Corunna Downs Project

Supplementary Report - EPA Referral

September 2019

179-LAH-EN-REP-0006

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Abbreviations

AH Act	*Aboriginal Heritage Act 1972*
ALARP	as low as reasonably practicable
AN	ammonium nitrate
ANFO	ammonium nitrate fuel oil
AUD	Australian Dollar
BC Act	*Biodiversity Conservation Act 2016*
DBCA	Department of Biodiversity, Conservation and Attractions
DEE	Department of the Environment and Energy
DMIRS	Department of Mines, Industry Regulation and Safety
DPAW	(former) Department of Parks and Wildlife
DPLH	Department of Planning, Lands and Heritage
DTGW	depth to groundwater
DWER	Department of Water and Environmental Regulation
EMP	environmental management plan
EP Act	*Environmental Protection Act 1986*
EPA	Environmental Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
Fe	iron
GDP	Ground Disturbance Permit
GDV	Groundwater Dependent Vegetation
GL	Gigalitre
HSEMS	Health, Safety and Environmental Management System
IBRA	Interim Biogeographical Regionalisation for Australia
kbcm	thousand bank cubic metres
mbgl	metres below ground level
MNES	Matters of National Environmental Significance
MOC	mine operation centre
NAF	non-acid forming
NVCP	Native Vegetation Clearing Permit
PAF	potentially acid forming

PEC	Priority Ecological Community
RC	reverse circulation
RIWI Act	*Rights in Water and Irrigation Act 1914*
ROM	run of mine
SRE	short range endemic
SSMP	Significant Species Management Plan
TDS	total dissolved solids
TEC	Threatened Ecological Community
TSS	total suspended solids
WRD	waste rock dump
WWTP	wastewater treatment plant

Executive Summary

Atlas Iron Pty Ltd (Atlas Iron) is currently seeking approval to develop the Corunna Downs Project (the Proposal), an iron ore project located in the Pilbara region of Western Australia, approximately 33 km south of Marble Bar. Atlas Iron referred this Proposal under Section 38 of the *Environmental Protection Act 1986* due to its potential to have a significant effect on a number of the Environmental Factors defined by the Environmental Protection Authority (EPA). On 7 August 2019, the EPA advertised their decision to assess the Proposal and set the level of assessment as Referral Information with additional information required under Section 40(2)(a) of the EP Act. This document has subsequently been revised in consideration of the outcomes of a number of additional investigations and to address the EPA's request for the following additional information:

- Impacts on riparian vegetation and habitat for Conservation Significant species, particularly relating to the results of updated hydrogeological investigations.
- Noise impacts on sensitive receptors by truck movements and mitigation measures.

Atlas Iron has already obtained the following environmental approvals in support of this Proposal:

- Commonwealth approval under Sections 130(1) and 133 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), Granted by the Department of Environment and Energy (DEE) on the 23 February 2018 (EPBC 2017/7861). This approval addressed the Proposal's potential impacts to Listed Threatened Species (Sections 18 and 18A).
- Works Approval under Part V of the EP Act, was granted by the Department of Water and Environment Regulation (DWER) on the 6 September 2017 (W6043). This approval supports the Proposal's prescribed premises, specifically; the crushing and screening facility, sewage facility and landfill facility (categories 5, 85 and 89).

This Proposal involves the development of five open pits (Split Rock, Razorback, Shark Gully, Runway North and Runway South) using conventional drill and blast, load and haul methods. It is anticipated 23.3 million tonnes of iron ore will be mined above the groundwater table over approximately 6 years with an average strip ratio of 0.55:1 (waste: ore). Associated infrastructure will include open pits, waste rock dumps, mine operation centre, borefield and accommodation camp.

The Proposal will utilise the Hillside-Marble Bar Road route from the site haul road across to the Corunna Downs Road and through to the Limestone-Marble Bar Road for haulage of final product to Utah Point Bulk Commodities Berth at Port Hedland for export.

Table ES1 provides a summary of the Proposal. Table ES2 provides a description of the location and proposed extent of physical and key operational elements of the Proposal.

Table ES1 – Proposal Summary

Proposal Title	Corunna Downs Project
Proponent Name	Atlas Iron Pty Ltd
Short Description	Atlas Iron Pty Ltd is currently seeking approval to develop the Corunna Downs Project (the Proposal) located in the Pilbara region of Western Australia, approximately 240 km south east of Port Hedland and 33 km south of Marble Bar. The Proposal involves mining iron ore at a rate of five million tonnes per annum over a six-year period. Ore will be sourced from five open pits using conventional drill and blast, load and haul methods. Ore will then be trucked to the run-of-mine pad for crushing and screening with the final product hauled to Utah Point in Port Hedland for export overseas.

Table ES2 – Location and Proposed Extent of Physical and Operational Elements

Element	Location	Proposed Extent
Physical Elements		
Mine and Associated Infrastructure	Figure 2.3	Clearing no more than 423.11 hectares (ha) of native vegetation within the 2,257.6 ha Development Envelope.
Operational Elements		
Mining and processing rate	N/A	Up to 5 Mtpa
Water abstraction	N/A	Up to 1.1 GLpa

Various biological and physical studies have been completed over the last six years to identify key environmental values and assess the risk of impact to these values from the Proposal. Where there has been information gaps or scientific uncertainty, Atlas Iron has sought to address these through additional investigations and specialist advice and has otherwise applied a conservative approach when assessing risk.

Careful evaluation has been made of options to avoid or minimise any potential environmental impacts, followed by the identification and development of management measures and rehabilitation considerations for any residual risks to key environmental factors in consideration of the Environmental Objectives for each environmental factor, as well as the EPA's Environmental Principles. Key environmental values avoided include:

- Both significant diurnal roosts for the Pilbara Leaf-nosed Bat and the majority of nocturnal refuges for this species and/or the Ghost Bat (i.e., 14 of the 16).
- All five perennial and six ephemeral pools.
- Two of the five conservation significant flora species (*Rothia indica* subsp. *australis* (P1) and *Acrostichum speciosum* (other)) and the majority of locations of the remaining three species (*Eragrostis crateriformis* (P3), *Heliotropium murinum* (P3) and *Swainsona thompsoniana* (P3)) so that only one location of each of these species will be disturbed.

Table ES3 provides a summary of potential impacts, proposed mitigation and predicted outcomes for each of the Proposal's key environmental factors, specifically Inland Waters, Flora and Vegetation and Terrestrial Fauna.

Table ES3 – Summary of Potential Impacts, Proposed Mitigation and Outcomes

Factor	Summary
Inland Waters	
EPA Objective	To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected.
Policy and Guidance	Environmental Factor Guideline: Inland Waters (EPA, 2018).
Receiving Environment	The Proposal lies within the middle reaches of the Coongan River catchment (7,090 km2), which sits within the De Grey River Basin (Stantec, 2018a). Eleven significant water sources (i.e. pools) have been identified within the vertebrate fauna Study Area (MWH, 2018a). Only five of the 11 pools were determined to be perennial (i.e., permanent), four of which are considered likely to be groundwater dependent; CO-WS-01, CO-WS-05, CO-WS-12 and CO-WS-14 (SRK, 2019). The microclimate of cave CO-CA-03, a non-permanent breeding roost for the Pilbara Leaf-nosed Bat, is likely to be supported by pool CO-WS-14 along with an observed seep inside this cave. A potential 'soak' has also identified within the Development Envelope (Stantec, 2018a, Woodman, 2019). Groundwater gradients within the elevated BIF plateau are typically a subdued reflection of surface topography, lying within 25 to 60 mbgl within pit areas and between 3 to 10 mbgl in the low lying elevations (SRK, 2019). Groundwater quality in the Proposal area is generally neutral with pH values ranging between 5.6 and 8.6, and fresh to marginally brackish with TDS values between 42 and 1,800 mg/L. Generally, lower salinity is recorded within the BIF units of the Corunna ridge, with the more saline water occurring within the Hardy Formation to the north of the ridge within the Coongan River valley (SRK, 2019).
Potential Impacts	• Direct loss of significant hydrological features (e.g., pools) due to clearing. • Alteration of surface water flows due to the change in quantity of surface water associated with the interruption of natural drainage channels and drainage shadowing and ponding. • Alteration of surface water quality associated with increased sediment and runoff, potential exposure of PAF shale waste rock material and/or potential hydrocarbon and chemical contamination. • Alteration of groundwater quality and availability associated with water abstraction. Indirect impacts on significant hydrological features due to change in water quality and quantity.
Mitigation	**Avoidance:** The Development Envelope was altered to avoid all significant pools inclusive of a 50 m buffer, except for CO-WS-01, where a 20 m buffer has been applied. **Minimisation and management:** The key regulatory mechanism relevant to this factor is the 5C Licence to take water under the RIWI Act and associated Water Management Plan and Site Water Operating Plan. These documents are currently being prepared following completion of recent hydrological investigation and revised drawdown model and will contain site-specific trigger values and management response actions developed in collaboration with the relevant regulatory agencies (i.e., DWER).

Factor	Summary
	In addition to this, the following plans and procedures will be implemented to assist in minimising impacts to inland waters: • Dust Management Procedure. • Ground Disturbance Permit (GDP) Procedure. • Clearing and Grubbing Procedure. • Waste Rock Management Strategy and Split Rock waste rock dump design. • Waste Management Procedure. • Wastewater Treatment Plant (WWTP) Care and Maintenance Plan. • WWTP Management Plan. • WWTP Sampling Procedure. • Hydrocarbon Management Procedure. • Hydrocarbon (and Chemical) Spill Management Procedure. Key management measures contained in these plans include: • Ensure appropriate surface water management (e.g., around pits, waste rock dumps and the ROM) is incorporated into the final mine design, in accordance with the objectives and design principles. • Culverts will be installed along the haul road where it intersects drainage features, to minimise impacts to surface water quality and quantity in pools, the freshwater soak and the Coongan River. • Haul road construction impacts will be managed to minimise the risk of overburden travelling down embankments into pool CO-WS-01 (e.g., using windrows). • To minimise impacts to pool CO-WS-09, Atlas Iron will investigate moving the nearby topsoil stockpile or, if unable to do so, will work to optimise/reduce the area of the stockpile. Stormwater management will be implemented while topsoil is stockpiled. • Water management at waste rock dumps will encourage surface water flow to infiltrate internally or otherwise be directed to sedimentation ponds, where the bulk of the suspended material will be settled out prior to any discharge to the downstream environment. • Most flows will be directed around the ROM pad. Any internal flows will be contained on the ROM pad and encouraged to infiltrate/evaporate. • The minimal flows entering the pit and the mining of the pit in such a way as to allow water to collect away from active work front areas and infiltrate and/or evaporate. No excess surface water will be discharged from pits to the environment. • Ensure any PAF shale waste rock material if present is appropriately managed (i.e., encapsulated). • Containment of hydrocarbons in accordance with *AS1940:2004 – The Storage and Handling of Flammable and Combustible Liquids*, this includes sitting and bunding/containment restrictions, provision and maintenance of relevant MSDS and regular inspections. • Refuelling procedures, including the provision of a spill kit at all refuelling stations. • Spill recovery and clean up materials maintained at all hazardous material storage areas. Relevant employees and contractors will be trained in the use of this equipment.

Factor	Summary
	Rehabilitation: All areas of the Indicative Disturbance Footprint (except for open pits) will be progressively rehabilitated as soon as practicable and as required by the Mine Closure Plan.
Predicted Outcome	• Approximately 0.04% disturbance to the regional Coongan River catchment. • Approximately 0.1 ha disturbance to the northern side of the freshwater 'soak'. • No disturbance to the freshwater wetland system. • No direct impact to any of the 11 pools, with pools CO-WS-01 buffered from the Development Envelope by 20 m and all other pools buffered by a minimum of 50 m. • Minor shadow effects to surface water flows downstream of pit and waste rock dump areas and land bridge, but no appreciable impact to catchments. • Minor deterioration in surface water quality from increase in sediment runoff. • Unlikely occurrence of PAF and associated AMD. • No significant change to pool water quality or levels. Specifically, no loss of permanent pools. Up to 4.64 & 6.70 m of drawdown at the 'soak' which may result in tree stress or death where drawdown results in a loss of moisture within the soil matrix at this site.
Flora and Vegetation	
EPA Objective	To protect flora and vegetation so that biological diversity and ecological integrity are maintained.
Policy and Guidance	• Environmental Factor Guideline: Flora and Vegetation (EPA, 2016a). • Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016b). • Guidance Statement No. 51, Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA, 2004a). Position Statement No. 3 Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA, 2002).
Receiving Environment	Fifteen VTs mapped, with five of these (VTs 3, 4, 8, 14 and 15) could represent groundwater dependent vegetation. No VTs represent any TEC or PEC, however VT 3, 6, 7 and 8 were considered locally significant. Majority of the vegetation ranked as being Excellent condition. 413 discrete vascular flora taxa recorded. No BC Act or EPBC Act Threatened Flora taxa, however eleven DBCA classified Priority Flora taxa. A further five species were considered significant flora.
Potential Impacts	• Direct clearing of flora and vegetation resulting in a change to the local or regional representation of vegetation communities and flora species. • Changes to vegetation composition, condition and/or health resulting from the following indirect impacts: – Introduction and/or spread of weeds. – Dust deposition. – Altered hydrological regimes (i.e., drainage shadowing and ponding). Groundwater drawdown associated with water abstraction activities.

Factor	Summary
Mitigation	**Avoidance:** The Development Envelope was altered to: • Avoid two significant flora taxa; *Rothia indica* subsp. *australis* (P1) and *Acrostichum speciosum*. • Avoid 13 of the 14 locations of *Eragrostis crateriformis* (P3). • Avoid two of the three locations of *Heliotropium murinum* (P3). • Avoid two of the three locations of *Swainsona thompsoniana* (P3). **Minimisation and management:** The following plans and procedures will be implemented to assist in minimising impacts to flora and vegetation: • GDP Procedure. • Clearing and Grubbing Procedure. • Flora Management Procedure. • Weed Hygiene Procedure. • Dust Management Procedure. • Water Management Plan and Site Water Operating Plan. Key management measures contained in these plans include: • No more than 423.11 ha of vegetation/habitat within the 2,257.6 ha Development Envelope will be cleared/disturbed. • Restricting clearing to the minimum necessary for safe construction and operation of the Proposal and to within approved areas through GDP Procedure. • Surveying and delineation of the GDP boundary in the field prior to any works commencing, including all buffers and values to be avoided and weed infested areas. • Prohibition of off-road driving unless otherwise authorised by Senior Management. • Weed hygiene inspections and certification to ensure all mobile equipment arriving on site is clean and free of material. • Weeds and weed contaminated topsoil will be cleared, handled and stockpiled separately to native vegetation and 'clean' topsoil. • Regular and targeted weed control (e.g. by spraying, physical removal) will be undertaken as appropriate (during all stages of operation including care and maintenance). • Implementation of standard dust suppression techniques shall be used on roads, stockpiles and infrastructure areas (e.g., water carts, sprinklers). • Road train trailers will be fitted with covers during product transport to port. • Abstraction of water in accordance with 5C Licence to take groundwater granted under the RIWI Act and associated management and operating plans. **Rehabilitation:** • The removal and stockpiling of all vegetative matter during clearing for future use in rehabilitation. All areas of the Indicative Disturbance Footprint (except for open pits) will be progressively rehabilitated as soon as practicable and as required by the Mine Closure Plan. Rehabilitation works are expected to return disturbed areas to a stable and vegetated state.

Factor	Summary
Predicted Outcome	• No impact to Threatened Flora, TECs or PECs. • Removal of a maximum of 423.11 ha of native vegetation within the 2,257.6 ha of Development Envelope. • Removal of up to 6% of each of the locally significant VTs (3, 6, 7 and 8) from the Study Area, which is unlikely to result in a significant regional impact. • A 10 m buffer around all locations of conservation significant flora with the exception of a single location of *Eragrostis crateriformis* (P3), *Heliotropium murinum* (P3) and *Swainsona thompsoniana* (P3), low level of regional impact. Loss of vigour and/or tree death in a single species, *Melaleuca argentea*, in up to 112.80 ha of obligate GDV, however it is not considered a significant impact.
Terrestrial Fauna	
EPA Objective	To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.
Policy and Guidance	• Environmental Factor Guideline: Terrestrial Fauna (EPA, 2016c). • Technical Guidance: Sampling methods for terrestrial vertebrate fauna (EPA, 2016d). • Technical Guidance: Terrestrial Fauna Surveys. (EPA, 2016e). Technical Guidance: Sampling of short range endemic invertebrate fauna (EPA, 2016f).
Receiving Environment	Eleven fauna habitat types mapped, five of which are significant fauna habitats (Rocky Ridge and Gorge, Rocky Foothills, Granite Outcrop, Drainage Line and Riverine). Eighteen caves known to support the Pilbara Leaf-nosed Bat and/or Ghost Bat, including cave CO-CA-01 (permanent diurnal roost for Pilbara Leaf-nosed Bat and temporary diurnal roost for Ghost Bat) and CO-CA-03 (non-permanent breeding roost for Pilbara Leaf-nosed Bat). Eleven perennial and ephemeral pools of value for fauna. Seven conservation significant fauna confirmed present including the Northern Quoll, Ghost Bat, Pilbara Leaf-nosed Bat, Pilbara Olive Python, Peregrine Falcon, Spectacled Hare-wallaby and Western Pebble-mound Mouse. Two further species considered likely to occur (the Long-tailed Dunnart and a blind snake) and eleven considered possible to occur.
Potential Impacts	• Loss and/or degradation of fauna habitat, particularly for conservation significant fauna. • Loss and/or degradation of terrestrial fauna habitat due to increased presence of weed species. • Injuries to and mortalities of fauna caused by interactions with vehicles, infrastructure, machinery and the workforce. • Reduced diversity or abundance of foraging resources due to altered hydrological regimes. • Alteration in behaviour of fauna due to noise, vibration, artificial light emissions and dust. • Increased presence of non-indigenous fauna species. Alteration to fire regimes.
Mitigation	**Avoidance:** • A 340 m buffer provided between the Development Envelope and Pilbara Leaf-nosed Bat permanent diurnal roost (cave CA-CO-01).

Factor	Summary
	• A 50 m buffer provided between the Development Envelope and Pilbara Leaf-nosed Bat non-permanent breeding roost (cave CA-CO-03) (effective distance 68 m from rear of cave and 100 m overland). • A 20 m buffer provided between the Development Envelope and all Pilbara Leaf-nosed Bat and/or Ghost Bat nocturnal refuges (except caves CO-CA-08 and CO-CA-15). • A 50 m buffer provided between the Development Envelope and all perennial and ephemeral pools except for CO-WS-14, which is limited to a 20 m buffer. **Minimisation and management:** The following plans and procedures will be implemented to assist in minimising impacts to fauna and fauna habitat: • Ground Disturbance Permit. • Clearing and Grubbing Procedure. • Flora Management Procedure. • Significant Species Management Plan. • Water Management Plan and Site Water Operating Plan. Key management measures contained in these plans include: • No more than 423.11 ha of vegetation/habitat within the 2,257.6 ha Development Envelope will be cleared/disturbed. • Speed limits on roads will be 50 km/h south of the run-of-mine pad (i.e., where it intersects the majority of significant fauna habitat) and 80 km/h north of the run-of-mine pad to limit vehicle interactions with fauna. • Night-time vehicle movements will be restricted where possible to minimise potential vehicle strikes. • Blasting operations will be limited to daytime only to limit disturbance to fauna including bats. • Noise, dust and light emissions will be controlled where possible to avoid excessive disturbance to native fauna, including directing lights to working areas, shielding lights to reduce glow, and using conventional dust suppression techniques (i.e. water trucks). **Rehabilitation:** • All areas of the Indicative Disturbance Footprint (except for open pits) will be progressively rehabilitated as soon as practicable and as required by the Mine Closure Plan. • Should structural damage to either of caves CO-CA-01 and CO-CA-03 be observed which would prevent ongoing use by the Pilbara Leaf-nosed Bat, Atlas Iron is committed to undertaking practical corrective rehabilitation in accordance with the SSMP. **Offset:** Atlas Iron is required to offset significant habitat impacts, including 56.39 ha of critical habitat and 366.73 ha of foraging and/or dispersal habitat for the Pilbara Leaf-nosed Bat and the Ghost Bat (i.e., the entire Proposal footprint), through contribution to the Pilbara Offset Fund as detailed in Chapter 9.
Predicted Outcome	• Clearing of 56.39 ha of critical habitat for the Northern Quoll. • Clearing of 39.82 ha of critical habitat for both the Pilbara Leaf-nosed Bat and Ghost Bat and an additional 366.73 ha of foraging and/or dispersal habitat for both species. • Clearing of 44.95 ha of critical habitat for the Pilbara Olive Python.

