmental Management Plan

The Yandi Biodiversity Environmental Management Plan (Version 2.0, 2025) (BHP 2025a) is provided separately.

Appendix 11 Summary of Terrestrial Fauna studies and surveys

Table A11 presents a summary of historical terrestrial and aquatic fauna studies and surveys used in the assessment of the Proposal.

Table A11: Summary of historical terrestrial fauna studies and surveys

Title/ Reference	Survey Level*	Sampling Methods and Survey Effort	Timing	EPA Guidance (Applicable at time of survey)	Habitats	Significant Fauna Recorded
Vertebrate fauna surveys						
Yandi Stage 2 Biological Assessment Survey (Ecologia 1995)	Detailed (Level 2)	10 trapping sites - Pit traps (140 trap nights) - Elliot traps (200 trap nights) - Bird census (5 person hours) - Microhabitat searches Fish sampling (spotlights) Nocturnal searches (4 person hours) Systematic traverses / transect searches	May - June 1995	Survey undertaken prior to EPA guidelines being available	Six broad fauna habitats were mapped including Riverine, Drainage Gully, Colluvial Flat, Outwash Flat, Scree Slope and Mesa Top.	One Threatened fauna listed under the EPBC Act and/or the BC Act recorded: Pilbara Olive python (*Liasis olivaceus barroni*; Vu). One Priority fauna species was recorded: Western Pebble-mound Mouse (*Pseudomys chapmani*; P4). One 'other specially protected species' (OS) listed under the BC Act recorded: Peregrine Falcon (*Falco peregrinus*; OS).
Yandi Stage 2 Iron Ore Project - Pebble-mound Mouse Pseudomys chapmani Site Survey (Ecologia 1996)	Targeted	Systematic traverses / transect searches	19-21 Dec 1995	Survey undertaken prior to EPA guidelines being available	N/A	A total of 121 Pebble-mound mouse mounds were recorded within the survey area and comprised 47 active mounds (Category 3), 31 dormant mounds (Category 2) and 43 abandoned mounds (Category 1 and 0 combined).

Title/ Reference	Survey Level*	Sampling Methods and Survey Effort	Timing	EPA Guidance (Applicable at time of survey)	Habitats	Significant Fauna Recorded
Mining Area C Biological Survey (Ecologia 1998b)	Detailed	Core area: 11 sites totalling 530 pit trap nights and 1180 Elliott trap nights. Rail Corridor Site: two sites totalling 15 pit trap nights and 60 Elliott trap nights each. 62.5 person hours active searching 10 person hours nocturnal searches Bird census Opportunistic sightings Two mist site (bats) collections	14-30 Apr 1997	Survey undertaken prior to EPA guidelines being available	Six fauna habitats recorded: Mulga Woodland, Gully systems and Gorge and Creekline bases, Detrital Slopes: Ridges and Hill tops, Outwash and Acacia Shrubland.	One Priority fauna species **recorded**: Western Pebble-mound Mouse (*Pseudomys chapmani*; P4).
Marillana Creek Western Access Corridor - Biological Assessment (Halpern Glick Maunsell 1999)	Basic	Not applicable	23-30 Apr 1999	Survey undertaken prior to EPA guidelines being available	Five fauna habitats mapped including: Riverine, Minor Drainage, Outwash Plains, Mulga Woodland and Hills and Ridges.	One Priority fauna species **recorded**: Western Pebble-mound Mouse (*Pseudomys chapmani*; P4).

Title/ Reference	Survey Level*	Sampling Methods and Survey Effort	Timing	EPA Guidance (Applicable at time of survey)	Habitats	Significant Fauna Recorded
Yandi Life of Mine Flora and Fauna (Maunsell 2003)	Basic and targeted	Systematic traverses / transect searches 10 hours of nocturnal searches Bird census Bat call recordings	23-28 Sept 2003	Survey undertaken prior to EPA guidelines being available	Not mapped at time of survey.	One Priority fauna species was **recorded**: Western Pebble-mound Mouse (*Pseudomys chapmani*; P4). Two Migratory species listed under the EPBC Act and/or the BC Act were recorded: Great Egret (*Ardea* alba) and Common Sandpiper (*Actitis hypoleucos*).
Yandi Stockyard and Overland Conveyor Fauna and Flora Assessment (Ecologia 2004])	Desktop	Not applicable	October 2004	None reported	Not applicable	Not applicable
Upper Marillana Exploration Project Biological Survey (Ecologia 2005)	Basic (Level 1)	680 minutes of bird census 790 minutes of hand foraging 840 minutes of nocturnal searches Two nights of recording bat calls at two locations Opportunistic observations	13-20 Apr 2005	Guidance for the Assessment of Environmental Factors: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia, No. 56 (EPA 2004b)	Three fauna habitats: *Acacia* and *Eucalyptus* undulating gravel plain, *Eucalyptus* ridges over Spinifex and *Acacia aneura* Mulga Sandplain.	One Threatened fauna listed under the EPBC Act and/or the BC Act was recorded: Ghost Bat (*Macroderma gigas*; Vu). One Priority fauna species was recorded: Western Pebble-mound Mouse (*Pseudomys chapmani*; P4).