Factor	Summary
	• Loss of two nocturnal refuges (CO-CA-08 and CO-CA-15), both of which support the Ghost Bat and one of which supports the Pilbara Leaf-nosed Bat. • No direct impact to any of the 11 pools identified as significant microhabitat features. • Temporary daytime abandonment of the non-permanent breeding roost (cave CO-CA-03) by the Pilbara Leaf-nosed Bat due to disturbance from blasting operations in the Razorback pit. • While habitats present within the Study Area are generally recognised as suitable roosting and foraging habitat for the Ghost Bat, no significant impact to this species is anticipated given it does not appear to be reliant on habitat within the Study Area (i.e., no significant roosts and only sporadic visitation recorded). • No significant impact to SRE fauna or habitat. • No significant indirect impact to pool water quality or levels. Specifically, no loss of permanent pools. Potential decline in the quality of an additional 56.86 ha of fauna habitat associated with the potential tree death of a single flora species (*M. argentea*) in area of GDV considered to be at high risk of drawdown. However, this is not considered to be a significant impact for any species of conservation significance.

Atlas Iron also considered the Proposal's impact on a number of other environmental factors including Subterranean Fauna, Landforms, Terrestrial Environmental Quality, Air Quality and Social Surroundings. Atlas Iron does not anticipate any significant impacts on these factors, given the absence of significant values and/or low level of impact anticipated and the application of proposed mitigation measures and other regulatory mechanisms.

In summary, with the exception of Terrestrial Fauna, the Proposal is not currently predicted to have a significant residual impact on any environmental factor and so is anticipated to meet the EPAs environmental objectives. While significant residual impacts on Terrestrial Fauna are anticipated (refer to Section 7.7), Atlas Iron believes the EPA's objective for this factor can be met with the implementation of the SSMP and EMP and execution of the offset package required by EPBC 2017/7861 (refer to Chapter 9) which is anticipated to result in positive outcomes for the environment that counterbalances the predicted outcomes.

1. Introduction

1.1 Purpose and Scope

Atlas Iron Pty Ltd (Atlas Iron) is currently seeking approval to develop the Corunna Downs Project (the Proposal), an iron ore project located in the Pilbara region of Western Australia, approximately 33 km south of Marble Bar (Figure 1.1). Atlas Iron referred this Proposal under Section 38 of the *Environmental Protection Act 1986* (WA, EP Act) due to its potential to have a significant effect on a number of the Environmental Factors defined by the Environmental Protection Authority (EPA). This document served to provide supplementary information in support of a Section 38 referral under the EP Act in accordance with the *Instructions for the referral of a Proposal to the Environmental Protection Authority under Section 38 of the Environmental Protection Act 1986* (EPA, 2018).

On 7 August 2019, the EPA advertised their decision to assess the Proposal and set the level of assessment as Referral Information with additional information required under Section 40(2)(a) of the EP Act. The EPA subsequently requested the following additional information:

- Impacts on riparian vegetation and habitat for Conservation Significant species, particularly relating to the results of updated hydrogeological investigations.
- Noise impacts on sensitive receptors by truck movements and mitigation measures.

This document has been revised to address these additional information requirements.

1.2 Proponent

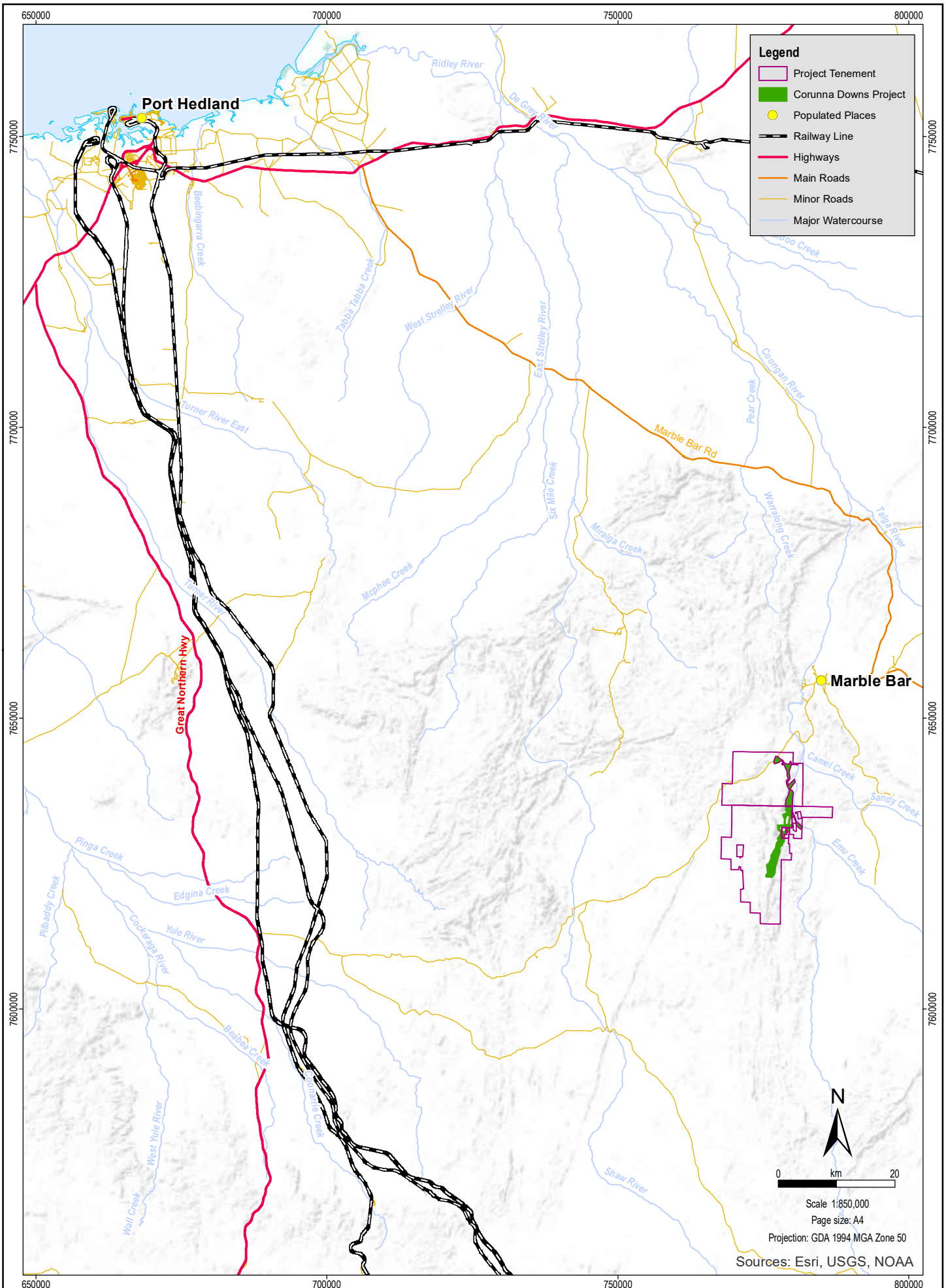
The proponent for this Proposal is Atlas Iron Pty Ltd (ACN 110 396 168), located on Level 17, Raine Square, 300 Murray St, Perth, WA. All correspondence regarding this proposal should be forwarded to the key contact:

Natassja Bell
Senior Approvals Advisor
Email: Natassja.Bell@atlasiron.com.au
Phone: (08) 6228 8000

1.3 Environmental Impact Assessment Process

Atlas Iron has already obtained the following environmental approvals in support of this Proposal:

- Commonwealth approval under Sections 130(1) and 133 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), Granted by the Department of Environment and Energy (DEE) on the 23 February 2018 (EPBC 2017/7861). This approval addressed the Proposal's potential impacts to Listed Threatened Species (Sections 18 and 18A) as detailed in Section 9.



File Name: GIS_2483.mxd Date: 28/05/2019 Author: Drew.Smith	Source & Notes: *Disclaimer: This figure has been produced for internal review only and may contain inconsistencies or omissions. It is not intended for publication.*	**Regional Location**	Figure No: **1-1**

CORUNNA DOWNS *Atlas*

- Works Approval under Part V of the EP Act, was granted by the Department of Water and Environment Regulation (DWER) on the 6 September 2017 (W6043). This approval supports the Proposal's prescribed premises, specifically; the crushing and screening facility, sewage facility and landfill facility (Categories 5, 85 and 89).

Atlas Iron is also seeking the following environmental approvals in support of this Proposal:

- Section 38 EP Act approval from the EPA (supported by this document).
- Mining Proposal and Mine Closure Plan approval under the *Mining Act 1978* (Mining Act) from the Department of Mines, Industry Regulation and Safety (DMIRS).
- Licence under Part V of the EP Act, to operate the prescribed premises following construction and commissioning, as approved under the above Works Approval.

1.4 Other Approvals and Regulation

A number of other approvals will also be required in support of the Proposal, including but not limited to:

- Permit to construct a bore (26D) under the *Right in Water and Irrigation Act 1914* (RIWI Act) to abstract groundwater to meet the Proposal water supply demands.
- Groundwater Licence (5C) under the RIWI Act to abstract groundwater to meet the Proposal water supply demands.
- Section 18 consent under the *Aboriginal Heritage Act 1972* (AH Act) where the Department of Planning, Land and Heritage (DPLH) determine that heritage place CRD-51-16 meets the definition of a 'registered aboriginal site' under Section 5 of the AH Act.
- Approval to construct or install an apparatus for the treatment of sewage under the *Health Act 1911* and Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste) Regulations 1974.
- Dangerous Goods License under the *Dangerous Goods Safety Act 2004* to store fuel and/or chemicals above prescribed volume.

Atlas Iron has also been granted the following tenure under the Mining Act in support of this Proposal; M45/1257, G45/339, L45/407, L45/408 and L45/410.

2. Proposal Description

2.1 Background

Atlas Iron initially met with the EPA to discuss this Proposal on the 30 November 2016. On the basis of completed environmental surveys and perceived environmental impacts Atlas Iron did not refer the Proposal under Section 38 of the EP Act at this time. Atlas Iron believed that the Proposal's potential impacts could be adequately assessed and managed by other agencies (e.g., DEE, DWER and DMIRS).

In January 2017 Atlas Iron referred the Proposal to the DEE under the EPBC Act (January 2017). The DEE determined that the Proposal was a controlled action under Section 75 of the EPBC Act, on the basis it was likely to have a significant impact on listed threatened species and communities (sections 18 and 18A), specifically the Northern Quoll, Pilbara Leaf-nosed Bat, Ghost Bat and Pilbara Olive Python. The Proposal was assessed by preliminary documentation and approval was granted on the 23 February 2018 (EPBC 2017/7861).

Atlas Iron also submitted a Mining Proposal (REG ID 64209) and a NVCP (7456/1) to DMIRS in January/February 2017 for concurrent assessment. In response to DMIRS concerns, Atlas Iron met with the EPA again on the 28 March 2017 to discuss the proposal, where the EPA reconfirmed their above position regarding referral of the Proposal and confirmed the adequacy of the Proposal's subterranean fauna impact assessment methodology.

A number of revisions to the Mining Proposal were completed to address various DMIRS requests for further information, however a decision was made by Atlas Iron in November 2018 to withdraw the Mining Proposal and NVCP pending the completion of a number of additional investigations, including further waste rock and hydrogeological characterisation. Furthermore, in response to DMIRS concern around potential impacts of the Proposal on permanent pools, currently being re-examined as part of the above hydrogeological investigation, Atlas Iron decided to formally refer the Proposal under Section 38 of the EP Act (supported by this document).

On 7 August 2019, the EPA advertised their decision to assess the Proposal and set the level of assessment as Referral Information with additional information required under Section 40(2)(a) of the EP Act (CMS 17014).

Atlas Iron has also applied for a Works Approval and Licence in support of the construction and operation of the Proposal's prescribed premises, namely; crushing and screening plant, wastewater treatment facility and landfill facility (Categories 5, 85 and 89). The Works Approval was granted by the DWER on the 6 September 2017 (W6043).

2.2 Justification

The Proposal will be Atlas Iron's first mine development since Mt Webber. Lower haulage costs, current market conditions and close contractor engagement increases Atlas Iron's ability to bring other resources to market which in the past have been located too far for trucking. Without Corunna Downs, Atlas Iron's production will cease following the depletion of reserves at the Mt Webber mine in May 2022.

Corunna Downs will produce Lump and Fines ore and be blended with Mt Webber Ore to produce Atlas Iron Lump and Fines products. This is consistent with the current product strategy. At the time that Corunna ore is available Mt Webber will be producing from Daltons pit which is a higher grade pit than other Mt Webber pits. This will benefit the cut-off grade strategy at Corunna Downs and therefore helps to maximise the value of Corunna Downs.

The location of the Proposal is directly related to the location of the resource. The Development Envelope and Indicative Disturbance Footprint for the Proposal have been refined and optimised to mitigate impacts to significant environmental impacts including, direct impacts to significant flora taxa and microhabitats (i.e., caves and water sources) and associated impacts on conservation significant fauna species (e.g., Pilbara Leaf-nosed Bat).

Atlas Iron has developed mines from small deposits, such as Corunna Downs, that major miners are not interested in developing. Over its current lifetime, Atlas Iron has generated gross revenues of approximately AUD$6.5 billion and paid approximately AUD$400 million in State royalties. This financial year (FY20), Atlas Iron will produce approximately 8 million tonne of ore from its Mount Webber mine and expects to pay AUD$55 million in State royalties, AUD$46.7 million in port charges and AUD$1.7 million in payroll tax. Atlas Iron has been the major user of the State-owned Utah Point port facility, contributing greater than 50% of the total throughput. This Proposal was forecast to generate a total of $137 million in state royalties (based on an earlier benchmark Fe 62% price of $68/t and total life of mine tonnes of 30 million tonne) and $133 million in Port Hedland Port Authority charges (based on the continuation of the current discount Atlas receives).

Approximately 860 people are currently working directly on Atlas Iron projects, and new roles are being created as it looks to develop this Proposal.

2.3 Proposal Description

This Proposal involves the development of five open pits using conventional drill and blast, load, and haul methods. It is anticipated 23.3 million tonnes of iron ore will be mined above the groundwater table over approximately 6 years with an average strip ratio of 0.55:1 (waste: ore). Associated infrastructure will include open pits, waste rock dumps, mine operation centre, borefield and accommodation camp.

The indicative development schedule for this Proposal is outlined in Table 2.1 and is dependent on the timing of key regulatory approvals.

Table 2.1 – Indicative Development Schedule

Development Stage	Indicative Timing
Obtain key environmental approvals	Q2 2020
Commence Site Construction	Q2 2020
Commence Mining	Q1 2021
Commence Shipping	Q2 2021
Mining Ceases	Q2 2027
Decommissioning and Closure	Q2 2028

The Proposal will utilise the Hillside-Marble Bar Road route from the site haul road across to the Corunna Downs Road and through to the Limestone-Marble Bar Road for haulage of final product to Utah Point Bulk Commodities Berth at Port Hedland for export.

Table 2.2 provides a summary of the proposal in accordance with *Instructions on how to define the key characteristics of a proposal* (EPA, 2017).

Table 2.2 – Proposal Summary

Proposal Title	Corunna Downs Project
Proponent Name	Atlas Iron Pty Ltd
Short Description	Atlas Iron Pty Ltd is currently seeking approval to develop the Corunna Downs Project (the Proposal) located in the Pilbara region of Western Australia, approximately 240 km south east of Port Hedland and 33 km south of Marble Bar. The Proposal involves mining iron ore at a rate of five million tonnes per annum over a six-year period. Ore will be sourced from five open pits using conventional drill and blast, load and haul methods. Ore will then be trucked to the run-of-mine pad for crushing and screening with the final product hauled to Utah Point in Port Hedland for export overseas.

The following sections provide a description of the key proposal elements.

2.3.1 Mining

This proposal involves the mining of five open pits, namely; Split Rock, Razorback, Shark Gully, Runway North and Runway South (Figure 2.1).

Mining will be undertaken by a reputable mining contractor and managed by Atlas Iron. The proposed mining will incorporate pre-stripping, drilling, blasting, and excavation using excavators and a dump truck fleet.

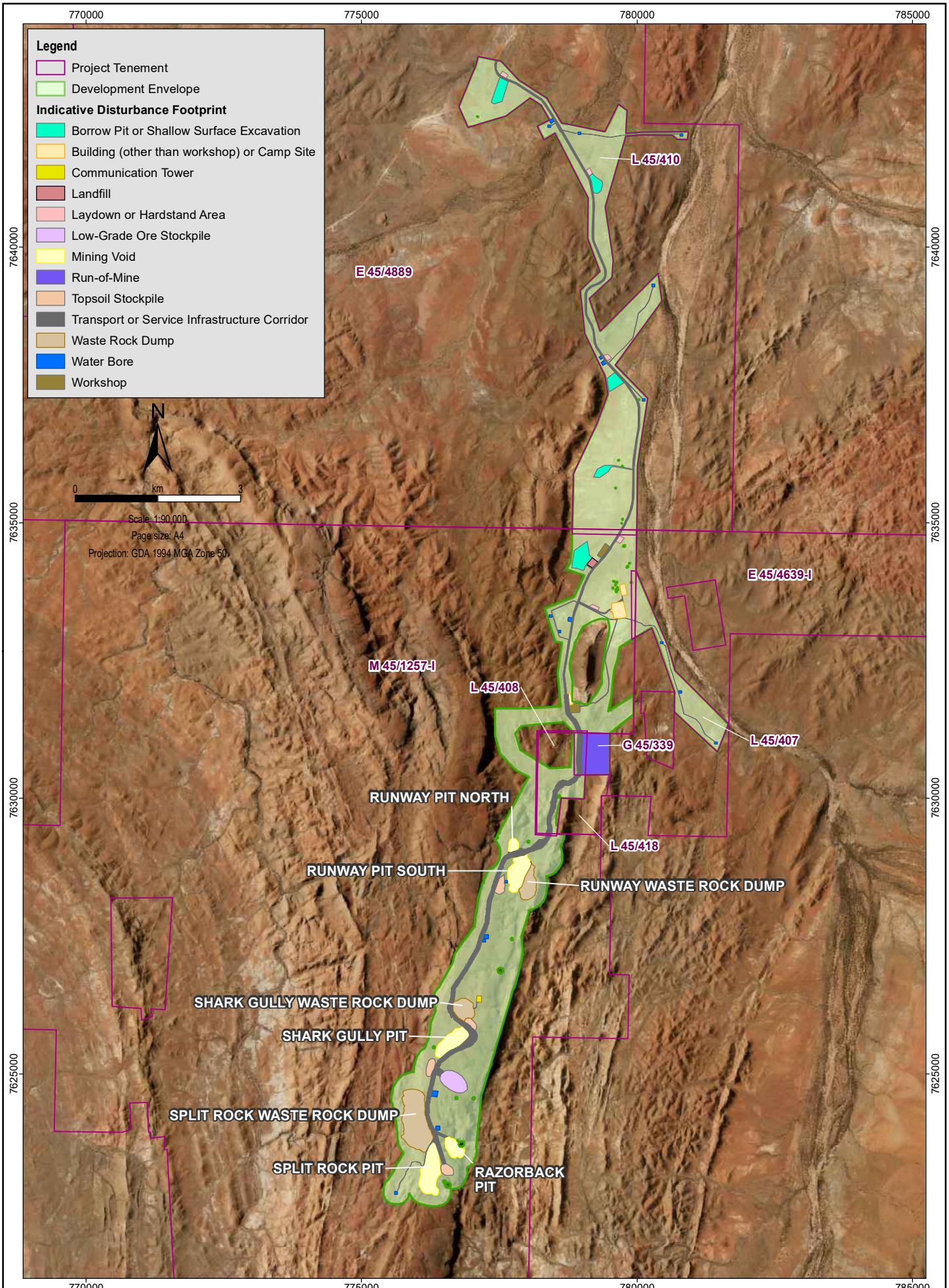
Pre-stripping will be required to expose the targeted ore. Topsoil and vegetation will be removed, where possible, during pre-stripping and stockpiled in adjacent well-drained areas for future use in rehabilitation.

Following pre-stripping, weathered rock will be free-dug (without blasting) where possible. Drill and blasting will be undertaken on the remaining material, using modern blasting techniques and typical pattern sizes for the expected rock conditions. Grade control will be conducted through reverse circulation (RC) drillhole samples prior to drill and blast to establish ore blocks.

Blasting will be undertaken on a daily basis in the open pits. Indicative maximum blast parameters are as follows:

- Drillhole diameter: 102 mm to 115 mm.
- Drill pattern: between approximately 2.8 m by 3.2 m and 3.0 m by 3.7 m.
- Powder factor: nominally up to 0.7 kg/m3, dependent on pattern size and blast activity.
- Explosive type: ammonium nitrate fuel oil (ANFO) emulsion.
- Typical charge size: 35 kg per hole.

All pits have been designed to sit above the current water table in consideration of seasonal variation so no mine dewatering is required.



ATLAS	File Name: GIS_2485.mxd Date: 28/05/2019 Author: Drew.Smith	Source & Notes: *Disclaimer: This figure has been produced for internal review only and may contain inconsistencies or omissions. It is not intended for publication.*	**Indicative Mine Layout**	Figure No: **2-1**

CORUNNA DOWNS *Atlas*

2.3.2 Ore Processing and Product Transport

Once blasted, ore and waste rock will be loaded separately into haul trucks. Ore will be transported via the haul road network to the run of mine (ROM) pad. From the ROM pad ore will be crushed and screened onsite using a crushing and screening plant, which will provide primary, secondary and tertiary crushing and screening to produce Lump (40 – 6.3 mm) and Fines (<6.3 mm) products.

Atlas Iron has applied for a works approval and licence for the construction and operation of a number of prescribed premises, including the crushing and screening facility (Category 5). DWER granted the Works Approval (W6043) on the 6 September 2017. Approval of the associated Licence (L9045) is pending the delivery of a construction compliance report, demonstrating the construction of these premises in accordance with the Works Approval.

The product will then be transported using side-tipper, quad-configuration road trains with a total payload up to approximately 140 tonnes to the Utah Point Bulk Commodities Berth at Port Hedland.

Product transport operations will operate on a continuous basis (24 hours per day, seven days a week) with approximately 98 truck cycles per day (round trip).

2.3.3 Waste Rock Management

Approximately 10.6 Mt of waste rock will be mined throughout the life of the Proposal (Table 2.3). Waste rock will initially be used to construct mine site infrastructure (e.g., access ramps, drainage structures and safety bunds) and then transported and disposed of in one of three waste rock dumps, referred to as Runway, Shark Gully or Split Rock (Figure 2.1).

Table 2.3 – Preliminary Mine Waste Inventory

Lithology	Estimated Volume (kbcm)	Estimated tonnage (kt)	Percentage (%)
Clastic sediment (shale)	658	1,394	13.3
Chert and Shaley Chert	1,131	2,776	26.4
Jaspilite	194	436	4.2
BIF	2,375	5,902	56.2
Total	**4,358**	**10,508**	**100**

The majority of waste rock material is likely to be relatively resistant to surface erosion, with the exception of the shale unit and clay-rich BIF (MWH, 2016a). The majority of waste rock samples have also been found to be entirely non-acid forming (NAF) and geochemically benign. The exception is the clastic sediment/shale waste unit within Split Rock deposit and potentially Runway South pit (for which there are no in-pit samples due to terrain/access constraints), given two recent samples from Split Rock suggested the potential presence of discrete locations of potentially acid forming (PAF) shale, although this is considered unlikely (Mine Earth, 2018; Appendix A).

Notably, shale makes up less than 15% (658 kbcm) of the Proposal's total waste rock volume based on current pit design. In the unlikely event the shale unit is found to be problematic (i.e., PAF), this entire unit can be adequately stored and encapsulated within the current Split Rock waste rock dump design, which has the capacity to store up to 2,235 kbcm of problematic material (Figure 2.2).

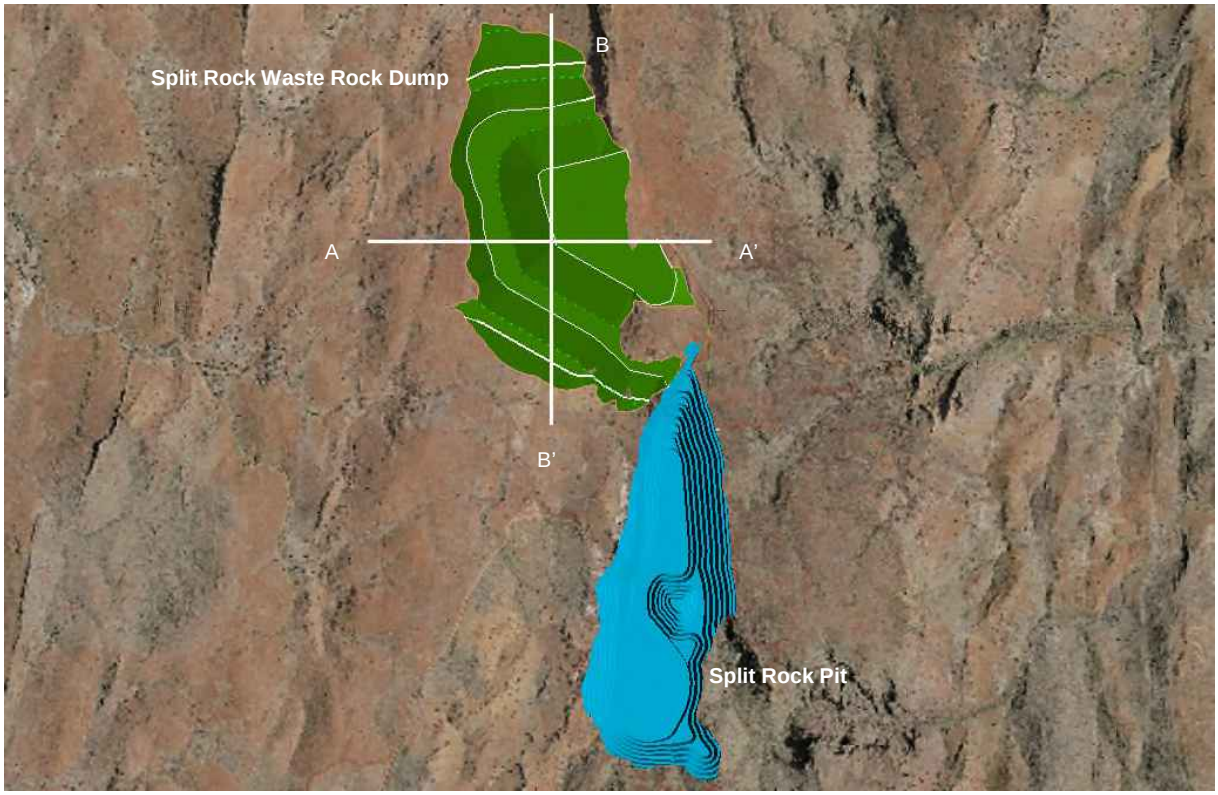
Atlas Iron is currently undertaking a drilling program to support additional sampling and characterisation of waste rock, specifically to confirm the presence/absence of PAF shale in the Split Rock deposit.

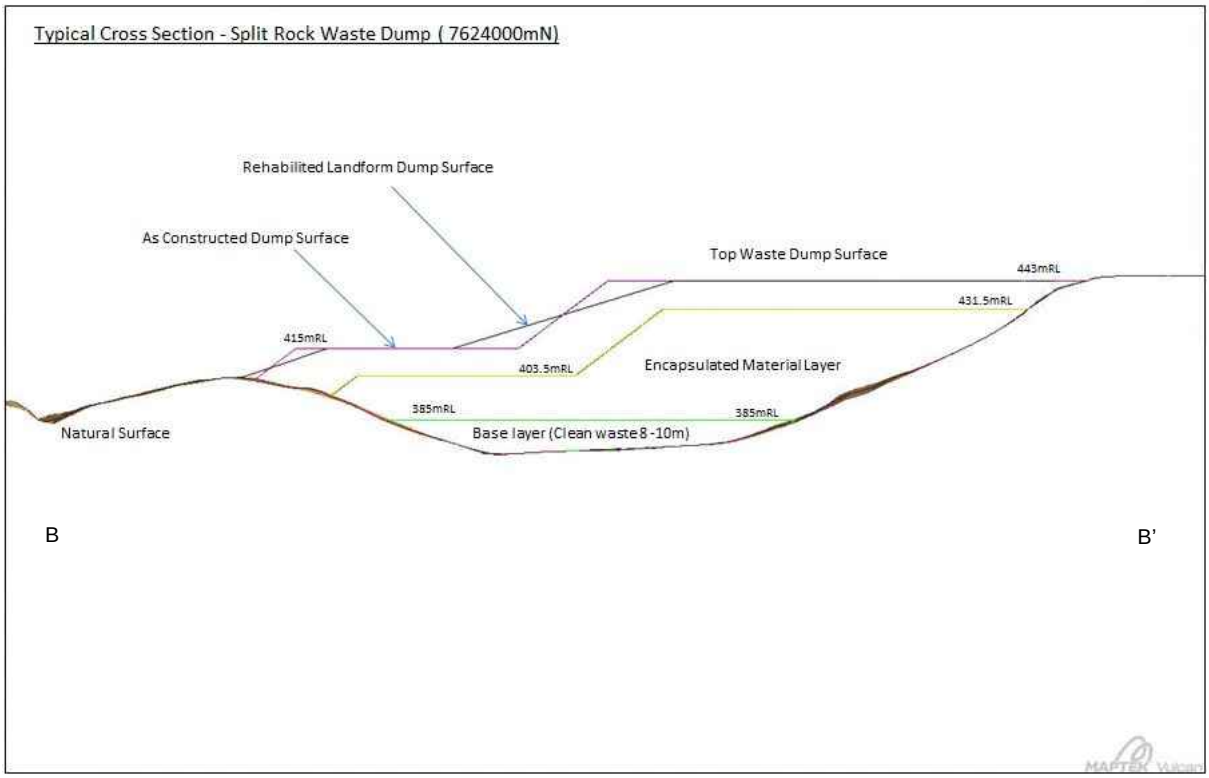
Waste rock will also be managed to ensure that:

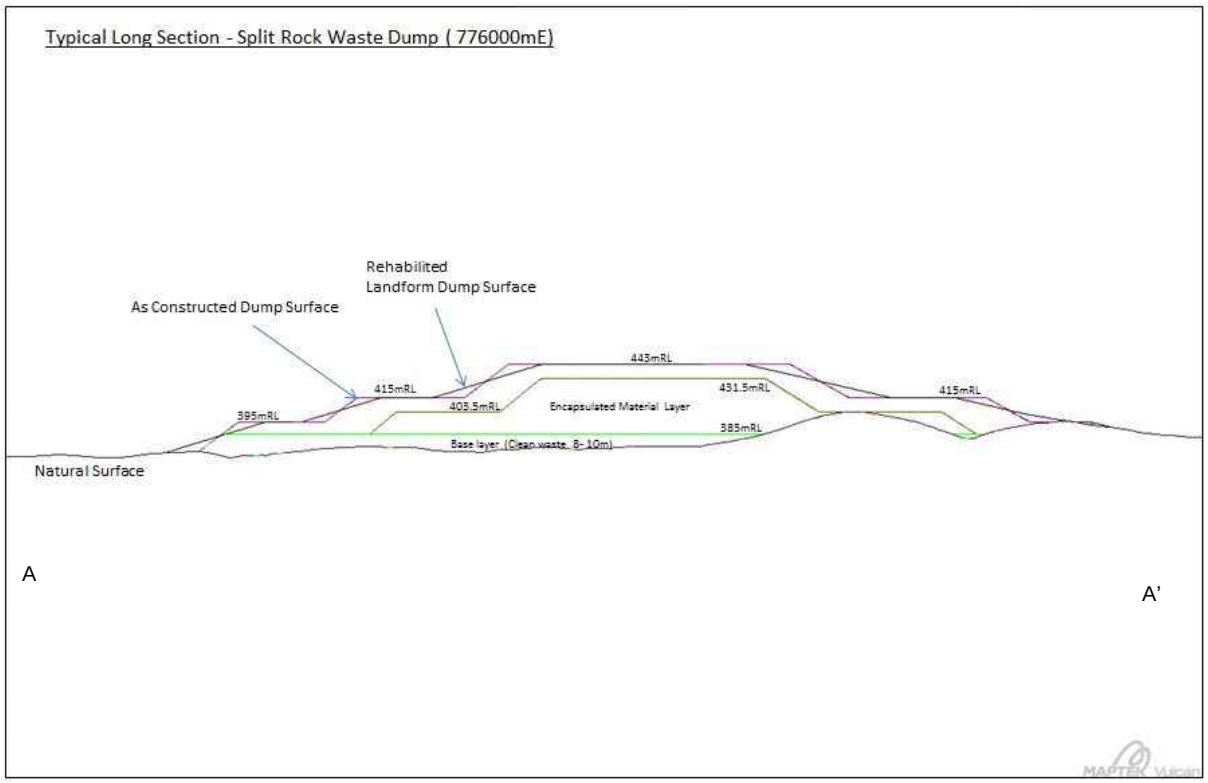
- Clay rich BIF and geochemically benign NAF shale are not placed on sloped surfaces of waste rock dumps, or used initially in the construction of mine site infrastructure (e.g., access ramps) given their susceptibility to surface erosion.
- Any NAF shale with elevated mercury is buried 10 m below final surface of profiled landform (i.e., below rooting zone of most vegetation) to prevent absorption by plants.

The Waste Management Strategy for each of the deposits is provided in Appendix B. Atlas Iron will ensure that waste units are correctly classified prior to mining during infill and grade control drilling and managed in accordance with this strategy.

Figure 2.2 – Split Rock Waste Rock Dump Design




Typical Cross Section - Split Rock Waste Dump (7624000mN)
Rehabilited Landform Dump Surface
As Constructed Dump Surface
Top Waste Dump Surface
443mRL
431.5mRL
415mRL
403.5mRL
Encapsulated Material Layer
385mRL
385mRL
Natural Surface
Base layer (Clean waste 8 -10m)
B
B'


Typical Long Section - Split Rock Waste Dump (776000mE)
Rehabilited
Landform Dump Surface
As Constructed Dump Surface
443mRL
415mRL
431.5mRL
415mRL
385mRL
403.5mRL
Encapsulated Material Layer
385mRL
Base layer (Clean waste 8- 10m)
Natural Surface
A
A'

2.3.4 Additional Infrastructure and Support Facilities

A number of additional infrastructure and support facilities will be required for the Proposal (Figure 2.1), including:

- Mine operation centre (MOC) and administration area.
- Mining contractors yard and workshop.
- Haulage contractor's area.
- Explosives magazine and AN prill storage.
- Water production bores and turkey nests.
- Potable water treatment and storage.
- Sewage facility.
- Spray field.
- Fuel storage and refuelling areas.
- Haul roads, access roads and tracks.
- Borrow pits.
- Accommodation camp.
- Communication towers.
- Landfill facility.

Atlas Iron has applied for a works approval and licence for the construction and operation of a number of prescribed premises, including the sewage facility (category 85) and landfill facility (Category 89).

2.3.5 Water Abstraction

Groundwater abstraction from a number of production bores is proposed to supply the Proposal's construction, operational (i.e., product conditioning and dust suppression) and potable water requirements. While water demand varies throughout the life of the mine dependent on how many pits are operational at that time, maximum annual water demand is anticipated to be approximately 1 Gigalitre (GL).

2.3.6 Location and Proposed Extent of Physical and Operational Elements

The location and proposed extent of physical and operational elements of this Proposal are summarised in Table 2.4.

Table 2.4 – Location and Proposed Extent of Physical and Operational Elements

Element	Location	Proposed Extent
Physical Elements		
Mine and Associated Infrastructure	Figure 2.3	Clearing no more than 423.11 hectares (ha) of native vegetation within the 2,257.6 ha Development Envelope.
Operational Elements		
Mining and processing rate	N/A	Up to 5 Mtpa
Water abstraction	N/A	Up to 1.1 GLpa

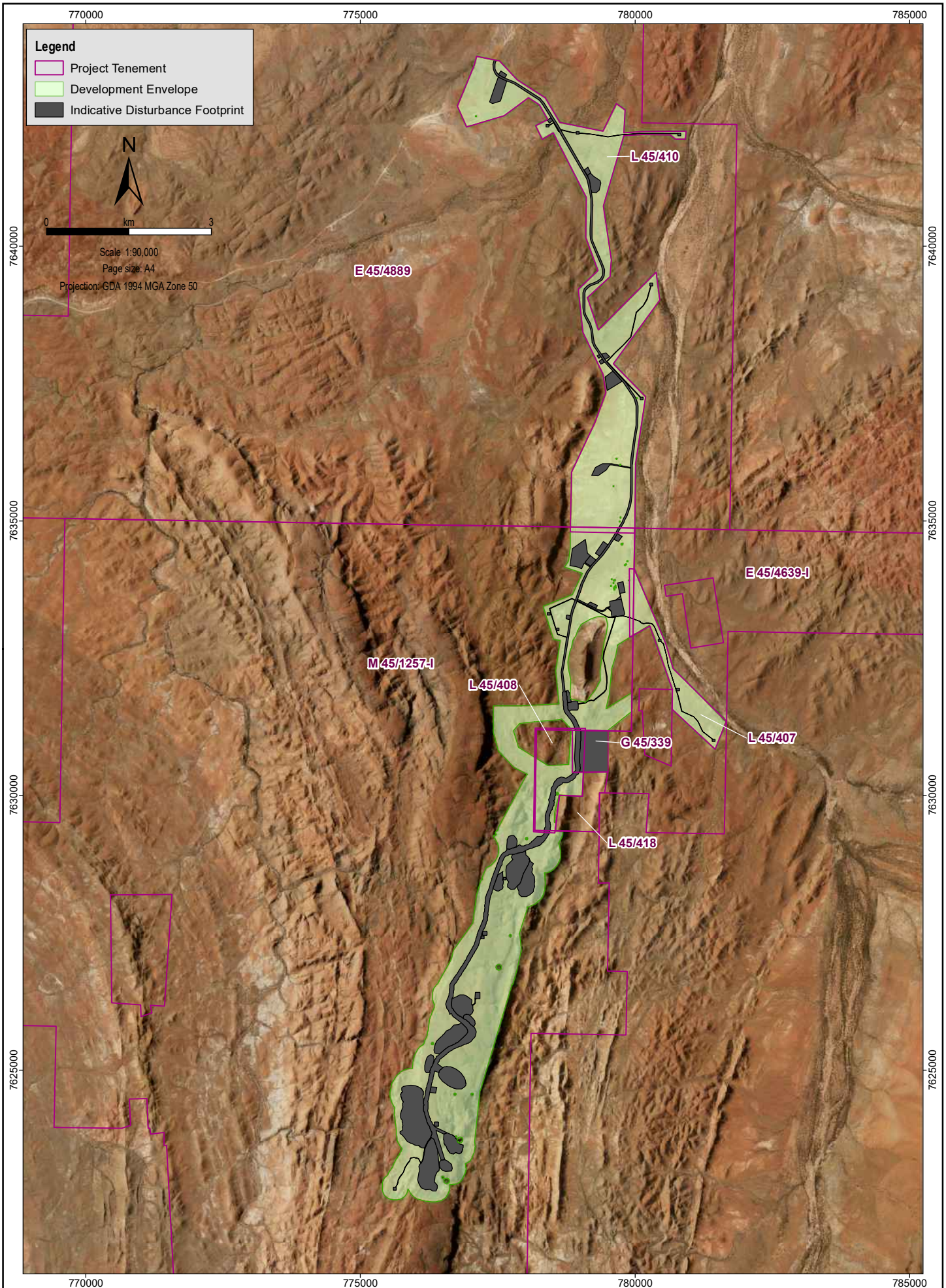
2.4 Local and Regional Context

The Proposal is located 33 km south of Marble Bar within the Chichester sub-region of the Pilbara bioregion of Western Australia (Kendrick & McKenzie, 2001). The Chichester subregion has 6.6% of its land surface reserved under some form of conservation tenure, including the Abydos-Woodstock reserve (60 km west of the Development Envelope; Figure 2.4), Millstream-Chichester National Park (190 km west), Mungaroona Range Nature Reserve (116 km southwest) and Meentheena ex-pastoral lease (54 km east) (Kendrick and McKenzie, 2001).

The majority of the Development Envelope lies within the Panorama (90%) and Eginbah (1%) Pastoral Stations and the remaining comprises unallocated crown land. Evidence of pastoral activity is widespread particularly around water holes and drainage lines, with cattle, pasture grasses such as Buffel Grass (*Cenchrus ciliaris*) and land degradation frequently observed in such areas.