Title/ Reference	Survey Level*	Sampling Methods and Survey Effort	Timing	EPA Guidance (Applicable at time of survey)	Habitats	Significant Fauna Recorded
Summary of Important Findings from RGP5 Railway Project Biological Assessments (Letter Report) (ENV 2008b)	Basic (Level 1)	Bird census Active searching Nocturnal searches	21-28 May 2008	Terrestrial Biological Surveys as an Element of Biodiversity Protection, Position Statement No. 3 (EPA 2002) Guidance for the Assessment of Environmental Factors: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia, No. 56 (EPA 2004b)	Fauna habitat types included: Stony spinifex plains, Low Hills, Undulating Plains, Mulga Plains and Open Clay Pans.	One Threatened fauna listed under the EPBC Act and/or the BC Act was recorded: Pilbara Olive python (*Liasis olivaceus barroni*; Vu).
Marillana Creek (Yandi) Iron Ore Mine Modification Level 2 Fauna Survey (Ecologia 2008b)	Detailed (Level 2)	Six fauna sites 960 pit trap nights 960 funnel trap nights 960 Elliot trap nights 96 cage trap nights 1620 bird census minutes 3660 minutes of opportunistic searches 240 minutes of bat recordings 1825 minutes of nocturnal searches	19-30 Mar 2008	Terrestrial Biological Surveys as an Element of Biodiversity Protection, Position Statement No. 3 (EPA 2002) Guidance for the Assessment of Environmental Factors: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia, No. 56 (EPA 2004b)	Fauna habitats only mapped at the six survey sites, not for the entire survey area. Fauna habitats included Minor Drainage Line, Hillslope, Outwash Plain and Open Plain.	One Priority fauna species was recorded: Western Pebble-mound Mouse (*Pseudomys chapmani*; P4).

Title/ Reference	Survey Level*	Sampling Methods and Survey Effort	Timing	EPA Guidance (Applicable at time of survey)	Habitats	Significant Fauna Recorded
RGP5 Fauna Survey Kurrajura Siding to Yandi Wye (incl. Yandi Repeater 1) (Ecologia 2008c)	Basic (Level 1)	2080 minutes of Anabat recordings 660 minutes of bird census 340 minutes of nocturnal road cruising 530 minutes of nocturnal searching 660 minutes of diurnal searching 120 minutes surveying Repeater 1 Access Track (including search transects and bird census) 30 minutes opportunistic foraging Repeater 1 Footprint (including bird census)	9-13 May 2008	Terrestrial Biological Surveys as an Element of Biodiversity Protection, Position Statement No. 3 (EPA 2002) Guidance for the Assessment of Environmental Factors: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia, No. 56 (EPA 2004b)	Three broad fauna habitat types were identified: Rocky Slopes, Open Woodland, Rock face/Gorge.	Two Threatened fauna listed under the EPBC Act and/or the BC Act were recorded: Ghost Bat (*Macroderma gigas*; Vu) and Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*; Vu). One Priority fauna species was recorded: Western Pebble-mound Mouse (*Pseudomys chapmani*; P4).

Title/ Reference	Survey Level*	Sampling Methods and Survey Effort	Timing	EPA Guidance (Applicable at time of survey)	Habitats	Significant Fauna Recorded
Survey for conservation significant bats between Kurrajura siding and the Yandi Wye (Specialised Zoological 2008)	Targeted	17 daytime traverses Five night-time traverses 24 Anabat sites Three caves were located and examined	2-8 Oct 2008	Terrestrial Biological Surveys as an Element of Biodiversity Protection, Position Statement No. 3 (EPA 2002) Guidance for the Assessment of Environmental Factors: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia, No. 56 (EPA 2004b)	Not applicable	None recorded
RGP5 Yandi Flora Survey and Assessment of Barimunya Airport and a Potential Borrow Area (ENV 2009f)	Targeted (Western Pebble-mound mouse)	Transect searches	24-26 Nov 2008	Terrestrial Biological Surveys as an Element of Biodiversity Protection, Position Statement No. 3 (EPA 2002) Guidance for the Assessment of Environmental Factors: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia, No. 56 (EPA 2004b)	Not applicable	A total of 137 Pebble-mound mouse (P4) mounds were recorded across the project areas. Of these, 36 were active, 46 were recently active, and 55 were inactive/extinct.

Title/ Reference	Survey Level*	Sampling Methods and Survey Effort	Timing	EPA Guidance (Applicable at time of survey)	Habitats	Significant Fauna Recorded
Newman to Yandi Transmission Line Terrestrial Vertebrate Fauna Assessment (ENV 2009g)	Basic (Level 1)	Diurnal fauna searches Nocturnal searches Bird census Bat calls (Anabat) Opportunistic observations	7-16 May 2009	Terrestrial Biological Surveys as an Element of Biodiversity Protection, Position Statement No. 3 (EPA 2002) Guidance for the Assessment of Environmental Factors: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia, No. 56 (EPA 2004b)	Seven fauna habitat types were identified including Alluvial Plain, Scree/Low Hills, Riverine, Stony Plain, Gorge/Gully, Minor Drainage Line, and Hill Crest	One Priority fauna species was recorded: Western Pebble-mound Mouse (*Pseudomys chapmani*; P4).
Yandicoogina Junction South-West and Oxbow Fauna Survey (Biota 2010)	Detailed (Level 2)	11 trap sites Bird census (610 minutes) Pit traps (360 nights) Funnel traps (360 nights) Elliot traps (310 nights) Bat survey (11 Anabat/Harp Trap nights) Opportunistic observations	5-12 Jul 2008 4-7 Mar 2010	Terrestrial Biological Surveys as an Element of Biodiversity Protection, Position Statement No. 3 (EPA 2002) Guidance for the Assessment of Environmental Factors: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia, No. 56 (EPA 2004b)	Five fauna habitats were identified including Major Drainage Line, Drainage Line, Hillslopes, Plain and Valley Floors, Rocky Breakaways and Screes	One Priority fauna species was recorded: Western Pebble-mound Mouse (*Pseudomys chapmani*; P4).