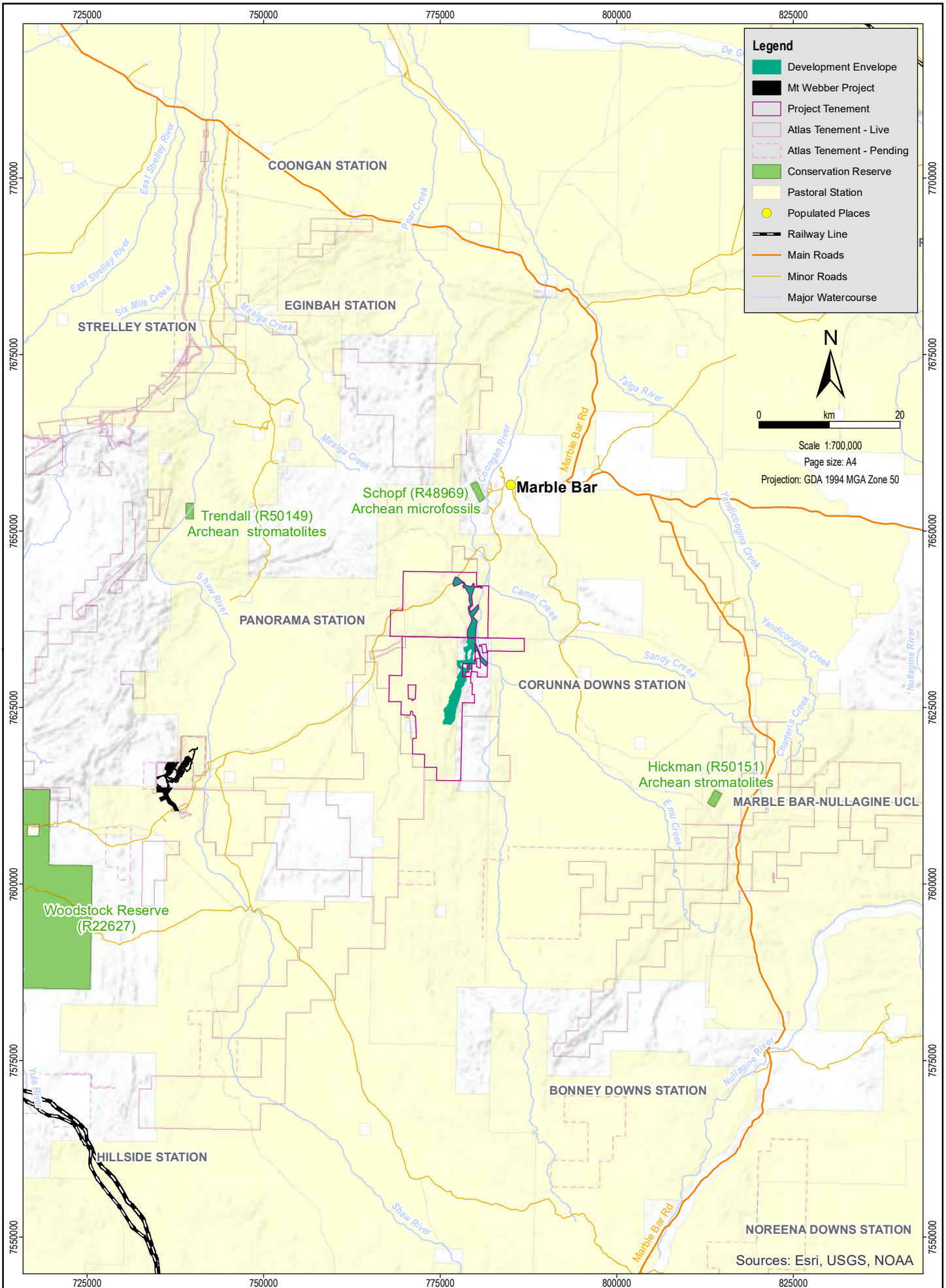
Historically, mining activity has been highly active within the Development Envelope and surrounding areas. The western portion, possess a legacy of tracks, clearings, small mining camps and abandoned shafts associated with mining and exploration activities having degraded the fauna habitat locally. Atlas Iron's existing operation, Mt Webber, is approximately 40 km south-west of the Proposal.

The Development Envelope lies wholly within the Njamal (WC1999/008) registered Native Title claim. Atlas Iron has a claim wide agreement with Njamal and has conducted exploration activities on site in accordance with this agreement and in regular consultation with the Njamal people and their representatives.



File Name: GIS_2484.mxd Date: 28/05/2019 Author: Drew.Smith	Source & Notes: *Disclaimer: This figure has been produced for internal review only and may contain inconsistencies or omissions. It is not intended for publication.*	**Development Envelope and Indicative Disturbance Footprint**	Figure No: **2-3**

CORUNNA DOWNS *Atlas*



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Date: 29/05/2019	*Disclaimer: This figure has been produced for internal review only and may contain inconsistencies or omissions. It is not intended for publication.*		
Author: Drew.Smith			

3. Stakeholder Engagement

As the Proposal has developed, Atlas Iron has had ongoing consultation with relevant stakeholders. The principal objectives of the stakeholder consultation program were to:

- Identify interested and potentially affected individuals and groups and to understand the nature of stakeholders' interest in the Proposal.
- Ensure that stakeholders are properly informed about the Proposal and that there are adequate and timely opportunities for stakeholders to provide input and raise issues.
- Ensure that any stakeholder issues or concerns are managed with respect, are given due consideration and are responded to in a timely manner.
- Meet the relevant regulatory requirements with regard to appropriate stakeholder input to the impact assessment and approvals process.

3.1 Targeted Community and Engagement Strategy

Atlas Iron undertook an assessment to determine all stakeholders with an interest in the Proposal and Atlas Iron has proactively consulted with stakeholders during the exploration, design and planning phases of the Proposal.

Table 3.1 provides a list of stakeholders and groups that may have interest in the Proposal and indicates which stakeholders have been directly contacted. The consultation undertaken by Atlas Iron prior to the submission of this document (Appendix C). No material concerns were raised during consultation prior to submission of assessment documentation, however some concerns have been raised during the environmental assessment process, particularly with regard to bat impacts and this feedback, along with associated conditions of approval regulated by other agencies, has been considered in the development of this document.

Table 3.1 – Proposal Stakeholders

Interest Group	Stakeholder
Pastoral Stations	Panorama/Hillside Station
	Eginbah Pastoral Station
Mining Tenure Holders	Whim Creek Mining Pty Ltd
Native Title Groups	Njamal, Palyku and Kariyarra Native Title Groups
Shires and Local Governments	Shire of East Pilbara
	Town of Port Hedland
State Government Agencies	Department of Mines, Industry Regulation and Safety (previously Department of Mines and Petroleum)
	Department of Water and Environment Regulation (previously Department of Environment Regulation, Office of Environmental Protection Authority and Department of Water)
	Department of Biodiversity, Conservation and Attractions (previously Department of Park and Wildlife)

Interest Group	Stakeholder
	Pilbara Ports Authority
	Main Roads Western Australia
	Department of Planning, Lands and Heritage (previously Department of Aboriginal Affairs and Department of Lands)
Commonwealth Government Agencies	Department of the Environment and Energy
Local and Regional Groups	Marble Bar and Nullagine Community Resource Centre
	Marble Bar Progress Association

3.2 Ongoing Community and Stakeholder Engagement

Atlas Iron recognises that ongoing consultation with stakeholders is critical to ensuring environmental and social concerns raised and can be addressed during the life of the mine. As such, Atlas Iron will continue its proactive consultation program until after closure of the mine. The details of this consultation will continue to be documented in the Proposal's consultation register.

4. Environmental Principles

Table 4.1 shows how the EP Act principles have been considered in the development of this Proposal.

Table 4.1 – Consideration of the EP Act principles

Principle	Description of how the Proposal has considered the principle
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.	Atlas Iron has in place a Health Safety and Environmental Management System (HSEMS), which will be implemented to ensure environmental risks associated with all Proposal activities are mitigated to as low as reasonably practicable (ALARP). Various biological and physical studies have been completed over the last five years to identify key environmental values and assess the risk of impact to these values from the Proposal. Where there has been information gaps or scientific uncertainty, Atlas Iron has sought to address these through additional investigations and specialist advice and has otherwise applied a conservative approach when assessing risk. Careful evaluation has been made of options to avoid or minimise any potential environmental impacts, followed by the identification and development of management measures and rehabilitation considerations for any residual risks to key environmental factors. A summary of the significant environmental values avoided by this Proposal is provided in Chapter 10. Specific examples of the application of the precautionary principle in the development of this Proposal are summarised below: • Waste rock characterisation identified the potential presence of discrete locations of potentially acid forming (PAF) shale within the Split Rock deposit (although considered unlikely and a factor of the sampling method). No additional in-pit samples were available at the time to confirm these results. Furthermore, there is a minor shale unit within the Runway North Pit, which could not be sampled in-pit due to terrain/access constraints, which may have similar properties. To address this risk, Atlas Iron implemented the precautionary principle and designed the Split Rock Waste Rock Dump to ensure it could adequately encapsulate all shale material should it prove to be problematic (see Section 2.3.3). • The DEE raised concerns relating to the suitability of a 25 m buffer around cave CO-CA-03 in maintaining its structural integrity to ensure its ongoing suitability as a non-permanent diurnal roost post-mining (i.e., ensure any abandonment of the roost during mining is temporary). A series of additional investigations and specialist advice was sought to better inform the risk assessment. This identified that the 25 m buffer was likely to be adequate; however, the buffer was subsequently increased to 68 m (from the back/nearest point of the cave) following further pit refinement and definition of the cave (i.e., laser scan) further mitigating this risk (see Section 7.5.1.2). A Significant Species Management Plan

Principle	Description of how the Proposal has considered the principle
	(SSMP) has been developed to ensure impacts on this cave (and other significant ecological values) are managed and monitored. Atlas Iron approach to risk management is proactive and ongoing. The Environmental Risk Register will be reviewed and updated on a biannual basis by the site Environmental Advisor and on an annual basis by the site Management Team. Furthermore, in developing the mine plan, various options are regularly reviewed and addressed to ensure the most economical and environmentally sound option is adopted, including; progressive rehabilitation and backfilling of pits wherever possible.
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.	Atlas Iron is committed to minimising harm to the environment and leaving an enduring positive legacy in the communities in which it operates. Atlas Iron considers excellence in environmental management essential to our future, as documented in our HSE Policy. Atlas Iron will implement the Proposal to ensure that the health, diversity and productivity of the environment is maintained and enhanced for the benefit of future generations. Furthermore, rehabilitation and closure planning is fully integrated into operating mine planning throughout the life of the mine. This along with the Proposal's short mine life support early return of disturbed areas to self-sustaining ecosystems.
3. Principles relating to improved valuation, pricing and incentive mechanisms a) Environmental factors should be included in the valuation of assets and services. b) The polluter pays principles – those who generate pollution and waste should bear the cost of containment, avoidance and abatement. c) 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. d) Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structure, including market mechanisms, which enable those best placed to maximise benefits and/or minimise costs to develop their own solution and responses to environmental problems.	Environmental constraint avoidance and management costs have been considered in the design of the Proposal. Atlas Iron also actively implements programs to conserve resources, reduce waste, promote recycling and prevent pollution, in accordance with our HSE Policy. The Proposal will also be subject to a Mine Closure Plan (Appendix D) prepared in accordance with the *Guidelines for Preparing Mine Closure Plans* (DMP and EPA, 2015). The Mine Closure Plan is a dynamic document, which having identified post-mining land use objectives will be reviewed and updated regularly, taking into consideration ongoing stakeholder consultation and further studies and research. The integration of rehabilitation and closure planning into operating mine planning will ensure cost-effective measures and mechanisms to reduce liability and risks with mine closure are identified and implemented.

Principle	Description of how the Proposal has considered the principle
4. The principle of the conservation of biological diversity and ecological integrity Conservation of biological diversity and ecological integrity should be a fundamental consideration.	Conservation of biological diversity and ecological integrity is fundamental to Atlas Iron's approach to environmental management. Extensive biological surveys have been undertaken over the last 5 years to identify conservation significant species and associated habitat within and outside of the Development Envelope in an effort to understand, avoid and/or minimise potential impacts of the Proposal. The risk of this Proposal on these values has been regularly assessed in response to additional information/studies, stakeholder consultation and specialist advice. Consideration of biological diversity is detailed in Chapters 6 and 7. In accordance with the Proposal's MCP, Atlas Iron also strives to return disturbed areas (excluding pits) to self-sustaining ecosystems, through rehabilitation.
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.	Atlas Iron is committed to minimising environmental harm, and has established a series of plans, procedures and work statements to minimise impacts on the local environment, prevent pollution, reduce waste and reduce the consumption of resources. Atlas Iron's Waste Management Procedure is centred around three key principles: • Stewardship (i.e., avoiding unnecessary waste generation through the lifecycle of a product). • Waste Hierarchy (i.e., avoid, reduce, reuse, recycle). • Resource Efficiency (i.e., getting the most out of a resource). This procedure ensures waste minimisation and recycling opportunities are explored throughout the lifecycle of products used, appropriate waste management practices are in place and compliance with relevant legislation and standards. Major waste streams for this Proposal include waste rock, waste for landfill (inert and putrescible) treated wastewater and hydrocarbon/hazardous waste.

5. Inland Waters

5.1 EPA 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" (EPA, 2018).

5.2 Policy and Guidance

The EPA has published guidelines for the Inland Waters factor. Guidance relevant to the Proposal includes:

- Environmental Factor Guideline: Inland Waters (EPA, 2018).

5.3 Receiving Environment

5.3.1 Previous Studies

Hydrological and hydrogeological studies and reports completed for the Proposal and relevant to the consideration of the Inland Waters factor generally are summarised in Table 5.1.

Table 5.1 – Inland Waters Studies

Reference	Study Title	Survey Timing	Study Purpose and Limitations
Stantec (2018a) Appendix E	Surface Water Environmental Impact Assessment	None – desktop assessment only	To support environmental impact assessment by identifying contributing catchment areas, development of design peaks and assessment of flood risk. Specifically: • A surface water runoff assessment of the Development Envelope. • A conceptual surface water management scheme. • A high-level assessment of the potential hydrological impacts associated with the proposed mining activity. • Recommendations for any further studies to support approvals. A risk assessment of the access / haul road and development of indicative mitigation measures. • An analysis of surface water flows around post-mining landforms including a discussion of risks and management requirements.

Reference	Study Title	Survey Timing	Study Purpose and Limitations
Stantec (2018b) Appendix F	Hydrogeological Investigation	Groundwater monitoring since 2013. Monthly or bi-monthly groundwater monitoring since October 2017.	In response to hydrogeological queries from DMIRS and DWER in September 2017, this assessment investigated: • Hydrogeology of the Razorback pit area (in relation to cave CO-CA-03 and pool CO-WS-14) • Hydrological and hydrogeological context of the 'soak'. • Drawdown predictions based on 'life of mine' at each of the GDEs, including all pools and the potential freshwater soak. • Discussion of all pools' permanency and groundwater connectivity and an assessment of Proposal impacts using DWER's Rapid Risk Assessment tool. • Catchment analysis/conceptual model demonstrating the mechanisms and sources of water discharging into cave CO-CA-03 and pool CO-WS-14 and how the Proposal may impact these (e.g., how removal of the ridge - mining of Razorback Pit may reduce seepage/water levels). (Outcomes of this assessment area largely superseded by SRK (2019) H3 Hydrogeological Assessment report below)
Stantec (2018c)	H2 Hydrogeological Study	Groundwater exploration and production bore drilling was undertaken between April and May 2017, and in November 2017.	Submitted to DWER in support of an application for a 5C Licence to Take Water under the *Rights in Water and Irrigation Act 1914* (RIWI Act). (Superseded by SRK (2019) H3 Hydrogeological Assessment report below)
SRK (2019) Appendix G	H3 Hydrogeological Assessment	Groundwater exploration, monitoring and production bore drilling and testing was undertaken between April and June 2019. Monthly pool monitoring has also been conducted by Atlas Iron between August 2017 and April 2019 (with a few exceptions due to weather/access).	This study addressed DMIRS & DWER concerns around potential water abstraction impacts on environmental values (i.e., pools, soak and groundwater dependent vegetation) and support Atlas Iron's application for a 5C Licence to Take Water under the *Rights in Water and Irrigation Act 1914* (RIWI Act) and Mining Proposal.

Reference	Study Title	Survey Timing	Study Purpose and Limitations
MWH (2018)	Terrestrial Vertebrate Fauna Survey	*(Refer to Chapter 7)*	Identified significant water sources (i.e. pools). *(Refer to Chapter 7)*
Woodman (2019)	Assessment of Groundwater Drawdown Impacts to Vegetation	*(Refer to Chapter 6)*	Assessment of the potential groundwater-dependence of vegetation associated with specific surface water features (pools) that may be maintained by groundwater. *(Refer to Chapter 6)*
Woodman (2018)	Investigation of Relationships Between Vegetation and Hydrology – "Soak" Area	*(Refer to Chapter 6)*	Investigated the relationship between the hydrology of the 'soak' and associated terrestrial vegetation. *(Refer to Chapter 6)* (Superseded by Woodman (2019) Assessment of Groundwater Drawdown Impacts to Vegetation above)

5.3.2 Surface Water

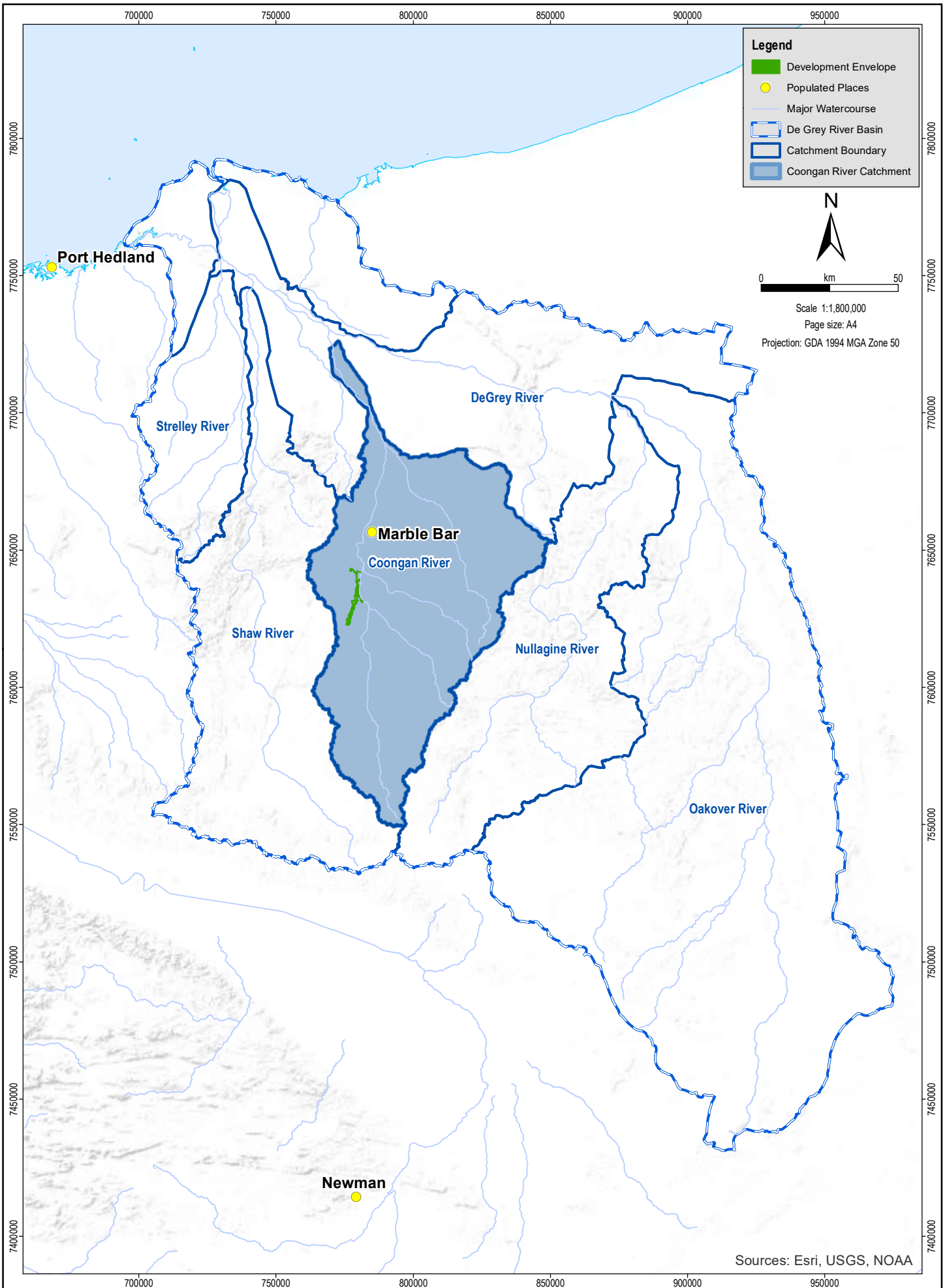
This section provides an overview of the received environment with respect to surface water and is based on Stantec (2018a).

5.3.2.1 Regional Context

The Proposal lies within the middle reaches of the Coongan River catchment, which sits within the De Grey River Basin (Figure 5.1). The De Grey River Basin covers an area of 56,890 km^2 (Ruprecht & Ivanescu, 2000) with its major tributaries being the Strelley, Shaw, Coongan, Oakover and Nullagine Rivers.

The Coongan River system has a total catchment area of around 7,090 km^2 and lies between the Chichester Ranges in the south and minor ranges on the west and east. The Coongan River has a number of tributaries, including Budjen Creek, Triberlar Creek, Boobina Creek, Emu Creek and Camel Creek. Coongan River joins the De Grey River at Mulyie Pool, about 41 km upstream of the confluence with the Shaw River.

Rivers in the Pilbara region are typically ephemeral in nature; however, surface water does exist throughout the year in pools along the main rivers and creeks. These pools are often surface expressions of locally perched groundwater within the alluvium. During periods of river flow, following significant rainfall events, the groundwater systems are recharged by the presence of surface water in the river beds. As river flows subside and river beds dry, permanent pools remain and are fed by groundwater inflow during the dry periods. Major pools on the main branch of the Coongan River are the Nandingarra, Bookargemoona and Doolena pools (Ruprecht & Ivanescu, 2000).



File Name: GIS_2498.mxd Date: 29/05/2019 Author: Drew.Smith	Source & Notes: *Disclaimer: This figure has been produced for internal review only and may contain inconsistencies or omissions. It is not intended for publication.*	**Regional Catchments**	Figure No: **5-1**

CORUNNA DOWNS *Atlas*

Surface flow in the region occurs almost exclusively as a direct response to rainfall and is highly skewed to summer events (December to March). Flow in the smaller channels is typically of short duration, and ceases soon after the rainfall event passes. In the larger river channels, which drain the larger catchments, runoff can persist for several weeks and possibly months following major rainfall events such as tropical cyclones. No perennial streams occur in the immediate vicinity of the Proposal.

There are two stream flow gauging stations located on the Coongan River (Table 5.2) that can be used to provide an indication of the nature of flows within the catchment.

Table 5.2 – Coongan River Stream Flow Gauges

Station No. and Name	Location	Station Coordinates	Record Period	Catchment Area	Available Data
710006: Coongan River – Marble Bar Rd X	Marble Bar road crossing	20°54'59.8" S, 119°47'15.7" E	13/12/2007 onwards	4,338 km^2	Level only
710204: Coongan River – Marble Bar	Marble Bar	21°11'33.4" S, 119°42'52.6" E	11/12/1966 onwards	3,736 km^2	Level and daily flows

Source: DWER (2019)

The Proposal is located within the Pilbara Surface Water Area, a DWER Surface Water Management area managed under the RIWI Act.

5.3.2.2 Local Hydrology

Gradients along the elevated areas within the Development Envelope are relatively steep, reducing to flatter gradients along the valley floor. The incised drainage paths along the ridge and hill areas indicate that high flows do occur after heavy rainfall events with subsequent erosion and sediment transport. The flat areas spreading out from the ridges provide evidence of low gradient sheet flow. In these areas finer materials carried from high velocity areas would settle out as flow velocities decrease.

The Development Envelope is generally located on or near watershed divides, resulting in small contributing catchment areas. These local catchments generally drain from west to east across the Development Envelope towards the Coongan River.

The Coongan River generally lies in a north-south direction parallel to the Development Envelope and is within 50 m of minor infrastructure (i.e., infrastructure corridor), approximately 700 m from the proposed camp and over 1 km from other major project infrastructure (e.g., pits and run-of-mine) (Figure 5.3).

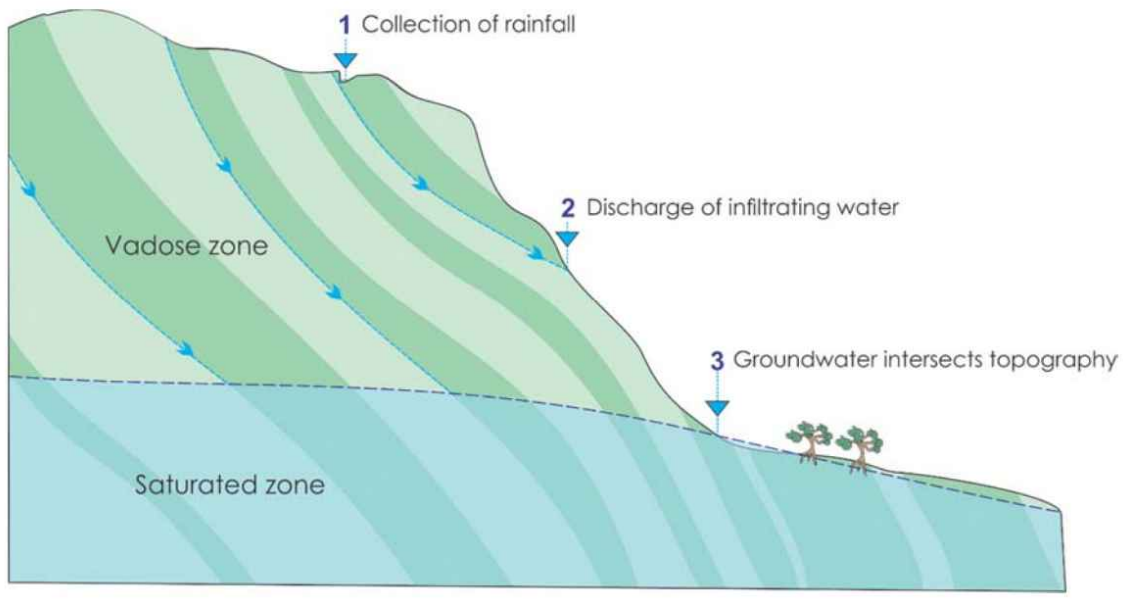
5.3.2.3 Significant Hydrological Features

There are a number of pools, seeps and springs in the vicinity of the Proposal. The mechanisms for these features' occurrence is likely through one of three modes identified in Table 5.3 and illustrated in Figure 5.2. Each mode leads to distinct hydrochemical signatures that can be used to identify the likely source of water for each feature (discussed further in relation to surface water quality in Section 5.3.2.4).

Table 5.3 – Modes of Occurrence of Surface Water Features

Mode of Occurrence	Description	Hydrochemical Characteristics
Collection of rainfall	Pools may exist where surface morphology allows rainwater to collect in locations where evaporation is minimal.	Dependent on the amount of evaporation that has occurred.
Discharge of infiltrating water	Infiltrated groundwater may discharge before reaching the saturated zone due to geological structures or perched aquifers.	Interactions between rock and water are minimised due to short aquifer residence time.
Groundwater intersects topography	Local groundwater may intersect topography, e.g. surface expression of groundwater. Mostly occurs in incised gullies where groundwater is shallow. May support groundwater dependent vegetation.	Similar signature to regional groundwater, but may be modified by subsequent evaporation after discharge.

Source: Adapted from Stantec (2018c)



Source: Stantec (2018c)

Figure 5.2 – Conceptual Modes of Occurrence of Surface Water Features

Eleven significant water sources (i.e. pools) were identified during the vertebrate fauna survey within the Study Area (MWH, 2018a) (see Section 7.3.3.2; Figure 5.3). An assessment of the permanency and connectivity to groundwater of these pools was undertaken by SRK (2019) (Table 5.4). Pools were classified as either ephemeral or perennial. The likely groundwater dependency of each pool was also rated.

As discussed in Section 7.3.3.2, water features that can provide resources for ecosystems for the majority, if not all, of the year (e.g., perennial pools) are considered important (MWH, 2018a), as these are critical to sustaining ecosystems during the driest periods when water is scarcest.

Only five of the 11 pools were determined to be perennial (i.e., permanent), four of which are considered likely to be groundwater dependent. One of these groundwater dependent pools, pool CO-WS-14, is of particular importance as it is also believed to be intrinsically linked to cave CO-CA-03, a non-permanent breeding roost for the Pilbara Leaf-nosed Bat (see further discussion in Section 7.3.3.1 and Figure 5.3). This pool along with an observed seep inside this cave are likely to contribute to the microclimate (i.e., humidity) and thus the suitability of this cave as a non-permanent breeding roost for the Pilbara Leaf-nosed Bat.

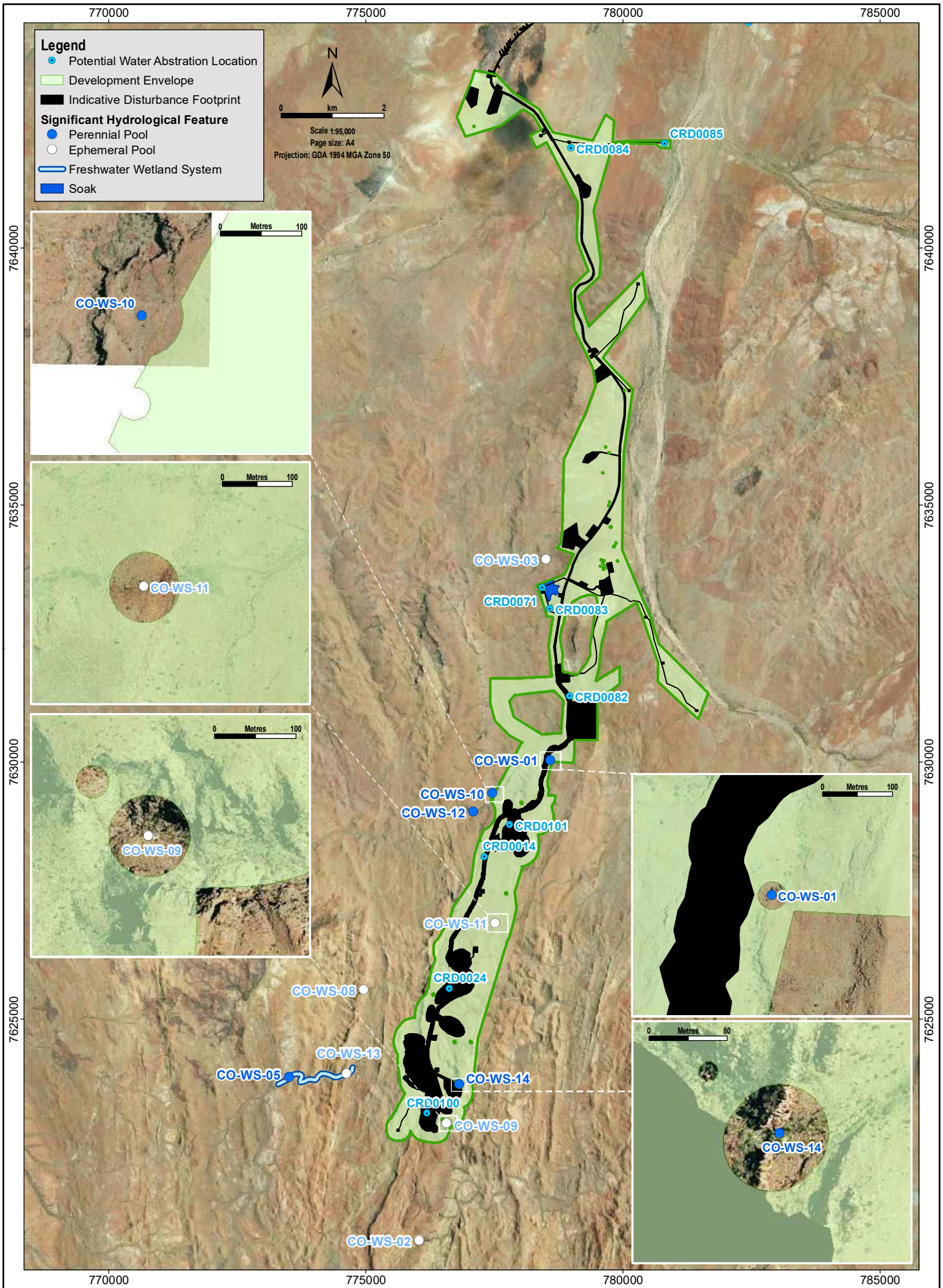
In addition to the pools identified in Table 5.4, a potential freshwater ‘soak’ (associated with a 6.7 ha occurrence of the vegetation unit VT 8) was also identified within the Development Envelope during flora and vegetation and heritage surveys. The soak is a small pan at the upper reaches of a minor catchment, interpreted to be an ephemeral, perched alluvial water bearing unit based on the observation of residual encrusted evaporates and the presence of stratified sands and clays, and is likely recharged during major rainfall events (SRK, 2019). While there is a limited number of presumed facultative phreatophytes present within the soak, there are no obligate phreatophytes present, which suggests limited to no groundwater reliance of the vegetation in this area. Furthermore, the high clay content of the soils in this area likely means water persists in the soil profile for a significant period of time and may be the mechanism supporting the presence of these presumed facultative phreatophytes, as supported by the presence of sedge species (Woodman, 2019). While no active groundwater discharge or standing water has ever been observed at the soak by Atlas or its contractors, groundwater data in the vicinity of the soak suggests that the water table in the area is shallow (within 3-5m). As, the connectivity of the soak with the deeper groundwater system is not well understood, reliance on groundwater cannot be completely ruled out (SRK, 2019).

A system of several permanent and temporary freshwater pools of variable size was recorded within the Study Area in 2010 by Golder Associates (Golder, 2010). The system was recorded approximately 1 km west of the Development Envelope (Figure 5.3). A survey in 2009 by Outback Ecology did not find any standing water within this system (i.e., all pools were dry) (Golder, 2010). Two of the pools (CO-WS-05 and CO-WS-13) recorded by MWH (2018a) appear to be associated with this system.

Table 5.4 – Pool Permanency and Groundwater Dependency

Pool	Location	Permanency	Groundwater Dependency
CO-WS-01	Within Development Envelope, outside Indicative Disturbance Footprint. Approximately 20 m downstream of the haul road.	Perennial	Likely
CO-WS-02	Outside Development Envelope. Approximately 2 km south of the Split Rock pit.	Ephemeral	Unlikely
CO-WS-03	Outside Development Envelope. Approximately 430 m upstream of a borrow pit.	Ephemeral	Unlikely
CO-WS-05	Outside Development Envelope. Approximately 2.2 km downstream of the Split Rock waste dump.	Perennial	Likely
CO-WS-08	Outside Development Envelope. Approximately 1.4 km downstream of the Shark Gully pit.	Ephemeral	Potential seasonal contribution
CO-WS-09	Outside Development Envelope. Approximately 185 m downstream of pit and 175 m downstream of topsoil stockpile.	Ephemeral	Unlikely
CO-WS-10	Outside Development Envelope. Approximately 280 m downstream of the Runway North pit.	Perennial	Potential seasonal contribution
CO-WS-11	Outside Development Envelope. Approximately 500 m downstream of a waste rock dump, 600 m downstream of haul road and 200 m upstream of minor infrastructure corridor.	Ephemeral	Potential seasonal contribution
CO-WS-12	Outside Development Envelope. Approximately 570 m downstream of the Runway North pit and 470 m downstream of haul road.	Perennial	Likely
CO-WS-13	Outside Development Envelope. Approximately 1.1 km downstream of the Split Rock waste rock dump.	Ephemeral	Potential seasonal contribution
CO-WS-14	Outside Development Envelope. Approximately 70 m downstream of the Razorback pit.	Perennial	Likely

Source: SRK (2019)



File Name: GIS_2499.mxd Date: 11/09/2019 Author: Drew.Smith	Source & Notes: Freshwater wetland system - location and extent inferred from Golder, 2010 Other hydrological data from Stantec, 2018b. Freshwater soak from Woodman 2018b. *Disclaimer: This figure has been produced for internal review only and may contain inconsistencies or omissions. It is not intended for publication.*	**Hydrological Features**	Figure No: **5-3**

5.3.2.4 Surface Water Quality

Water quality was sampled at 8 pools with available surface water between July 2017 and May 2019. Samples were analysed for physical parameters (pH, electrical conductivity, total dissolved solids, total suspended solids), major ions (Cl, HCO_3, SO_4, Ca, Mg, K, Na, NO_3), trace elements and metals (As, B, Cd, Cr, Cu, Fe, Pb, Mn, Ni, Se, Ag, Sr, Sn, Zn). Detailed analysis of results is provided in Appendix D of SRK (2019). Water quality was analysed to determine the likely mode of occurrence of surface water features (see also Table 5.3).

Salinity is highly variable at pool locations, with TDS ranging from 17 to 2,800 mg/L. High variation in salinity over time within a single pool indicates a level of analyte concentration due to evaporation that suggests recharge to those pools is inconsistent. A consistent and low salinity level over time is reflective of constant recharge/throughput, most likely from groundwater sources. Such is the case for pools CO-WS-01 and CS-WS-14, which have been determined to be perennial and groundwater dependent.

Several pools known to be perennial (CO-WS-01, CO-WS-05, CO-WS-10, CO-WS-12 and CO-WS-14) are characterised as bicarbonate and magnesium dominant, indicating some contribution from groundwater. However, some samples indicate some level of mixing from time to time reflecting periods of surface water inflow following rainfall events. Water quality in other pools (CO-WS-08, CO-WS-09, CO-WS-11 and CO-WS-13) is more reflective of surface water inflow, or end point water reflective of concentration of analytes through evaporative processes, supporting the conclusion that these pools are ephemeral (SRK, 2019).

In October 2017, available pools were sampled for stable isotopes including Oxygen (O^{18}), Deuterium (D), and Radon-222 (Rn^{222}) to support an assessment of their groundwater reliance. (Stantec, 2018b). However, results proved largely inconclusive and so are not discussed further.

Based on this analysis, only a subset of sampled pools appears to be actively connected to or dependent on groundwater: CO-WS-01, CO-WS-05, CO-WS-12 and CO-WS-14. However, in consideration of the additional investigations and field data, a number of other pools (CO-WS-08, CO-WS-10, CO-WS-11 and CO-WS-13) may also receive seasonal groundwater contributions (SRK, 2019). All other pools (CO-WS-02, CO-WS-03, CO-WS-08, CO-WS-10, CO-WS-11 and CO-WS-13) have been classified as having no to limited reliance on groundwater.

Water level hydrographs from pools CO-WS-08, CO-WS-10, CO-WS-11 and CO-WS-13 also support the conclusion that these pools receive minimal contribution from groundwater (steep antecedent trend indicative of a dominant evaporative influence) whereas pools CO-WS-12 and CO-WS-14 show a more gradual decline in water level consistent with ongoing groundwater replenishment. All pools show the influence of rainfall indicating surface water runoff forms a significant component of pool water (SRK, 2019).

5.3.3 Groundwater

5.3.3.1 Regional Context

The hydrogeology of the northern Pilbara is typified by faulted granitoid rocks and folded Archaean greenstone belt rocks, predominantly providing a fractured rock setting in which groundwater storage and transmission is structurally controlled. Aquifers types range from unconfined to confined, with the fractured rock setting typically unconfined to semi confined. Groundwater is predominantly recharged on the regional scale by episodic intense tropical low and cyclonic rainfall events, plus intense thunderstorm events on the local scale (Stantec, 2018c).

Groundwater typically occurs in zones of structurally developed secondary permeability and porosity such as fractures, zones of weathering and along bedding planes, joints and geological contacts (SRK, 2019)

The regional groundwater likely flows to the north consistent with the drainage direction of the major surface drainage features (rivers), while local groundwater flow directions will be driven by the interaction of topography, saturation level of the phreatic surface, and the interconnectivity of the structural elements of the rock mass (Stantec, 2018c).

The Proposal is situated within the East Pilbara subarea of the Pilbara Groundwater Area proclaimed under the *Country Areas Water Supply Act 1947*. Mining water supply is an accepted water usage under this plan. groundwater management areas (SRK, 2019).

5.3.3.2 Local Context

Groundwater resources in the Project area occur within two primary units, the Fractured Bedrock Aquifer (FBA) and ephemeral alluvial systems associated with surface water drainage lines.

The alluvial groundwater system is primarily associated with the Coongan River and its tributaries which runs adjacent to the Corunna ridge, east of the Proposal. Groundwater in this system is likely to be present during and for a period following significant rainfall events, however may persist for extended periods where the aquifer is thicker (SRK, 2019).

The FBA is in reality a set of discrete, highly compartmentalised aquifers associated with zones of secondary porosity formed through faults, folding and areas of contact between geological units, and is hosted in the Proposal area within the BIF, Mt Roe Basalt, Hardy Formation, Dalton Suite, Wyman Formation, and Euro Basalt. FBA systems are typically highly anisotropic, with groundwater flow and hydraulic characteristics strongly controlled by bedding planes and structure. Field investigations have determined that hydraulic conductivity is highly variable, as is connectivity within the strata and with other geological units, although analysis of water levels suggest that the hydraulic connection between the BIF and surrounding units is weak (SRK, 2019).

Recharge occurs primarily through direct rainfall infiltration where fracture systems and/or geological structures are exposed at surface, and may also occur through infiltration from overlying alluvium where present. The latter recharge mechanism is enhanced where fracture or contact zones intersect ephemeral water courses (SRK, 2019).