Title/ Reference	Survey Level*	Sampling Methods and Survey Effort	Timing	EPA Guidance (Applicable at time of survey)	Habitats	Significant Fauna Recorded
Yandi Vertebrate Fauna Review (Biologic 2011b)	Basic (Level 1) and targeted	Bat survey (Four Anabat nights) Motion cameras (effort not reported) Transect searches Opportunistic observations Dirurnal searches (47.5 hours)	9-17 Dec 2010	Terrestrial Biological Surveys as an Element of Biodiversity Protection, Position Statement No. 3 (EPA 2002) Guidance for the Assessment of Environmental Factors: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia, No. 56 (EPA 2004b)	Five fauna habitats mapped including Boulder Pile, Hill Crest and Slope, Major Drainage Line, Mulga Woodland, and Sandplain	Two Threatened fauna listed under the EPBC Act and/or the BC Act were recorded: Pilbara Olive Python (*Liasis olivaceus barroni*; Vu) and Northern Quoll (*Dasyurus hallucatus*; En; note this species record is a BHP record, reported in this study). One Priority fauna species was recorded: Western Pebble-mound Mouse (*Pseudomys chapmani*; P4). One Migratory species listed under the EPBC Act and/or the BC Act was recorded: Fork-tailed Swift (*Apus pacificus*)
Area C West to Yandi Level 2 Vertebrate Fauna Survey (Biota 2013)	Detailed (Level 2)	23 trapping transects Pit traps (2480 trap nights) Elliot traps (1,595 trap nights Funnel traps (600 trap nights) Bird Census (31.5 hours) Diurnal searches (64 hours) Bat survey (32 nights using SM2, AnaBat and Harp Trap)	Phase 1: 25 May 25 – 2 June 2011 Phase 2: 7-15 Sept 2011 Phase 3: 5-8 Feb 2012	Terrestrial Biological Surveys as an Element of Biodiversity Protection, Position Statement No. 3 (EPA 2002) Guidance for the Assessment of Environmental Factors: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia, No. 56 (EPA 2004b)	Seven fauna habitats were identified including: Rocky free faces and gorges, Stony and loamy plains, Major creeks, Hilly areas, Minor creeks, Calcrete plains and Mulga plains.	**Recorded:** One Threatened fauna listed under the EPBC Act and/or the BC Act was recorded: Pilbara Leaf-nosed Bat (*Rhinonicteris aurantius*; Vu). One Priority listed fauna species was recorded: Western Pebble-mound Mouse (*Pseudomys chapmani*; P4). One Migratory species listed under the EPBC Act and/or the BC Act was recorded: Common Greenshank (*Tringa nebularia*). One ‘other specially protected species’ (OS) listed under the BC Act was recorded: Peregrine Falcon (*Falco peregrinus*; OS).

Title/ Reference	Survey Level*	Sampling Methods and Survey Effort	Timing	EPA Guidance (Applicable at time of survey)	Habitats	Significant Fauna Recorded
Consolidated Fauna Habitat Mapping (Biologic 2014)	Desktop	Not applicable	2014	Terrestrial Biological Surveys as an Element of Biodiversity Protection, Position Statement No. 3 (EPA 2002) Guidance for the Assessment of Environmental Factors: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia, No. 56 (EPA 2004b)	Ten fauna habitat types were mapped within the Development Envelope: Stony plain, Sandy/Stony Plain, Sand Plain, Mulga Woodland, Minor Drainage Line, Major Drainage Line, Hardpan Plain, Drainage Area/Floodplain, Hillcrest/Hillslope, and Calcrete Areas.	**Not applicable**
Short-range Endemic (SRE) Invertebrate fauna surveys						
Ministers North to Yandi Corridor Single Phase Level 2 Fauna and Detailed Flora/Vegetation Survey (Biologic 2018b)	Basic (Level 1)[1]	Motion cameras (23 cameras) Bat survey (Five SM2) Bird survey (Two SM4) Opportunistic observations	9-13 October 2017	Technical Guidance Sampling Methods for Terrestrial Vertebrate Fauna (EPA 2016h) Technical Guidance Terrestrial Fauna Surveys (EPA 2016i)	Seven fauna habitats were identified within the Study Area: Basalt Outcrop, Breakaway/Cliff, Gorge/ Gully, Hillcrest/ Hillslope, Major Drainage Line, Minor Drainage Line and Drainage Area/ Floodplain.	One Priority fauna species was recorded: Western Pebble-mound mouse (*Pseudomys chapmani*; P4) Report also states that One Threatened fauna listed under the EPBC Act and/or the BC Act has previously been recorded: Northern Quoll (*Dasyurus hallucatus*; En)

Title/ Reference	Survey Level*	Sampling Methods and Survey Effort	Timing	EPA Guidance (Applicable at time of survey)	Habitats	Significant Fauna Recorded
Yandi Mine, Short-range Endemic Invertebrate Survey and Impact Assessment (Biologic 2013)[2]	Basic (Level 1)	55 habitat assessment sites 34 SRE sampling sites: • Active foraging • Leaf litter sifting • Soil sifting • Targeted searches	13-18 May 2013	Position Statement No. 3 'Terrestrial Biological Surveys as an Element of Biodiversity Protection' (EPA 2002) Guidance Statement No. 56 'Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia' (EPA 2004b) Guidance Statement No. 20 'Sampling of Short Range Endemic Fauna for Environmental Impact Assessment in Western Australia' No. 20 (EPA 2009)	Nine SRE habitat types were identified including: Major drainage lines, Minor drainage lines, Tall ridges of Channel Iron Deposits (CID) along Marillana Creek, Low CID Ridges on the plains, Dolerite outcrops, Shale ridges/ outcrops (and other geologies), Gullies, Vegetation groves, and Open plains.	Two potential SREs (Selenopid spiders) including: *Karaops* ARA001-DNA and *Karaops* ARA002-DNA.

Title/ Reference	Survey Level*	Sampling Methods and Survey Effort	Timing	EPA Guidance (Applicable at time of survey)	Habitats	Significant Fauna Recorded
A Survey of the Short Range Endemic Invertebrate Fauna of Area C West to Yandi (Biota 2014)	Detailed (Level 2)	22 sampling sites Habitat assessment Pitfall trapping (2480 trap nights) Funnel trapping (600 trap nights) Targeted searches (3,590 minutes) Active foraging Leaf litter and soil sifting	Phase 1: 25 May - 2 June 2011 Phase 2: 7-15 Sept 2011 Phase 3: 5-8 Feb 2012	Position Statement No. 3 'Terrestrial Biological Surveys as an Element of Biodiversity Protection' (EPA 2002) Guidance Statement No. 56 'Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia' (EPA 2004b) Guidance Statement No. 20 'Sampling of Short Range Endemic Fauna for Environmental Impact Assessment in Western Australia' No. 20 (EPA 2009)	Seven broad SRE invertebrate fauna habitat types were recorded: Rocky Free Faces and Gorges, Stony and Loamy Plains, Major Creeks, Hilly Areas, Minor Creeks, Calcrete Plain, Mulga Plains	10 potential SRE taxa (all mygalomorph spiders) including: Barychelid sp. 'B2', Barychelid sp. 'B20', Ctenizid sp. 'C2', Ctenizid sp. 'C11', Nemesiid sp. 'N36', Nemesiid sp. 'N39, Nemesiid sp. 'N41, Nemesiid sp. 'N47'. Nemesiid sp. 'N52', and Nemesiid sp. 'N53'.

Title/ Reference	Survey Level*	Sampling Methods and Survey Effort	Timing	EPA Guidance (Applicable at time of survey)	Habitats	Significant Fauna Recorded
Yandi Tenement Short-range Endemic Invertebrate Survey (Biologic 2015)	Detailed (Level 2)	119 habitat assessments 94 sampling sites Active foraging Leaf litter and soil sifting Targeted searches for burrows.	Phase 1: 3-10 April 2014 Phase 2: 9-16 September 2014	Position Statement No. 3 'Terrestrial Biological Surveys as an Element of Biodiversity Protection' (EPA 2002) Guidance Statement No. 56 'Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia' (EPA 2004b) Guidance Statement No. 20 'Sampling of Short Range Endemic Fauna for Environmental Impact Assessment in Western Australia' No. 20 (EPA 2009)	Eight major habitat types were identified within the Study Area: Gorges/ deep gullies, Shallow gullies, Ridges/ breakaways, Rocky outcrops/domes, Hillslopes/ footslopes, Drainage foci, Drainage lines (dispersal habitat), and Plains.	Five Potential SRE taxa recorded including: *Karaops* `ARA001-DNA (selenopid spider); *Succinea* `sp. indet.` (snail); and *Troglochernes* `sp. indet.`, *Sundochernes* `PSE090` and *Xenolpium* `sp. cf. PSE033.` (pseudoscorpions).
Aquatic fauna surveys						
Yandi: Marillana Creek Aquatic Fauna Survey Wet & Dry 2017 Sampling (Wetland Resource Management [WRM] 2018)	Baseline	Habitat characterisation and sampling of water quality, microinvertebrates (zooplankton), hyporheic fauna, macroinvertebrates, fish and opportunistic observations for other aquatic vertebrates (frogs and turtles).	May 2017 (wet season) Sept 2017 (dry season)	Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA 2002) Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia, No. 56 (EPA 2004)	Sites were generally dominated by transmissive gravel and sand substrates and characterised by submerged macrophyte and algal habitats. Sites MC1 and MC2 are semi-permanent to	Five stygal SREs were recorded: amphipods Paramelitdae sp. B, Paramelitdae sp. D and *Chydaekata* sp.; the isopod *Pygolabis weeliwolli*, and the ostracod *Gomphodella* n. sp. (BOS334) Three freshwater fish species were recorded: the Western Rainbowfish (*Melanotaenia australis*), Spangled Perch (*Leiopotherapon unicolor*) and Pilbara Tandan (*Neosilurus* sp.).

Title/ Reference	Survey Level*	Sampling Methods and Survey Effort	Timing	EPA Guidance (Applicable at time of survey)	Habitats	Significant Fauna Recorded
Yandi Aquatic Fauna Survey: Wet & Dry Season Sampling 2014 (WRM 2015)	Baseline	Habitat characterisation and sampling of water quality, microinvertebrates (zooplankton), hyporheic fauna, macroinvertebrates, fish and opportunistic observations for other aquatic vertebrates (frogs and turtles).	April 2014 (wet season) Sept 2014 (dry season)	Guidance Statement No. 20 'Sampling of Short Range Endemic Fauna (EPA 2009) ANZECC & ARMCANZ (2000) - default guidelines used for water quality	permanent water pools.	Aquatic invertebrates of significance included stygal and potential SREs, and ICUN listed damselflies and dragonflies. Three freshwater fish species were recorded: the Western Rainbowfish (Melanotaenia australis), Spangled Perch (Leiopotherapon unicolor) and Pilbara Tandan (Neosilurus sp.).