5.3.3.3 Groundwater Levels

Groundwater gradients within the elevated BIF plateau are typically a subdued reflection of surface topography (SRK, 2019), lying within 25 to 60 m below ground level (mbgl) within pit areas and between 3 to 10 mbgl in the low lying elevations. Water table elevations between pit areas (i.e., on the range) varies by as much as 82 m and currently lies at approximately 355 metres Australian Height Datum (m AHD) at Split Rock, 339 m AHD at Razorback, 421 m AHD at Shark Gully and 353 m AHD at Runway. Apart from the differences in water table elevation between pit areas, the variance in rates of annual water level fluctuations also appears to support the presence of perched or compartmentalised groundwater zones, as supported by the marked decline in water levels at Runway (1.6 m/year) and to a lesser extent at Split Rock and Razorback.

While water table elevations and rates of seasonal decline differ between pits, similarities in geology, structure, physiography and associated drainage characteristics suggest that the mechanism for recharge and responses to seasonal events may be similar across the range. Observed response to rainfall events across the range varied from 0 to 0.2 m at Split Rock and averaged 0.42 m at Shark Gully (Stantec, 2018b). Seasonal variation within the water table is anticipated to be 2 to 3.5 m in low lying elevations where depth to water is shallower and response to rainfall reharge is considerably greater (Stantec, 2018b).

5.3.3.4 Groundwater Quality

Groundwater samples have been collected from across the site from as early as 2014 through to 2019, and analysed by SRK (2019) in conjunction with the samples collected during their 2019 investigation.

Samples were analysed for physical parameters (pH, electrical conductivity, total dissolved solids, total suspended solids), major ions (Cl, HCO_3, SO_4, Ca, Mg, K, Na, NO_3), trace elements and metals (As, B, Cd, Cr, Cu, Fe, Pb, Mn, Ni, Se, Ag, Sr, Sn, Zn). Detailed analysis of results is provided as Attachment D of Appendix G.

Results indicate groundwater to be generally neutral with pH values ranging between 5.6 and 8.6, and fresh to marginally brackish with TDS values between 42 and 1,800 mg/L.

Generally, lower salinity is recorded within the BIF units of the Corunna ridge, with the more saline water occurring within the Hardy Formation to the north of the ridge within the Coongan River valley.

Groundwater sample analysis indicates a range of groundwater types, though typically bicarbonate and magnesium dominant indicating recharging water, or with no dominant cation or anion reflective of some form of mixing mechanism (i.e. between newly recharged water and older water). An exception was CRD0006, located at the northern end of the ridge which intersected sodium and chloride dominant groundwater, suggesting that this bore may intersect a discrete aquifer unit with older, end point water.

Two previous samples from monitoring bores at Split Rock indicated slightly elevated sulphate values, however subsequent sampling indicated no sulphate type water signatures. This discrepancy may be due to sampling methodologies with the more recent sampling considered to be more reliable (SRK, 2019).

Consistently detected dissolved metals in groundwater samples include barium (0.0003–0.092 mg/L), boron (0.02–1.0 mg/L), manganese (0.6–290 mg/L), nickel (0.0001–0.037 mg/L), strontium (0.022–0.73 mg/L) and zinc (0.001–0.23 mg/L) (SRK, 2019).

5.4 Potential Impacts

Potential impacts to inland waters from the Proposal include:

- Direct loss of significant hydrological features (e.g., pools) due to clearing.
- Alteration of surface water flows due to the change in quantity of surface water associated with the interruption of natural drainage channels and drainage shadowing and ponding.
- Alteration of surface water quality associated with increased sediment and runoff, potential exposure of PAF shale waste rock material and/or potential hydrocarbon and chemical contamination.
- Alteration of groundwater quality and availability associated with water abstraction.
- Indirect impacts on significant hydrological features due to change in groundwater levels and quality.

The potential for indirect impacts on groundwater dependent vegetation (GDV) as a result of water abstraction and associated groundwater drawdown is discussed in Section 6.5.5.

5.5 Assessment of Impacts

The following sections discuss the potential impacts to inland waters identified in Section 5.4 generally prior to applying mitigations (avoidance, minimisation and rehabilitation – discussed in Section 5.6).

5.5.1 Regional Surface Water Catchments

Stantec (2018a) found the Proposal's percentage of disturbance to the regional Coongan River catchment amounts to 0.04% of the total catchment. This is a very small percentage of the regional catchment, which implies any alteration to the surface water regime as a result of Proposal operations will be insignificant within the regional catchment. Alterations to the surface water regime may be noticed locally, but impacts will soon dissipate as flows from larger downstream areas contribute to the natural watercourses.

Major pools on the main branch of the Coongan River are the Nandingarra, Bookargemoona and Doolena pools (Ruprecht & Ivanescu, 2000). These pools are located upstream of the Proposal and will not be impacted by the mining operation.

5.5.2 Clearing of Surface Water Features

At the time of the vertebrate fauna survey (MWH, 2018a), four pools (CO-WS-01, CO-WS-09, CO-WS-11 and CO-WS-14) were located within the Development Envelope and were considered most likely to be at risk of direct impact. The Development Envelope was subsequently refined to exclude all four pools inclusive of a 50 m buffer, except for CO-WS-01, to which a 20 m buffer was applied. As a result, all pools are now outside the Development Envelope (Figure 5.3) and so will not be directly impacted as a result of the Proposal.

The soak is within the Development Envelope in an area where groundwater abstraction bores will be installed (Figure 5.3). Approximately 0.1 ha of the Indicative Disturbance Footprint crosses the northern side of the soak to enable a pipeline to be laid between the abstraction bore and the camp. This 0.1 ha impact is considered minor in the context of the 6.7 ha area of the soak.

The Proposal will not result in any direct disturbance to the Coongan River or the freshwater wetland system, associated with pools CO-WS-05 and CO-WS-13.

5.5.3 Alteration of Surface Water Flows

Where surface water flows are intercepted and/or modified, there is an increase in the potential for localised ponding to occur immediately upstream and water shadows to develop immediately downstream. This impact is most likely to occur when sheet flows are interrupted and is less likely to occur where channel drainage is intercepted. This impact can generally be managed and mitigated through the installation of appropriate surface water management infrastructure (e.g., culverts and flow diversion bunds) (Stantec, 2018a).

Due to the location and topography of the Proposal, there are minimal upstream flows entering the Indicative Disturbance Footprint, and it is unlikely that there are any surrounding areas of significant sheet flow. Accordingly, the Proposal is not anticipated to result in any significant shadowing or ponding (Stantec, 2018a).

Some shadow effects may be seen downstream of the pit and waste rock dump areas and land bridge (proposed between the Runway North and Runway South pits, discussed further below) as a result of runoff being retained within the pits and sediment ponds and/or captured by the land bridge. However, this impact is expected to dissipate as the system receives flows from the wider downstream catchment areas (Stantec, 2018a).

The land bridge is a component of the haul road required to cross a steep gully between the Runway North and Runway South pits. It will be constructed from local cut and fill of near surface outcropping material (maximum cut approximately 5 m) and/or NAF waste rock material from Runway pit (Figure 5.4). The location of the land bridge near the top of the catchment combined with its proximity to Runway South pit means that the catchment upstream of the land bridge is extremely small (less than 1 ha; Figure 5.4) and so it is unlikely to result in significant shadowing, as summarised above.

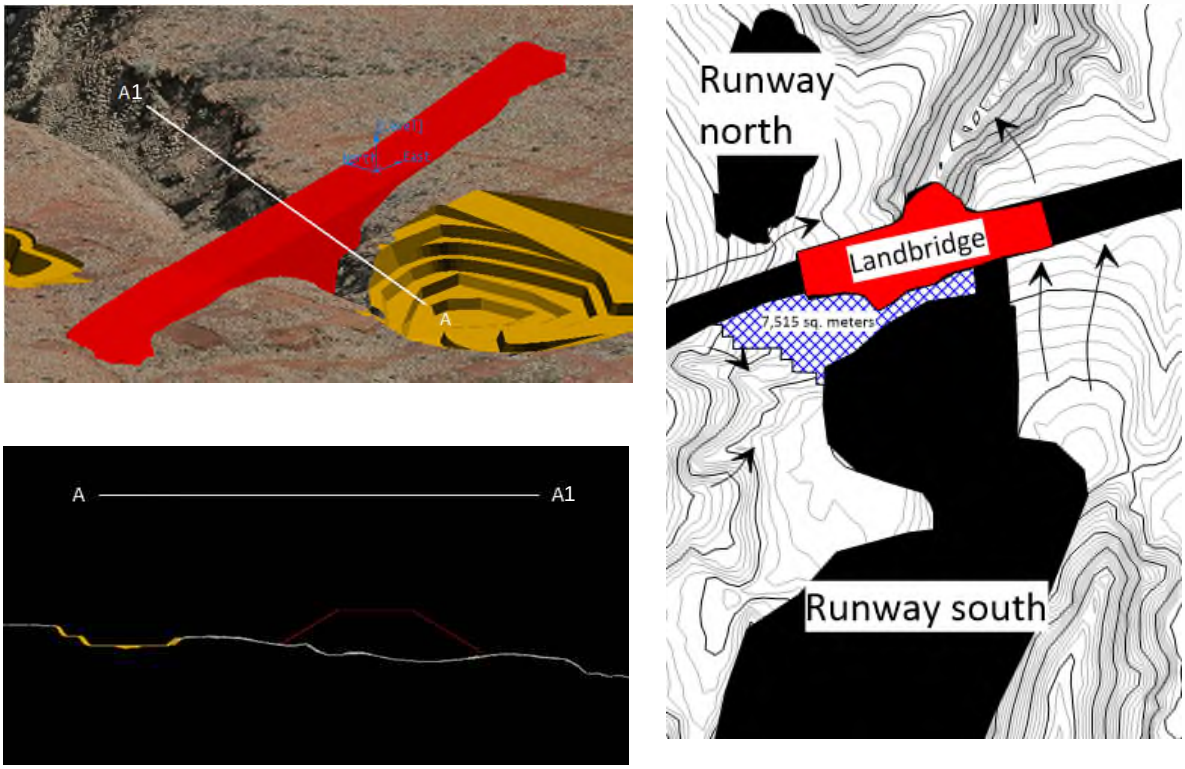


Figure 5.4 – Plan View and Cross-Section of the Land Bridge

5.5.4 Alteration of Surface Water Quality

Sediment runoff is likely to increase as a result of ground disturbance and vegetation removal required for the Proposal. However, it is unlikely to cause significant deterioration in water quality as soils within the Development Envelope are predominantly non-saline and non-acid forming (Stantec, 2018a). As discussed above, due to the location and topography of the Proposal, upstream catchments are small so there will be minimal upstream flows entering the Indicative Disturbance Footprint, and it is unlikely that there are any surrounding areas of significant sheet flow. Coupled with the installation of surface water management infrastructure, the Proposal is not anticipated to significantly increase levels of sediment and runoff (Stantec, 2018a).

The pit and waste rock dumps are the most likely contributors to elevated levels of sediment-laden runoff. Most flows will be directed around waste rock dumps and the minimal flows entering waste rock dumps will be encouraged to infiltrate internally or otherwise be directed to sedimentation ponds, where the bulk of the suspended material will be settled out prior to any discharge to the downstream environment (Stantec, 2018a). Similarly, pits will be mined to minimise discharge and encourage collection of direct stormwater and settling of sediments within the pit. Atlas does not propose to discharge any accumulated stormwater collected in pit. During larger magnitude rainfall events, sediment loads are naturally high, and so the release of any uncontained water from Proposal areas (e.g., from sedimentation ponds) during these events will not significantly impact sediment loads within the regional catchment (Stantec, 2018a).

As detailed in Section 2.3.3, there is also a risk of deleterious impacts to surface and ground water from the potential exposure of PAF shale within the Split Rock pit, and potentially the Runway South pit, although this is considered unlikely (Mine Earth, 2018; Appendix B). As a

result, the risk of deleterious impacts to surface water and groundwater from potential acid and metalliferous drainage (AMD) associated with exposure, handling and disposal of PAF shale is considered to be low. Atlas Iron is currently undertaking a drilling program to support additional sampling and characterisation of waste rock to confirm the presence/absence of PAF shale. In line with the precautionary approach, Atlas Iron has developed a Waste Management Strategy and designed the Split Rock waste rock dump to ensure that PAF shale if present is appropriately managed (i.e., encapsulated; refer to Section 2.3.3).

The risk of deleterious impacts to groundwater from AMD associated with exposures of PAF rock in pit walls is considered to be low given the low likelihood that PAF shale is present, and if found to be present will likely have limited distribution which may not correspond with planned pit walls. Furthermore, should PAF shale be exposed in pit walls, any seasonal flushing and collection of AMD within the pit sump will largely evaporate given the pits are above water table.

Where PAF is confirmed to be present and found to intersect the pit wall, Atlas Iron will undertake additional investigations to confirm AMD potential and where necessary develop a management strategy to ensure that it is appropriately managed to prevent deleterious groundwater quality impacts (i.e., limit PAF exposure and oxidation). This may include backfilling over PAF exposed pit face or redesigning the pit to ensure PAF shale material within 2 m of planned pit wall is left in-situ.

Mining activities also have the potential to contaminate surface water and groundwater with hydrocarbons and chemicals in the event of a hydrocarbon or hazardous substance spill. It is considered highly unlikely that hydrocarbons or chemicals will contaminate any significant hydrological features, given:

- The separation distance between the pools and the Indicative Disturbance Footprint (particularly the ROM, workshops and pits).
- The construction of appropriate surface water management structures around pits, waste rock dumps and the ROM (e.g., bund/diversion channels and sedimentation ponds).

5.5.5 Indirect Impacts on Significant Hydrological Features

This section considers impacts to significant hydrological features most likely to be at risk of indirect impacts discussed in Sections 5.5.3 and 5.5.4, i.e. change in quantity and quality of surface water. These hydrological features are those located within the Development Envelope and/or in relatively close proximity to (e.g. within 200 m) and downstream of the Proposal and so considered most at risk.

Water abstraction impacts on significant hydrological features are considered separately in Section 5.5.6.

Pool CO-WS-01

This pool is located within a minor drainage line east of a section of the proposed haul road connecting the proposed Runway pits and the ROM pad (Figure 5.3 and Table 5.4). Culverts will be installed where the haul road intersects this drainage line approximately 20 m downstream, so no drainage shadowing or ponding at this location is anticipated.

Construction of the adjacent haul road will be managed to minimise the risk of overburden traveling down the embankment and entering this pool (e.g., construction of a windrow).

While the haul road may result in increased sediment load reporting to this pool during rainfall events, water quality impacts at this location are unlikely to be significant, given:

- The haul road's location at the top of a catchment (minimal flows from upstream).
- The naturally high sediment loads during rainfall events.
- The permanent flowing/flushing nature of this pool.

No hydrocarbon and/or chemical contamination is anticipated, given the distance to active work areas most likely to experience such an event (e.g. pits, dumps, ROM pad, workshops etc.) and the implementation of Atlas Iron's Hydrocarbon Management Procedure and Hydrocarbon (and Chemical) Spill Management Procedure.

Pool CO-WS-09

This pool is located at the bottom of a gorge between two ridge systems (Figure 5.3 and Table 5.4). The proposed Split Rock pit lies on one of these ridges approximately 185 m to the west. A topsoil stockpile is proposed on top of the other ridge and will thereby reduce the upstream catchment area and therefore the volume of surface water runoff received at this pool following rainfall events.

The Split Rock pit and the topsoil stockpile are also the most likely source of increased sediment and runoff. The pit is also a potential source of hydrocarbon and/or chemical contamination and AMD, in the unlikely event PAF shale is confirmed to be present.

Despite the above, the Proposal is not anticipated to significantly impact water quality or levels at this pool, given:

- The diversion of clean runoff around the pit by safety bunds/windrows.
- The minimal flows entering the pit and the mining of the pit in such a way as to allow water to collect away from active work front areas and infiltrate and/or evaporate. No excess surface water will be discharged to the environment.
- The ephemeral (semi-permanent) nature of this pool CO-WS-09, which appears to have no groundwater connectivity (Stantec, 2018b).
- The unlikelihood PAF shale material is present at Split Rock (and intersects pit walls) and, in the instance it is confirmed to be present, Atlas Iron's commitment to ensure that it is appropriately managed to prevent deleterious groundwater quality impacts (e.g., through implementation of the Waste Rock Management Strategy, Appendix B.
- Atlas Iron will reconsider this stockpile location during final mine design with the aim of finding a more suitable location within the Development Envelope, and where this is not possible will work to optimise/reduce the area of this stockpile. Where topsoil is stored at this location Atlas will implement appropriate stormwater management measures.
- Naturally high sediment loads during large rainfall events.
- Implementation of Atlas Iron's Hydrocarbon Management Procedure and Hydrocarbon (and Chemical) Spill Management Procedure.

Pool CO-WS-14 and Cave CO-CA-14 Seep

This pool and cave are located at the bottom of a gorge between two ridge systems. The Razorback pit is on one of these systems approximately 70 m to the southwest (Figure 5.3 and Table 5.4). A catchment analysis completed by Stantec (2018b) determined that the proposed mining of the Razorback pit would intersect and remove 18% of the contributing catchment for this pool and seep. However, the impact on the seep and the pool's water level is not significant, given:

- Only a small volume of water is required to fill this pool to overflowing, and the loss of 18% of surface water catchment area is negligible in this regard.
- The current mine plan does not allow for active redirection of surface water around the pit, instead allowing surface water flows to drain into and collect within pit (where not diverted by safety bunds/windrows). This will enhance the period of time surface water has to infiltrate locally and thereby increase groundwater table levels locally, which may support seepage into the cave/pool.

Depending on the rate of infiltration, the collection of surface water in the Razorback pit may lead to a transient increase in TDS due to evaporative concentration. This could increase salinity in the groundwater seepage into cave CO-CA-03 and/or pool CO-WS-14.

The Razorback pit is also the most likely source of increased sediment and runoff, and hydrocarbon and/or chemical contamination. The Proposal is not anticipated to significantly impact water quality at this pool, given:

- The diversion of clean runoff around the pit by safety bunds/windrows.
- The minimal flows entering the pit and the mining of the pit in such a way as to allow water to collect away from active work front areas and infiltrate and/or evaporate. No excess surface water will be discharged to the environment.
- Naturally high sediment loads during large rainfall events.
- The permanent flowing/flushing nature of this pool.
- The unlikelihood PAF shale material is present at Split Rock (and intersects pit walls) and, in the instance it is confirmed to be present, Atlas Iron's commitment to ensure that it is appropriately managed to prevent deleterious groundwater quality impacts (e.g., through implementation of the Waste Management Strategy, Appendix B).
- Implementation of Atlas Iron's Hydrocarbon Management Procedure and Hydrocarbon (and Chemical) Spill Management Procedure.

The Freshwater Soak

As surface water flow is not expected to be impeded by the pipeline associated with the 0.1 ha impact from the Indicative Disturbance Footprint, no impact on surface water flow within the freshwater soak is expected. Culverts will also be installed where the haul road intersects this drainage line approximately 500 m downstream, so no drainage shadowing or ponding at this location is anticipated.

The Proposal is also not anticipated to result in any significant change in water quality given the naturally high sediment loads during large rainfall events and that all major Proposal infrastructure and disturbance (i.e. the haul road) is downstream of this location.

The Coongan River

The Coongan River runs south to north to the east of the Development Envelope. While the whole Development Envelope is within the catchment of the Coongan River, much of the Development Envelope drains west and/or to areas that join the Coongan River further downstream. As water quality impacts lessen with distance, the highest potential impacts could be expected where the pathway between the Proposal and the river is shortest.

The haul road north of the ROM pad is the closest part of the Proposal to the river and therefore may be the most likely contributor of elevated levels of sediment-laden runoff during rainfall events given its proximity. However, the Proposal is not expected to significantly impact water quality at the Coongan River, given:

- Most flows will be directed around the ROM pad. Any internal flows will be contained on the ROM pad and encouraged to infiltrate/evaporate.
- Culverts will be installed along the haul road where it intersects drainage features, to minimise drainage shadowing and/or ponding.
- Naturally high sediment loads during large rainfall events, when surface water may not be contained within sedimentation ponds and will pass into the downstream environment.
- The separation distance between the Coongan River and key Proposal infrastructure (e.g., over 4 km to nearest pit).
- Most flows will be directed around waste rock dumps and the minimal flows entering waste rock dumps will be encouraged to infiltrate internally or otherwise be directed to sedimentation ponds, where the bulk of the suspended material will be settled out prior to any discharge to the downstream environment.
- The diversion of clean runoff around the pits by safety bunds/windrows.
- The minimal flows entering the pit and the mining of the pit in such a way as to allow water to collect away from active work front areas and infiltrate and/or evaporate. No excess surface water will be discharged to the environment.
- The unlikelihood that PAF shale material is present at Split Rock (and intersects pit wall) and, in the instance it is confirmed to be present, Atlas Iron's commitment to ensure that it is appropriately managed to prevent deleterious groundwater quality impacts.
- Implementation of Atlas Iron's Hydrocarbon Management Procedure and Hydrocarbon (and Chemical) Spill Management Procedure.