Appendix 12 Terrestrial Fauna survey reports

The following studies undertaken to support the assessment of Terrestrial Fauna for the Proposal are provided:

1. Ministers North Consolidated Targeted Significant Vertebrate Fauna Surveys (Astron 2024b)
2. Yandi 45C Targeted Significant Vertebrate Fauna Survey (Astron 2023a)
3. Central Pilbara Hub Targeted Matters of National Environmental Significance Vertebrate Fauna Survey (Biologic 2023b)
4. Ministers North Level 1 Fauna Survey (GHD 2021)
5. Yandi Operations Short-Range Endemic Fauna Survey Report (Bennelongia 2024a)
6. Ministers North Short-Range Endemic (SRE) Desktop and Field Survey (Bennelongia 2024d)
7. Ministers North and Yandicoogina Creek Short-Range Endemic Invertebrate Fauna Survey (Biologic 2021)
8. Ministers North Yandicoogina Creek Aquatic Ecosystem Survey Dry 2022 and Wet 2023 (Biologic 2024c)
9. MAC Phase 4: Aquatic monitoring Dry 2022 and Wet 2023 (Biologic 2024b)
10. MAC Phase 4: Marillana Creek Baseline Aquatic Ecosystem Survey Dry 2021 & Wet 2022 (Biologic 2023e)
11. MAC Phase 4: Marillana Creek Baseline Aquatic Ecosystem Survey Dry 2020 & Wet 2021 (Biologic 2022a)
12. Ministers North: Yandicoogina Creek Aquatic Ecosystem Surveys (Biologic 2020b).

The following studies undertaken to support the assessment of Terrestrial Fauna for the Proposal are currently in preparation and will be provided when available:

- Ministers North Aquatic Ecosystem Survey: Dry 2021 – Wet 2022 (Biologic 2023d)
- Ministers North: Yandicoogina Creek Aquatic Ecosystem Surveys Dry 2020 and Wet 2021 (Biologic 2022b).

Appendix 13 Terrestrial Fauna likelihood of occurrence

Table A13 presents the likelihood of occurrence assessment for significant fauna in the Development Envelope.

Table A13: Significant fauna likelihood of occurrence in the Development Envelope

Species	Conservation status		Preferred habitat	Likelihood of occurrence*
	EPBC Act	BC Act / DBCA		
Fauna recorded within the Development Envelope				
Pilbara Olive Python (*Liasis olivaceus barroni*)	Vu	Vu	Prefers rocky outcrops, escarpments, and gorges, often in close proximity to water holes (including man-made) which attract suitable sized prey species. Microhabitat preferences include rock piles, on top of rocks or underneath spinifex.	**Recorded** There are six records of Pilbara Olive Python within the Development Envelope, including three historical records from areas now cleared, two records within the Indicative Footprint and one record approximately 580 m north-west of the Indicative Footprint. In addition, there are five regional records within a 15 km radius. The Breakaway/Cliff fauna habitat located close to the Flat rocks water pools, the Wetland and the Major Drainage Line habitats all provide critical habitat for the Pilbara Olive Python, with Medium Drainage Line also providing supporting habitat for this species.
Northern Quoll (*Dasyurus hallucatus*)	En	En	Rocky habitats which provide diversity of microhabitats, retain water, and provide protection from predators. Gorge/Gully and Breakaway habitats that are cave forming are particularly important for Northern Quoll, as they provide denning sites for breeding and shelter, and diverse microhabitats for foraging.	**Recorded** The species has been recorded in the Development Envelope twice, with both records occurring within areas that have been cleared under the Approved Proposal. In addition, there are almost 500 regional records of Northern Quoll within 20 km of the Development Envelope. Although there is no critical habitat present, supporting foraging and dispersal habitat is present within most of the habitats present within the Development Envelope.

Species	Conservation status		Preferred habitat	Likelihood of occurrence*
	EPBC Act	BC Act / DBCA		
Common Sandpiper (*Actitis hypoleucos*)	Mi	Mi	Prefers wetland habitats with steep shorelines, in particular along mangrove-lined creeks, muddy areas with rocky outcrops, steep sided dams, and sewage ponds.	**Recorded** The species was recorded eight times during the recent field survey and there are three historical records in the Development Envelope (Astron 2023). Suitable habitat for this species occurs within the Wetland habitat and some of the Major Drainage Line habitat.
Western Pebble-mouse (*Pseudomys chapmani*)	-	P4	Stony hillsides with hummock grassland and shelter in complex burrow systems under a mound which they construct on the surface using pebbles collected in the vicinity.	**Recorded** There are 1,039 records of this species across the Development Envelope including 78 records from areas that have been cleared under the Approved Proposal. This also includes seven mounds which were recorded during the current survey including three active mounds, three recently inactive mounds, and one historical inactive mound. The Stony Plain, Undulating Low Hills and Hillcrest/Hillslope habitats provide suitable habitat for this species.
Peregrine Falcon (*Falco peregrinus*)	n/a	OS	Hunts in any habitat and nests on rocky ledges in tall, vertical cliff faces and tall trees associated with drainage lines.	**Recorded** Has historically been recorded in the Development Envelope and regional records exist approximately 5 km south and east. Suitable habitat occurs within the Major and Medium Drainage Line fauna habitats.
Fauna with a moderate likelihood of occurrence				
Ghost Bat (*Macroderma gigas*)	Vu	Vu	Ghost Bats roost in deep, complex caves that provide diurnal and nocturnal roost with stable temperature and humidity, and good foraging opportunities, typically within 2 km of diurnal roosts (TSSC 2016a).	**Moderate** Has not been recorded within the Development Envelope; however, there are over 100 records of this species within 15-30 km of the Development Envelope, and recent records within 10 km. Given the proximity of nearby records, and availability of suitable foraging and dispersal habitat, this species has a moderate likelihood of occurrence.

Species	Conservation status		Preferred habitat	Likelihood of occurrence*
	EPBC Act	BC Act / DBCA		
Pilbara Leaf-nosed Bat (*Rhinonicteris aurantius)*	Vu	Vu	Roosts in deep, warm, humid caves or rock cracks near water pools and forages in a range of habitats including along watercourses and over *Triodia* grasslands.	**Moderate** Has not been recorded in the Development Envelope to date; however, over 1,200 records within 20 km of the Development Envelope occur (Astron 2023). Although there is no critical or roosting habitat for this species in the Development Envelope, supporting foraging and dispersal habitat does occur. This, along with the large number of records in the surrounding area, means that the species is considered to have a moderate likelihood of occurrence within the Development Envelope.
Grey Falcon (*Falco hypoleucos*)	-	Vu	Nests in the tall trees along watercourses, as well as in telecommunication towers. Frequents timbered lowland plains, particularly Acacia shrublands that are crossed by tree-lined water courses.	**Moderate** Has not been recorded within the Development Envelope; however, there are four regional records within 35 km of the Development Envelope. Due to both potential critical and supporting habitats being present in the Development Envelope, and proximity of nearby records, this species has a moderate likelihood of occurrence.
Australian Painted Snipe (*Rostratula australis*)	En	En	Inhabits shallow terrestrial freshwater wetlands, lakes, swamps and claypans.	**Moderate** Has not been recorded within the Development Envelope; however, there are regional records within 40 km. Suitable habitat is present in the Wetland, Major Drainage Line and Medium Drainage Line habitats. As such, the species has a moderate likelihood of occurrence.

Species	Conservation status		Preferred habitat	Likelihood of occurrence*
	EPBC Act	BC Act / DBCA		
Common Greenshank (*Tringa nebularia*)	Mi	Mi	A Migratory wader species generally found in a variety of freshwater, marine and artificial wetlands, including swamps, open muddy or rocky shores of lakes and large rivers, sewage farms, saltworks, muddy coastal flats, mangroves, and estuaries.	**Moderate** Has not been recorded in the Development Envelope; however, there are records within 2 km of the Development Envelope. Suitable habitat is present in the form of Wetland, Major Drainage Line and Medium Drainage Line habitats. Due to this and the proximity of the nearby records, this species has a moderate likelihood of occurrence.
Glossy Ibis (*Plegadis falcinellus*)	Mi	Mi	Inhabits wetlands and freshwater marshes at the edges of lakes, rivers, and wet swamp areas.	**Moderate** Has not been recorded within the Development Envelope; however, there is one regional record in proximity to the Development Envelope. There is also suitable habitat present in the Wetland, Major Drainage Line and Medium Drainage Line habitats. As such, the species has a moderate likelihood of occurring.
Fork-tailed Swift (*Apus pacificus*)	Mi	Mi	Is a predominantly airborne species that occurs in low to very high airspace and is mainly independent of terrestrial habitats and landforms.	**Moderate** Has not been recorded within the Development Envelope; however, there are three regional records of this species within 25 km. Given that the species wide range, it has a moderate likelihood of occurrence, however given it is mainly aerial, it is unlikely to depend on any of the habitats present in the Development Envelope.
Pilbara Barking Gecko (*Underwoodisaurus seorsus*)	-	P2	Confined to the Hamersley Ranges from Tom Price to Newman and occurs in rocky areas with spinifex and low tree cover.	**Moderate** Has not been recorded from the Development Envelope; however, there are 12 regional records, all which are over 20 km from the Development Envelope. Suitable habitat includes Sandy/Stony Plain, Stony Plain and Undulating Low Hills habitat.

Species	Conservation status		Preferred habitat	Likelihood of occurrence*
	EPBC Act	BC Act / DBCA		
Unpatterned Robust Slider (Robertson Range) (*Lerista macropisthopus remota*)	-	P2	Found in Acacia shrublands and woodlands in the central interior and shelters in loose soil under leaf litter at the base of shrubs.	**Moderate** Has not been recorded from the Development Envelope; however, there are three regional records, all which are over 20 km from the Development Envelope. Due to the species' undetectability without extensive survey/trapping effort and there being suitable habitat present in the form of Major and Medium Drainage Lines and Drainage Area/Floodplain habitats, there is a moderate likelihood of occurrence.
Brush-tailed Mulgara (*Dasycerus blythi*)	-	P4	Known to occur in a range of habitats, including tussock/hummock grasslands and low open woodlands.	**Moderate** Has not been recorded from the Development Envelope; however, there are four regional records within 15 km of the Development Envelope. Due to the presence of some suitable habitat within the Drainage Area/Floodplain and Sandy/Stony Plain habitats, and four regional records, the species is considered to have a moderate likelihood of occurrence.
Letter-winged Kite (*Elanus scriptus*)	-	P4	Inhabits open country and grasslands in arid and semi-arid Australia, where there are tree-lined streams or water courses.	**Moderate** Has not been recorded within the Development Envelope. One regional record occurs approximately 40 km from the Development Envelope. Some suitable habitat occurs within the Major and Minor Drainage Line habitats. Given the presence of suitable habitat and high mobility of this species, it is considered to have a moderate likelihood of occurrence.
Fauna with a low likelihood of occurrence				