5.5.6 Drawdown of Groundwater Levels and Reduced Groundwater Availability

A calibrated numerical groundwater model was developed to investigate the potential impacts of water abstraction on groundwater resources and environmental values dependent on groundwater (SRK, 2019). Full model construction details (e.g., model domain, conditions, aquifer parameters and calibration) and results can be found in Attachment C of Appendix G.

Two scenarios were modelled:

- Base case - with anticipated flow rates from eight production bores (under the most likely operating regime) to assess the drawdown impacts of water abstraction over the life of the Proposal (April 2021 to July 2026).

- Maximum pumping case – nine production bores operating at their maximum pumping capacity for the period that those bores would be in operation. This scenario was modelled to see how far the system could be stressed, significantly over and above the likely operating regime. This provides an estimate of "worst case" impact to afford Atlas the flexibility to proactively manage water abstraction over the life of the Project (e.g., alter abstractions rates and/or locations) to ensure the Project's environmental objectives and water demands are met. This scenario includes an additional (9th) production bore (CRD0024).

As there are no other groundwater users in the vicinity of the Proposal that would be impacted by reduced groundwater availability, this assessment focuses on the impact of drawdown on significant hydrological features identified in 5.3.2.3. The model found that four significant hydrological features; namely the soak and three pools CO-WS-01, CO-WS-03 and CO-WS-10, had the potential to be impacted by drawdown associated with the Proposal's proposed water abstraction, as detailed in Table 5.5. No drawdown impacts were predicted at the remaining significant hydrological features.

Table 5.5 – Estimates of Drawdown at Significant Hydrological Features

Significant Hydrological Features	Model Scenario	Modelled Drawdown Over the Life of the Proposal (m)					
		Mar 2022	Mar 2023	Mar 2024	Mar 2025	Mar 2026	July 2026
CO-WS-01	Base case	0.01	0.09	0.23	0.40	0.59	0.71
	Max. case[1]	0.01	0.10	0.36	0.72	1.13	1.38
CO-WS-03	Base case	2.61	3.12	3.47	3.74	3.94	4.04
	Max. case[1]	3.29	4.18	4.85	5.38	5.81	6.03
CO-WS-10	Base case	0	0	0	0.01	0.03	0.05
	Max. case[1]	0	0	0	0.02	0.06	0.10
Soak	Base case	3.14	3.67	4.04	4.32	4.53	4.64
	Max. case[1]	3.91	4.79	5.47	6.03	6.47	6.70

Source: SRK (2019).
Note:
(1) 'Max. case' is the maximum pumping case.
(2) No drawdown predicted at any significant hydrological features prior to year 2022.

A maximum of 0.71 m and 1.38 m of drawdown under the base case and maximum pumping case scenarios respectively has been predicted at CO-WS-01, a perennial groundwater dependent pool. However, geochemical analysis of water quality data from this pool indicates that it does not share a similar groundwater signature as the abstraction bores, which are completed in Mt Roe Basalt and from which drawdown will occur. Rather the chemistry of this pool mirrors groundwater from within the Runway bores to the north which are constructed within the BIF unit. It is therefore likely that this pool, and associated groundwater dependent vegetation, which are interpreted to be fed by groundwater flow from this BIF unit will be unaffected by the predicted drawdown within the Mt Roe Basalt as the two units are interpreted to be in poor hydraulic connection (SRK, 2019; Woodman, 2019). This is supported by pool water level monitoring which has remained stable over a prolonged period of groundwater level decline in the up-gradient monitoring bore (CRD0015), suggesting this pool is not sensitive to water table declines (SRK, 2019).

Pool CO-WS-03 has been identified as being ephemeral, distinct from groundwater and reliant on surface water processes, and as such, the predicted drawdown in this area (a maximum of 4.04 m and 6.03 m of drawdown under the base case and maximum pumping case scenarios respectively) is unlikely to impact the seasonal filling or draining of this pool (SRK, 2019) or any vegetation growing in association with this pool, noting that no groundwater dependent vegetation has been recorded at this location (Woodman, 2019).

A maximum of 0.05 m and 0.10 m of drawdown under the base case and maximum pumping case scenarios respectively has been predicted at CO-WS-10, a perennial pool that is believed to be fed primarily by surface water, but may be supplied intermittently with groundwater discharge following major rainfall/recharge events. Conceptually its thought that the source of groundwater in this pool is derived from overflowing groundwater expressed at pool CO-WS-12 situated upstream (which is known to be groundwater dependent) and which is not predicted to be impacted by drawdown. Based on the negligible level of predicted drawdown, the pools limited reliance on groundwater and our conceptual understanding of the likely source of seasonal groundwater contributions, it is unlikely that predicted drawdown will impact the permanency of this pool or any associated vegetation (SRK, 2019 and Woodman, 2019).

Given the limited understanding of the hydrogeology at the soak (i.e., connectivity of the perched ephemeral groundwater system and underlying bedrock aquifer from which water is being abstracted) we have conservatively assumed that the soak is in hydraulic connectivity with the underlying bedrock aquifer and may experience up to 4.64 & 6.70 m of drawdown between years 2 and 6 under the base-case and worst-case scenarios respectively (SRK, 2019). In the absence of obligate phreatophytes and with the potential for existing vegetation to be supported by stored soil moisture within the clay components of the site, severe impacts on vegetation are considered unlikely, however, given the lack of data regarding sensitivity of the species present, the impact of drawdown on this vegetation is difficult to predict (Woodman, 2019). Should drawdown result in a loss of moisture within the soil matrix at this site it is possible that plant stress or death may occur, however this impact is not predicted to be significant in a local or regional context (Woodman, 2019). Furthermore, any drawdown impacts will be temporary with groundwater within the deeper aquifer expected to recover within 2.5 years (SRK, 2019).

Assessment of drawdown impacts on groundwater dependent vegetation, other than that growing in association with the significant hydrological features discussed above, is provided in Section 6.5.5.

5.5.7 Alteration of Groundwater Quality

Groundwater abstraction from a number of production bores is proposed to supply the Proposal's construction, operational and potable water requirements (see Section 2.3.5). As discussed in Section 5.5.6, water abstraction will result in localised drawdown around pumping centres over the life of mine.

As no saline groundwater resource has been identified at depth to date, upwelling of saline groundwater and associated aquifer degradation is not anticipated (SRK, 2019).

Furthermore, there are no other groundwater users in the vicinity that would be impacted by any aquifer degradation.

5.6 Mitigation

Atlas has in place a HSEMS supported by an Environmental Management Plan (EMP), which defines Atlas's approach to environmental management and integrates regulatory and HSEMS requirements. Atlas has been operating iron ore mines in the Pilbara since 2008. During this time Atlas has developed, implemented and refined its Environmental Management Plans and Procedures.

The mitigation hierarchy (avoid, minimise and rehabilitate) has been applied during Proposal design to reduce the Proposal's potential impacts to inland waters. Table 5.6 – summarises the mitigations that will be applied during construction and operation of the Proposal.

Table 5.6 – Mitigation of Impacts to Inland Waters

	Mitigations to be Applied
Avoidance	The Development Envelope was altered to avoid all significant pools inclusive of a 50 m buffer, except for CO-WS-01, where a 20 m buffer has been applied.
Minimisation	The key regulatory mechanism relevant to this factor is the 5C Licence to take water under the RIWI Act and associated Water Management Plan and Site Water Operating Plan. These documents are currently being prepared following completion of recent hydrological investigation and revised drawdown model and will contain site-specific trigger values and management response actions developed in collaboration with the relevant regulatory agencies (i.e., DWER). In addition to this, the following plans and procedures will be implemented to assist in minimising impacts to inland waters: • Dust Management Procedure (950-HSE-EN-PRO-0026). • Ground Disturbance Permit (GDP) Procedure (950-HSE-EN-PRO-0001). • Clearing and Grubbing Procedure (950-HSE-EN-PRO-0004). • Waste Rock Management Strategy and Split Rock waste rock dump design (Appendix B and Figure 2.2). • Waste Management Procedure (950-HSE-EN-PRO-0023). • Wastewater Treatment Plant (WWTP) Care and Maintenance Plan (950-HSE-EN-PLN-0001). • WWTP Management Plan (950-HSE-EN-PLN-0002). • WWTP Sampling Procedure (950-HSE-EN-PRO-0025). • Hydrocarbon Management Procedure (950-HSE-EN-PRO-0005). • Hydrocarbon (and Chemical) Spill Management Procedure (950-HSE-EN-PRO-0007). Key management measures contained in these plans include: • Ensure appropriate surface water management (e.g., around pits, waste rock dumps and the ROM) is incorporated into the final mine design, in accordance with the objectives and design principles. • Culverts will be installed along the haul road where it intersects drainage features, to minimise impacts to surface water quality and quantity in pools, the freshwater soak and the Coongan River. • Haul road construction impacts will be managed to minimise the risk of overburden travelling down embankments into pool CO-WS-01 (e.g., using windrows).

	Mitigations to be Applied
	• To minimise impacts to pool CO-WS-09, Atlas Iron will investigate moving the nearby topsoil stockpile or, if unable to do so, will work to optimise/reduce the area of the stockpile. Stormwater management will be implemented while topsoil is stockpiled. • Water management at waste rock dumps will encourage surface water flow to infiltrate internally or otherwise be directed to sedimentation ponds, where the bulk of the suspended material will be settled out prior to any discharge to the downstream environment. • Most flows will be directed around the ROM pad. Any internal flows will be contained on the ROM pad and encouraged to infiltrate/evaporate. • The minimal flows entering the pit and the mining of the pit in such a way as to allow water to collect away from active work front areas and infiltrate and/or evaporate. No excess surface water will be discharged from pits to the environment. • Ensure any PAF shale waste rock material if present is appropriately managed (i.e., encapsulated). • If PAF is confirmed present and intersecting the pit wall, undertake additional investigations to confirm AMD potential and where necessary develop a management strategy to ensure appropriate management to prevent deleterious groundwater quality impacts (e.g., limit PAF exposure and oxidation). • When in operation as a treatment system or reconfigured for storage, the WWTP is to be inspected daily. The inspection is to include pipework (no cracks or leaks), tanks (levels correct, no overflows), seals (no leaks), and valves (in correct position, isolated where possible). Quarterly sampling is undertaken at least 45 days apart. • Prior to depositing any contaminated soil at the bioremediation facility, the logbook must be filled in. This is to capture information relating to the volume of contaminated soil, type of contaminant and source of contaminant. Maintenance includes ripping, watering and fertilising the cells. • All waste shall be segregated appropriately to enable effective reuse, recycling, transport and disposal as appropriate. • Containment of hydrocarbons in accordance with *AS1940:2004 – The Storage and Handling of Flammable and Combustible Liquids*, this includes sitting and bunding/containment restrictions, provision and maintenance of relevant MSDS and regular inspections. • Refuelling procedures, including the provision of a spill kit at all refuelling stations. • Spill recovery and clean up materials maintained at all hazardous material storage areas. Relevant employees and contractors will be trained in the use of this equipment. • The storage and regular disposal offsite by a licenced controlled waste contractor, of waste hydrocarbons (e.g., waste oil and used oil filters).
Rehabilitation	All areas of the Indicative Disturbance Footprint (except for open pits) will be progressively rehabilitated as soon as practicable and as required by the Mine Closure Plan. A Mine Closure Plan will be updated triennially or as required when significant changes are made to the Proposal. A detailed Mine Closure Plan, which will contain further information on rehabilitation works, will be prepared approximately one year to six months prior to the cessation of mining as stated in the Mine Closure Plan.

5.7 Predicted Outcome

The predicted impacts to Inland Waters from the Proposal after applying the mitigation hierarchy (avoid, minimise, rehabilitate) are:

- Approximately 0.04% disturbance to the regional Coongan River catchment.
- Approximately 0.1 ha disturbance to the northern side of the 'soak'.
- No disturbance to the freshwater wetland system.
- No direct impact to any of the 11 pools, with pool CO-WS-01 buffered from the Development Envelope by 20 m and all other pools buffered by a minimum of 50 m.
- Minor shadow effects to surface water flows downstream of pit and waste rock dump areas and land bridge, but no appreciable impact to catchments.
- Minor deterioration in surface water quality from increase in sediment runoff.
- Unlikely occurrence of PAF and associated AMD.
- No significant change to pool water quality or levels. Specifically, no loss of permanent pools.
- Up to 4.64 & 6.70 m of drawdown at the 'soak' which may result in tree stress or death where drawdown results in a loss of moisture within the soil matrix at this site.

After the application of mitigation hierarchy (i.e., avoidance, minimisation and rehabilitation measures), Atlas Iron expects that the EPA's objective for Inland Waters can be met.

5.8 Inland Waters Summary

A summary of the key information in this chapter is presented in Table 5.7.

Table 5.7 – Inland Waters Summary

Factor	Inland Waters Summary
EPA Objective	To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected.
Policy and Guidance	• Environmental Factor Guideline: Inland Waters (EPA, 2018).
Receiving Environment	The Proposal lies within the middle reaches of the Coongan River catchment (7,090 km2), which sits within the De Grey River Basin (Stantec, 2018a). Eleven significant water sources (i.e. pools) have been identified within the vertebrate fauna Study Area (MWH, 2018a). Only five of the 11 pools were determined to be perennial (i.e., permanent), four of which are considered likely to be groundwater dependent; CO-WS-01, CO-WS-05, CO-WS-12 and CO-WS-14 (SRK, 2019). The microclimate of cave CO-CA-03, a non-permanent breeding roost for the Pilbara Leaf-nosed Bat, is likely to be supported by pool CO-WS-14 along with an observed seep inside this cave. A potential 'soak' has also identified within the Development Envelope (Stantec, 2018a, Woodman, 2019). Groundwater gradients within the elevated BIF plateau are typically a subdued reflection of surface topography, lying within 25 to 60 mbgl within pit areas and between 3 to 10 mbgl in

Factor	Inland Waters Summary
	the low lying elevations (SRK, 2019). Groundwater quality in the Proposal area is generally neutral with pH values ranging between 5.6 and 8.6, and fresh to marginally brackish with TDS values between 42 and 1,800 mg/L. Generally, lower salinity is recorded within the BIF units of the Corunna ridge, with the more saline water occurring within the Hardy Formation to the north of the ridge within the Coongan River valley (SRK, 2019).
Potential Impacts	• Direct loss of significant hydrological features (e.g., pools) due to clearing. • Alteration of surface water flows due to the change in quantity of surface water associated with the interruption of natural drainage channels and drainage shadowing and ponding. • Alteration of surface water quality associated with increased sediment and runoff, potential exposure of PAF shale waste rock material and/or potential hydrocarbon and chemical contamination. • Alteration of groundwater quality and availability associated with water abstraction. • Indirect impacts on significant hydrological features due to change in water quality and quantity.
Mitigation	**Avoidance:** The Development Envelope was altered to avoid all significant pools inclusive of a 50 m buffer, except for CO-WS-01, where a 20 m buffer has been applied. **Minimisation and management:** The key regulatory mechanism relevant to this factor is the 5C Licence to take water under the RIWI Act and associated Water Management Plan and Site Water Operating Plan. These documents are currently being prepared following completion of recent hydrological investigation and revised drawdown model and will contain site-specific trigger values and management response actions developed in collaboration with the relevant regulatory agencies (i.e., DWER). In addition to this, the following plans and procedures will be implemented to assist in minimising impacts to inland waters: • Dust Management Procedure. • Ground Disturbance Permit (GDP) Procedure. • Clearing and Grubbing Procedure. • Waste Rock Management Strategy and Split Rock waste rock dump design (Appendix B and Figure 2.2). • Waste Management Procedure. • Wastewater Treatment Plant (WWTP) Care and Maintenance Plan. • WWTP Management Plan. • WWTP Sampling Procedure. • Hydrocarbon Management Procedure. • Hydrocarbon (and Chemical) Spill Management Procedure. Key management measures contained in these plans include: • Ensure appropriate surface water management (e.g., around pits, waste rock dumps and the ROM) is incorporated into the final mine design, in accordance with the objectives and design principles.

Factor	Inland Waters Summary
	• Culverts will be installed along the haul road where it intersects drainage features, to minimise impacts to surface water quality and quantity in pools, the freshwater soak and the Coongan River. • Haul road construction impacts will be managed to minimise the risk of overburden travelling down embankments into pool CO-WS-01 (e.g., using windrows). • To minimise impacts to pool CO-WS-09, Atlas Iron will investigate moving the nearby topsoil stockpile or, if unable to do so, will work to optimise/reduce the area of the stockpile. Stormwater management will be implemented while topsoil is stockpiled. • Water management at waste rock dumps will encourage surface water flow to infiltrate internally or otherwise be directed to sedimentation ponds, where the bulk of the suspended material will be settled out prior to any discharge to the downstream environment. • Most flows will be directed around the ROM pad. Any internal flows will be contained on the ROM pad and encouraged to infiltrate/evaporate. • The minimal flows entering the pit and the mining of the pit in such a way as to allow water to collect away from active work front areas and infiltrate and/or evaporate. No excess surface water will be discharged from pits to the environment. • Ensure any PAF shale waste rock material if present is appropriately managed (i.e., encapsulated). • Containment of hydrocarbons in accordance with *AS1940:2004 – The Storage and Handling of Flammable and Combustible Liquids*, this includes sitting and bunding/containment restrictions, provision and maintenance of relevant MSDS and regular inspections. • Refuelling procedures, including the provision of a spill kit at all refuelling stations. • Spill recovery and clean up materials maintained at all hazardous material storage areas. Relevant employees and contractors will be trained in the use of this equipment. **Rehabilitation:** • All areas of the Indicative Disturbance Footprint (except for open pits) will be progressively rehabilitated as soon as practicable and as required by the Mine Closure Plan.
Predicted Outcome	• Approximately 0.04% disturbance to the regional Coongan River catchment. • Approximately 0.1 ha disturbance to the northern side of the freshwater ‘soak’. • No disturbance to the freshwater wetland system. • No direct impact to any of the 11 pools, with pools CO-WS-01 buffered from the Development Envelope by 20 m and all other pools buffered by a minimum of 50 m. • Minor shadow effects to surface water flows downstream of pit and waste rock dump areas and land bridge, but no appreciable impact to catchments. • Minor deterioration in surface water quality from increase in sediment runoff. • Unlikely occurrence of PAF and associated AMD. • No significant change to pool water quality or levels. Specifically, no loss of permanent pools. • Up to 4.64 & 6.70 m of drawdown at the ‘soak’ which may result in tree stress or death where drawdown results in a loss of moisture within the soil matrix at this site.

6. Flora and Vegetation

6.1 EPA 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" (EPA, 2016a).

6.2 Policy and Guidance

The EPA has published a number of guidelines for the Flora and Vegetation factor. Guidance relevant to the Proposal includes:

- Environmental Factor Guideline: Flora and Vegetation (EPA, 2016a).
- Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016b).

Some assessments relevant to this factor were conducted under older guidelines that have since been replaced. Historical guidance relevant to surveys conducted for this Proposal includes:

- Guidance Statement No. 51, Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA, 2004a).
- Position Statement No. 3, Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA, 2002).

6.3 Receiving Environment

6.3.1 Previous Studies

Flora and vegetation studies and reports completed for the Proposal and relevant to the consideration of the Flora and Vegetation factor generally are summarised in Table 6.1.

Table 6.1 – Flora and Vegetation Studies

Reference	Study Title	Survey Timing	Study Purpose and Limitations
Woodman (2016a) Appendix H	Level 2 Flora and Vegetation Assessment	Level 2 survey was conducted over two visits in Autumn 2014 from 31 March to 9 April, and from 30 April to 9 May; and over one visit in Autumn 2016 from 2 to 13 May.	The overall objective of this study was to gather background information on the flora and vegetation of the Study Area (Woodman, 2016a).
Woodman (2016b) Appendix H	Flora and Vegetation Impact Assessment	As above.	To assess impacts from the Proposal to flora and vegetation, including species of conservation significance as identified in the above Flora and Vegetation Survey (Woodman, 2016a).

Reference	Study Title	Survey Timing	Study Purpose and Limitations
Woodman (2019) Appendix J	Assessment of Groundwater Drawdown Impacts to Vegetation	As above.	To assess the likelihood of Groundwater Dependent Vegetation (GDV) being present in the vicinity of the Proposal and the potential for groundwater abstraction impacts on these values.
Woodman (2018)	Investigation of Relationship Between Vegetation and Hydrology – "Soak: Area	As above.	To investigate the relationship between the hydrology of the soak and associated terrestrial vegetation and likelihood of impacts to vegetation health as a result of proposed groundwater abstraction. (Superseded by Woodman (2019) Assessment of Groundwater Drawdown Impacts to Vegetation above)

The following sections are primarily based on information from the studies and impact assessments listed in Table 6.1. The term Study Area refers to a 25,958.7 ha portion of land wholly encompassing the Development Envelope, and is used to provide context.