Species	Conservation status		Preferred habitat	Likelihood of occurrence*
	EPBC Act	BC Act / DBCA		
Night parrot (*Pezoporus occidentalis*)	En	Cr	Arid and semi-arid areas characterised by dense, low vegetation. Based on accepted records, the habitat consists of *Triodia* grasslands in stony or sandy environments, of samphire and chenopod shrublands, on floodplains and claypans and margins of salt lakes, creeks, and other water sources	**Low** Has not been recorded in the Development Envelope despite extensive survey effort but was identified as possibly occurring in the Protected Matters Search Tool (PMST) database. There are no nearby regional records. Potentially suitable habitat is present within the Sand Plain, Sandy/Stony Plain, Drainage Area/Floodplain, Undulating Low Hills, Stony Plain, and Hardpan Plains habitats; however, there is no old growth *Triodia* present, and large sections of the Development Envelope have been cleared or are disturbed. Based on this, and the lack of records within, or in proximity to, the Development Envelope (despite extensive survey effort), this species has a low likelihood of occurrence.
Greater bilby, dalgyte (*Macrotis lagotis*)	Vu	Vu	Includes mulga scrub and hummock grasslands on sandplains or along drainage or salt-lake systems. Requires sandy or loamy soils in which to burrow.	**Low** Has not been recorded in the Development Envelope despite extensive survey effort. Whilst there is some supporting habitat present within the Hardpan Plains, Stony/Sandy Plain, Stony Plain, and Drainage/Floodplain habitats, most the soils were stony and not suitable for the species. Soil substrate suitable for burrow construction is critical (Northover et. al. 2023) and no critical habitat is present (Astron 2023). Due to the low number of previous records within the vicinity, lack of suitable habitat and extensive survey effort, there is a low likelihood of this species occurring.
Great desert skink (*Liopholis kintorei*)	Vu	Vu	Red sandplains and sand ridges. Prefers a mosaic landscape of different aged vegetation and inhabits sites that have been burnt (3-15 years). Sparsely distributed across arid sand flats and clay-based or loamy soils vegetated with spinifex.	**Low** Has not been recorded in the Development Envelope. No nearby regional records and a lack of sandy habitats mean that this species is considered to have a low likelihood of occurrence.

Species	Conservation status		Preferred habitat	Likelihood of occurrence*
	EPBC Act	BC Act / DBCA		
Gull-billed Tern (*Gelochelidon (Sterna) nilotica*)	Mi	Mi	A migratory seabird that occasionally inhabits swamps, lagoons, river pools, claypans, and dams	**Low** Has not been recorded within the Development Envelope and only one (historical) regional record approximately 25km away. The species is more commonly associated with coastal areas. Due to this and the lack of recent regional records, the species has a low likelihood of occurrence.
Oriental Plover (*Charadrius veredus*)	Mi	Mi	Inhabits sparsely vegetated plains, beaches and tidal flats, and saltworks and sewage ponds.	**Low** Has not been recorded within the Development Envelope and no known nearby regional records. Some suitable habitat does occur within the Wetland, Major Drainage Line and Medium Drainage habitats; however, there have been no sightings of this species despite extensive survey effort. This species is considered to have a low likelihood of occurrence.
Pectoral Sandpiper (*Calidris melanotos*)	Mi	Mi	Mainly inhabits swamps, lagoons, river pools, irrigation channels, and sewerage ponds.	**Low** Has not been recorded within the Development Envelope and there are no known nearby regional records. Some suitable habitat does occur within the Wetland, Major Drainage Line and Medium Drainage habitats; however, given there have been no sightings of this species despite extensive survey effort and lack of regional records, this species is considered to have a low likelihood of occurrence.
Sharp-tailed Sandpiper (*Calidris acuminata*)	Mi	Mi	Inhabits muddy edges of shallow fresh/brackish wetlands with emergent sedges, saltmarsh, grass, and low vegetation.	**Low** Has not been recorded within the Development Envelop and there are no known nearby regional records. Some suitable habitat does occur within the Wetland, Major Drainage Line and Medium Drainage habitats; however, there have been no sightings of this species despite extensive survey effort. This species is considered to have a low likelihood of occurrence.

Species	Conservation status		Preferred habitat	Likelihood of occurrence*
	EPBC Act	BC Act / DBCA		
Barn swallow (*Hirundo rustica*)	Mi	Mi	Coastal open country generally, especially near surface water and man-made structures, such as bridges and power wires.	**Low** Has not been recorded within the Development Envelope and no nearby regional records. This species generally occurs closer to coastal areas, and is considered to have a low likelihood of occurrence
Yellow wagtail (*Motacilla flava*)	Mi	Mi	Damp short-grass flats, edges of swamps, sewerage ponds, grazed, or mowed grass and irrigated areas.	**Low** Has not been recorded within the Development Envelope. Vagrant to Australia. There are no known nearby regional records, and there is a lack of suitable habitat present.
Grey wagtail (*Motacilla cinerea*)	Mi	Mi	Mainly banks and rocks in fast flowing fresh water.	**Low** Has not been recorded within the Development Envelope. The species is a vagrant to Australia and rarely reaches Australia during migration. There is also no suitable habitat within the Development Envelope. .
Gane's blind snake (*Anilios ganei*)	-	P1	Associated with moist gorges and gullies.	**Low** Has not been recorded from the Development Envelope and there is no suitable habitat present. There are four regional records, three of which are over 20 km away and one within 20 km; however, due to the lack of suitable habitat, the species has as low likelihood of occurrence.
Short-tailed mouse (*Leggadina lakedownensis*)	-	P4	Open tussock and hummock grassland, Acacia shrubland and savanna woodland on alluvial clay/sandy soils, and cracking clays.	**Low** Has not been recorded from the Development Envelope; however, one regional record occurs approximately 35 km away. There is a lack of suitable habitat present within the Development Envelope for this species and the species has not been recorded despite extensive survey effort.

Adapted from: Astron 2023a, 2024b; Biologic 2023b; GHD 2021; Biologic 2011b and 2018b

Appendix 14 Summary of Subterranean Fauna studies and surveys

Table A14 presents a summary of the historical subterranean fauna studies and surveys used in the assessment of the Proposal.

Table A14: Summary of subterranean fauna studies and surveys

Title/ Reference	Survey Level	Sampling Methods and Survey Effort	Timing	EPA Guidance (Applicable at time of survey)	Significant Fauna
BHP Billiton Iron Ore Regional Subterranean Fauna Study (Biota 2006)	Stygofauna Investigation Plan	Programme design document that outlined the framework and components of a regional stygofauna investigation plan including ongoing monitoring of stygofauna at Yandi.	Twice yearly monitoring	Guidance Statement Number 54 (EPA 2003)	N/A
BHP Billiton Regional Subterranean Fauna Study (Stygofauna) 2005-2007 (Biota 2008)	Monitoring stygofauna survey / investigation plan	173 boreholes sampled across seven Mining Project Areas. At Yandi, total monitoring effort over four phases involved 36 samples from nine bores. Stygofauna were sampled from groundwater bores using sampling nets (70 µm plankton mesh, with a 50 mm aperture), with three samples taken from each.	Phases I-IV: 2005 to 2007	Guidance Statement Number 54 (EPA 2003) Guidance Statement No. 54a (EPA 2007).	A total of 1,226 stygofauna specimens representing five higher taxonomic groups. were collected from Marillana Creek during the four phases. Specimens were not identified to species level; however, the results indicate that the superficial alluvial systems of Marillana Creek support a diverse stygofauna community.
Regional Subterranean Fauna Study Yandi Stygofauna Monitoring Review (Subterranean Ecology 2010)	Monitoring stygofauna survey	Twice yearly monitoring of stygofauna over two years 33 samples from 10 bores collected Stygofauna were sampled using sampling net hauls	Phases V-VIII July 2008, October 2008, February 2009 and November 2009	Guidance Statement Number 54 (EPA 2003) Guidance Statement No. 54a (EPA 2007).	A total of 18 species were identified; Amphipoda (5 species), Bathynellacea (2 species), Copepoda (4 species), Ostracoda (4 species), Oligochaeta (3 species). Twelve species were considered to be restricted to the Marillana Creek catchment at the time of survey.

Title/ Reference	Survey Level	Sampling Methods and Survey Effort	Timing	EPA Guidance (Applicable at time of survey)	Significant Fauna
Yandi stygofauna – continuation of monitoring program (Bennelongia 2013)	Monitoring stygofauna survey	102 (42 bores) 62 samples collected from Yandi Net hauls (stygofauna)	Phases IX–XI May-June 2011. Aug 2011 and Feb 2012	Guidance Statement Number 54 (EPA 2003) Guidance Statement No. 54a (EPA 2007).	Among 17 species considered by Bennelongia (2012) to have ranges restricted to the area surveyed, four stygofauna species were considered ecologically significant, *Elaphoidella* sp. S02 (copepod), *Atopobathynella* sp. S02 (syncarid), *Notacandona* `*quasiboultoni*` (ostracod), Haplotaxidae sp. S01 (annelid worm).

Appendix 15 Subterranean Fauna survey reports

The following studies undertaken to support the assessment of Subterranean Fauna for the Proposal are provided:

1. Yandi Operations Subterranean Fauna Survey Report (Bennelongia 2024b)
2. Ministers North Subterranean Fauna Survey (Bennelongia 2024c)
3. Jugari East 8 Subterranean Fauna Habitat Modelling (Biologic 2024d)
4. Yandi Targeted Subterranean Fauna Survey Report (Bennelongia 2025)

Appendix 16 Social Cultural Heritage Environmental Management Plan

The Social Cultural Heritage Environmental Management Plan (Revision 2, 2025) (BHP 2025e) is provided separately.

Appendix 17 Marillana Creek Diversion Management Plan

The Marillana Creek Diversion Management Plan (Revision 0, 2016) (BHP Billiton 2016) is provided separately.

Appendix 18 Yandi Impact Reconciliation Procedure

The Marillana Creek (Yandi) Life of Mine Proposal Impact Reconciliation Procedure Revision 2.0. BHP 2025. (BHP 2025d) is provided separately