Note that the studies listed in Table 6.1 were conducted using an earlier 2,263.19 ha version of the Development Envelope, which has since been reduced to 2,257.6 ha. Likewise the Indicative Disturbance Footprint has been amended subsequent to this assessment to mitigate a number of significant environmental impacts, however, the total area remains unchanged (423.11 ha).

6.3.2 Regional Vegetation

The Proposal is in the Pilbara Interim Biogeographical Regionalisation for Australia (IBRA), specifically the Chichester subregion (Pilbara 1 subregion) of the Pilbara Biogeographic Zone (Kendrick and McKenzie, 2001). The Chichester subregion is approximately 9,044,560 ha in size and is characterised by undulating granite and basalt plains with significant areas of basaltic ranges. The plains support a shrub steppe characterised by *Acacia inaequilatera* over *Triodia wiseana* (spinifex) hummock grasslands and the ranges support *Eucalyptus leucophloia* tree steppes (Kendrick and McKenzie, 2001).

6.3.2.1 Land System

Land system classifications, as defined by the WA Department of Agriculture and Food, are used to map the land according to similarities in landform, soil, vegetation, geology and geomorphology (van Vreeswyk et al. 2004). Eight land systems occur within the Study Area and are briefly described in Table 6.2.

Table 6.2 – Land Systems Located Within Study Area

Land System	Description	Mapped Extent (ha)[1]
Rocklea	Basalt hills, plateaux, lower slopes and minor stony plains supporting hard (and occasionally soft spinifex) grasslands.	2,299,300
Capricorn	Hills and ridges of sandstone and dolomite supporting low shrublands or shrubby spinifex grasslands.	529,600
Talga	Hills and ridges of greenstone and chert and stony plains supporting hard and soft spinifex grasslands.	212,400
Boolgeeda	Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands or mulga shrublands.	774,800
Satirist	Stony plains and low rises supporting hard spinifex grasslands, and gilgai plains supporting tussock grasslands.	37,700
Granitic	Rugged granitic hills supporting shrubby hard and soft spinifex grasslands.	402,000
River	Narrow, seasonally active flood plains and major river channels supporting moderately close, tall shrublands or woodlands of acacias and fringing communities of eucalypts sometimes with tussock grasses or spinifex.	408,800
Macroy	Sandy/Stony plains and occasional tor fields based on granite supporting hard and soft spinifex shrubby grasslands.	1,309,500

Source: Woodman (2016a).
(1) Total extent of land system, not just the portion within the Study Area.

6.3.2.2 Pre-European Vegetation

The Proposal is located within the Fortescue District of the Eremaen botanical province (Beard, 1990). The Fortescue botanical district is characterised by tree (*Eucalyptus* spp. and *Corymbia* spp.) and shrub (*Acacia* spp., *Hakea* spp., *Grevillea* spp. and *Senna* spp.) steppe communities and *Triodia* spp. hummock grasslands (Beard, 1990).

The Pilbara region was mapped by Beard (1975) at a scale of 1:1,000,000. These vegetation systems have since been updated by Shepherd et al. (2002) to conform to National Vegetation Information System (NVIS) standards (ESCAVI, 2003). The update also accounts for extensive clearing since the Beard (1975) mapping. Shepherd et al. (2002) developed a series of systems to assist in the removal of mosaics; however, some mosaics still occur. The Development Envelope is located within the Abydos Plain and George Ranges, which still have close to 100% of the pre-European vegetation remaining (Table 6.3).

Table 6.3 – Pre-European Vegetation System Associations Located Within Development Envelope

System	System Code	Description	Current Extent (ha)	% of Pre-European Extent remaining
Abydos Plain	93	Hummock grasslands, shrub steppe; kanji over soft spinifex	432,038.31	99.94
Georges Ranges	82	Hummock grasslands, low tree steppe; snappy gum over *Triodia wiseana*	316,855.10	99.90
	587	Mosaic: Hummock grasslands, open low tree-steppe; snappy gum over *Triodia wiseana* / Hummock grasslands, shrub-steppe; kanji over *Triodia pungens*	103,444.39	99.99
	619	Medium woodland; river gum (*Eucalyptus camaldulensis*)	4,402.59	100

Source: Woodman (2016a)

6.3.3 Local Vegetation

6.3.3.1 Vegetation Types

A combination of floristic analysis and manual dissection defined 15 vegetation types (VTs) within the Study Area as defined in Table 6.4 and Figure 6.1 (Woodman, 2016a).

6.3.3.2 Vegetation Condition

The majority of the vegetation in the Study Area (90.32%) was ranked as being in Excellent condition, with little to no human disturbance and an absence or low levels of introduced flora taxa (Woodman, 2016a). However, the majority of larger drainage features, including creeks and flow lines, had lower condition scores as a result of the presence of high densities of aggressive introduced species and high grazing and trampling impacts from cattle. These scores varied from 'Very Good' to 'Poor', depending on the levels of introduced taxa and trampling impacts recorded. These condition scores were often correlated with the size of the drainage feature, with large creeks and rivers tending to be ranked lower than smaller flow lines and creeks. Condition was also generally poorer in the far northern section of the Study Area closer to Marble Bar.

Table 6.4 – Vegetation Types

VT	Description	Extent (ha) within Study Area
1	Mid sparse shrubland dominated by mixed Acacia species over low sparse shrubland of mixed species including *Acacia stellaticeps*, *Pluchea tetranthera* and *Eremophila latrobei* subsp. *glabra* over low hummock grassland dominated by *Triodia epactia* on grey to brown sand to clay loam with occasional granite outcropping, on stony plains, low hills or sandy dunes.	349.6
2	Tall to mid open shrubland dominated by mixed Acacia species including *Acacia eriopoda* and *Acacia maitlandii* and over low sparse shrubland of mixed species including *Acacia stellaticeps*, *Corchorus parviflorus* and *Corchorus laniflorus* over low hummock grassland dominated mainly by *Triodia epactia* on red-brown sandy clay to clay loam, on granite outcrops to stony plains and drainage lines with exposed granite.	334.2
3	Low open woodland of mixed species dominated by species including *Corymbia ferriticola*, *Ficus brachypoda*, *Terminalia canescens* over tall sparse shrubland usually dominated by *Acacia pruinocarpa* and *Acacia tumida* var. *pilbarensis* over low open mixed grassland dominated by *Triodia epactia*, *Cymbopogon ambiguus* and *Eriachne mucronata*, on red to brown sand to clay loam on ironstone or metamorphosed granite outcropping, in steep gorges, often with semi-permanent water.	48.7
4	Low Open Woodland usually dominated by *Corymbia hamersleyana* over Tall Sparse Shrubland dominated by mixed Acacia species including *A. trachycarpa* and *A. ancistrocarpa* with *Dichrostachys spicata* over Low Hummock Grassland dominated by species including *Triodia wiseana* and *T. epactia* with *Eragrostis eriopoda* on brown sandy loams on plains and drainage lines.	586.6
5	Mid Sparse Shrubland of mixed Acacia species usually dominated by *A. synchronicia* over Low Hummock Grassland dominated by various Triodia species including *T. epactia*, *T. wiseana* and *T. longiceps* on brown clay loams on stony plains and base of low hills.	836
6	Tall hummock grassland dominated by *Triodia longiceps* with tall isolated shrubs of *Acacia synchronicia* on red or brown sandy to clay loams on stony plains, interspersed with low sparse forbland of mixed species including *Sida fibulifera*, *Rhynchosia minima*, *Tephrosia sp*. clay soils (S. van Leeuwen et al. PBS 0273), *Crotalaria dissitiflora* subsp. *benthamiana*, *Cullen graveolens* and *Eriachne flaccida* on brown cracking clay in clay pans.	273
7	Tall sparse shrubland dominated by species including *Acacia bivenosa*, *Acacia synchronicia* and *Dichrostachys spicata* over mid hummock grassland dominated by *Triodia longiceps* over low sparse tussock grassland and chenopod shrubland dominated by *Cenchrus ciliaris* and *Sclerolaena hostilis* on brown clay loam on flats and in open depressions.	124.9
8	Low isolated shrubs dominated by *Melaleuca glomerata* over mid hummock grassland dominated by *Triodia longiceps* over low mixed sedgeland, grassland and forbland of mixed species including *Schoenus falcatus*, *Trianthema cusackianum* and *Stemodia grossa* on white to brown clay to clayey sand with occasional calcrete and dolerite stones, at the head of drainage lines.	65.6

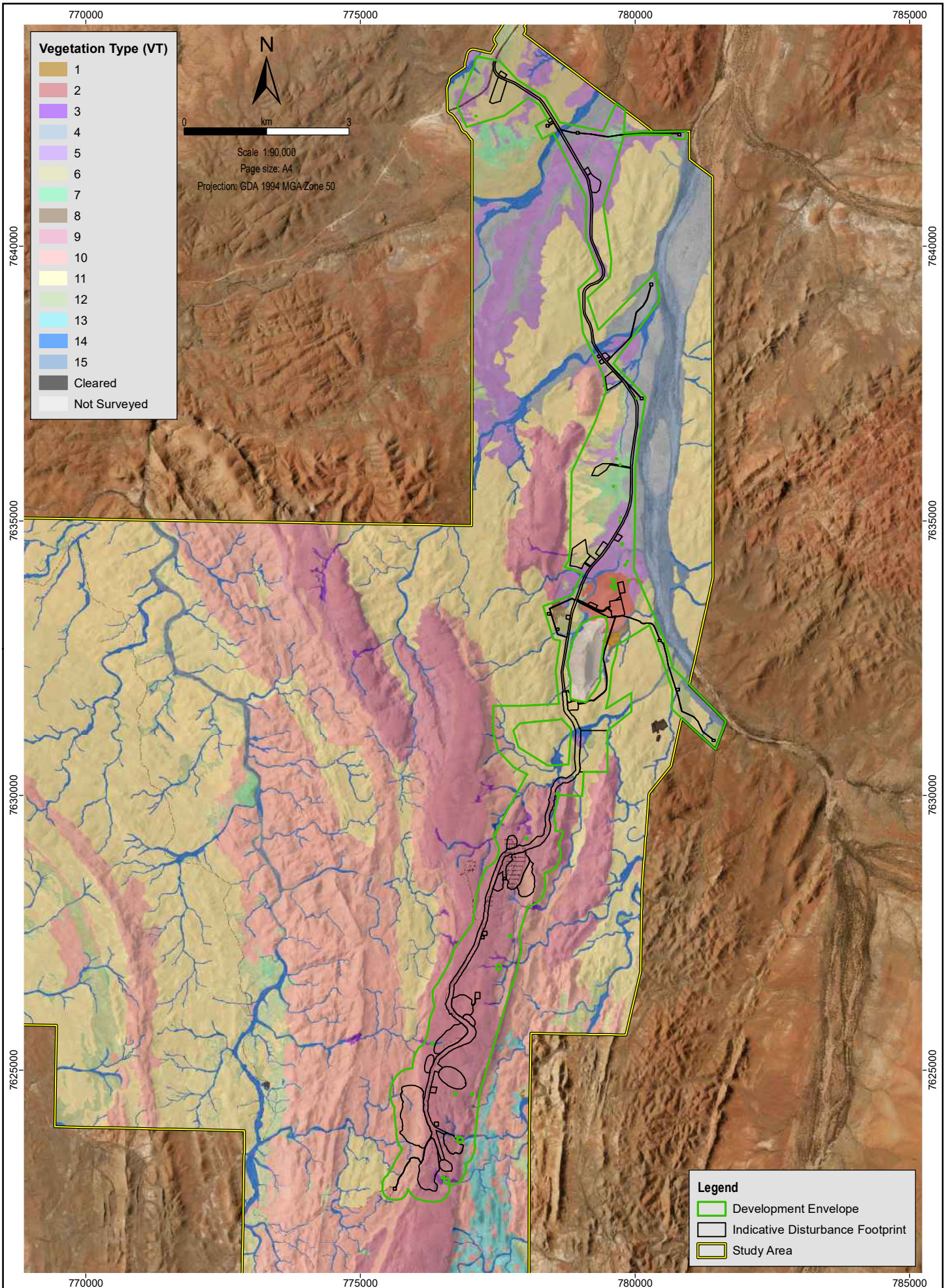
VT	Description	Extent (ha) within Study Area
9	Low open woodland to isolated trees of *Eucalyptus leucophloia* subsp. *Leucophloia* and/or *Corymbia hamersleyana* over tall sparse shrubland of mixed species usually dominated by *Acacia orthocarpa*, *Acacia monticola*, *Acacia tumida* var. *pilbarensis* and *Grevillea wickhamii* over low shrubland to sparse shrubland of mixed species dominated by *Acacia ptychophylla*, *Acacia spondylophylla*, *Goodenia stobbsiana*, *Dampiera candicans* and *Ptilotus calostachyus* over low hummock grassland dominated by *Triodia epactia* and occasionally *Triodia brizoides* on red to brown clay loam usually over ironstone or metamorphosed granite outcropping, on hill crests or occasionally low rises.	2,694.4
10	Isolated trees dominated by *Eucalyptus leucophloia* subsp. *leucophloia* and occasionally *Corymbia hamersleyana* over tall to mid sparse shrubland dominated by species including *Acacia bivenosa*, *Acacia inaequilatera*, *Acacia pyrifolia* var. *pyrifolia* and *Grevillea wickhamii* over low open to sparse shrubland of mixed species including *Indigofera monophylla*, *Acacia ptychophylla* and *Senna* spp. over low hummock grassland dominated by *Triodia brizoides*, *Triodia epactia* and/or *Triodia wiseana* over low sparse tussock grassland dominated by *Eriachne mucronata* on red or brown clay loam, usually over metamorphosed granite or occasionally dolerite, quartz or ironstone outcropping, on the upper slopes and crests of steep hills and ridges, or occasionally on low hills, undulating plains and outwashes.	6,625.7
11	Low isolated trees of *Corymbia hamersleyana* over tall sparse shrubland dominated by *Acacia inaequilatera* and often *Grevillea pyramidalis* subsp. *leucadendron* over low sparse shrubland dominated by *Corchorus parviflorus*, *Indigofera monophylla* and *Senna glutinosa* subsp. *glutinosa* over low hummock grassland dominated by *Triodia wiseana* and/or *Triodia epactia* on red to brown clay loam often with dolerite or occasionally quartz or metamorphosed granite outcropping, on low hills, ridges and occasionally undulating plains.	9,767.1
12	Low open woodland of *Corymbia hamersleyana* over mid sparse shrubland dominated by *Acacia bivenosa* over low sparse shrubland of mixed species including *Corchorus parviflorus*, *Heliotropium cunninghamii*, *Indigofera monophylla and Pluchea ferdinandimuelleri* over low hummock grassland dominated by *Triodia wiseana* and/or *Triodia angusta* or *Triodia longiceps* on brown clay loam on stony undulating plains and low rises often with calcrete outcropping.	1,439.7
13	Isolated trees dominated by *Corymbia hamersleyana* over tall to mid sparse shrubland dominated by *Grevillea wickhamii* and *Acacia bivenosa* over low open to sparse shrubland dominated by *Acacia arrecta*, *Goodenia stobbsiana*, *Corchorus parviflorus* and *Heliotropium ovalifolium* over low hummock grassland dominated by *Triodia angusta* and often *Triodia wiseana* on brown clay loam on stony undulating plains, low hills and ridges with calcrete, dolerite and occasional granite or ironstone outcropping.	694.9
14	Mid open woodland of mixed species including *Eucalyptus victrix* and *Corymbia hamersleyana* over tall open to sparse shrubland of mixed species including *Acacia coriacea* subsp. *pendens*, *Acacia trachycarpa*, *Acacia pyrifolia* var. *pyrifolia*, *Acacia tumida* var. *pilbarensis* and *Melaleuca glomerata* over low sparse shrubland of mixed species including *Pluchea ferdinandi-muelleri*, *Cajanus pubescens* and *Stemodia grossa* over mid open grassland and sedgeland of mixed species dominated by **Cenchrus ciliaris*, *Triodia longiceps*, *Triodia epactia*, *Chrysopogon fallax* and *Cyperus vaginatus* on red to brown sand to sandy loam with riverstones in minor to medium drainage lines.	1,419.4

VT	Description	Extent (ha) within Study Area
15	Mid open forest to woodland dominated by *Eucalyptus camaldulensis* subsp. *refulgens* and occasionally *Eucalyptus victrix* over tall open shrubland dominated by species including *Acacia ampliceps*, *Melaleuca glomerata* and *Acacia pyrifolia* var. *pyrifolia* over mixed mid open grassland and sedgeland dominated by **Cenchrus ciliaris*, *Cyperus vaginatus* and *Triodia longiceps* on red to brown sandy to clay loam with riverstone in major drainage lines.	502.7
C	Cleared (including the Hillside-Marble Bar Road, and major exploration tracks)	123.8
NS	Not Surveyed[1]	72.4
Total[2]		**25,958.7**

Source: Woodman (2016b)

(1) This area relates to an earlier boundary around a potential Aboriginal ethnographical site, which was avoided on consultation with the Njamal traditional owners.

(2) Totals may include rounding errors.



ATLAS	File Name: GIS_2501.mxd Date: 28/05/2019 Author: Drew.Smith	Source & Notes: Woodman, 2016a. *Disclaimer: This figure has been produced for internal review only and may contain inconsistencies or omissions. It is not intended for publication.*	**Vegetation Types**	Figure No: **6-1**

6.3.3.3 Groundwater Dependent Vegetation

Five of the VTs mapped within the Study area (VTs 3, 4, 8, 14 and 15) are at least occasionally characterised by taxa that are either known or presumed obligate or facultative phreatophytes, and therefore have the potential to represent groundwater dependent vegetation (GDV) either wholly or in part, however, are only considered to be GDV where the groundwater is located within 10 m of ground surface (Woodman, 2019).

A site specific assessment was conducted to confirm the presence of, and refine the areas identified as GDV within the impact area (i.e., maximum extent of predicted drawdown as discussed in Section 6.5.5), and to categorise these areas as either obligate or facultative GDV based on the presence and distribution of phreatophytic taxa recorded (Woodman, 2019). This assessment determined that within the impact area, and where groundwater is within 10 m of ground surface:

- All occurrences of VT 15 represent obligate GDV.
- All occurrences of VT 4 and VT 8 represent facultative GDV.
- VT 3 and VT 14 are obligate in areas where *Melaleuca argentea* and/or *Eucalyptus camaldulensis* subsp. *refulgens* are present, but otherwise are categorised as facultative.

These areas of facultative and obligate GDV are illustrated on Figure 5 of Appendix K.

6.3.3.4 Conservation Significant Vegetation

None of the VTs mapped in the Study Area are considered to represent any Threatened Ecological Community (TEC) as classified by Department of Biodiversity, Conservation and Attractions (DBCA) and endorsed by the Western Australian Minister for Environment, or as listed under the EPBC Act. None of the VTs mapped in the Study Area are considered to represent any DBCA-classified Priority Ecological Community (PEC; Woodman, 2016a).

The majority of VTs have limited local conservation significance (were ranked 1 to 2) on the basis that each of the VTs comprised more than 1% of the Study Area and the landform/soil type they occurred on was locally common and widespread (Woodman, 2016b), the exceptions being:

- VT 6 and VT 7 – have a local conservation significance ranking of 3 on the basis that each of these VTs while comprising 1 to 10% of the Study Area, the landform/soil type they occurred on was locally uncommon and/or restricted.
- VT 3 and VT 8 – have a local conservation significance ranking of 4 on the basis that each of these VTs comprised less than 1% of the Study Area and the landform/soil type they occurred on was locally uncommon and/or restricted.

Due to a lack of knowledge regarding the regional distribution and the types of landforms upon which they occur, these four VTs are also considered to be of potential regional significance (Woodman, 2016b).

6.3.4 Flora

A total of 413 discrete vascular flora taxa, one known hybrid and one putative hybrid were recorded within the Study Area (Woodman, 2016a). These taxa represent 63 families and 177 genera. The most well-represented families were Fabaceae (80 taxa, plus one known and one putative hybrid), Poaceae (62 taxa), Malvaceae (38 taxa), Cyperaceae (21 taxa), Amaranthaceae (20 taxa) and Asteraceae (17 taxa).

6.3.4.1 Conservation Significant Flora

Conservation significant flora includes species listed as:

- Threatened or Migratory under the EPBC Act.
- Threatened or Specially Protected (includes migratory species) under the *Biodiversity Conservation Act 2016* (BC Act).
- Priority species listed by DBCA.

No Threatened Flora taxa listed under the BC Act or EPBC Act, were recorded within the Study Area (Woodman, 2016a). Eleven DBCA classified Priority Flora taxa were recorded within the Study Area (Figure 6.2):

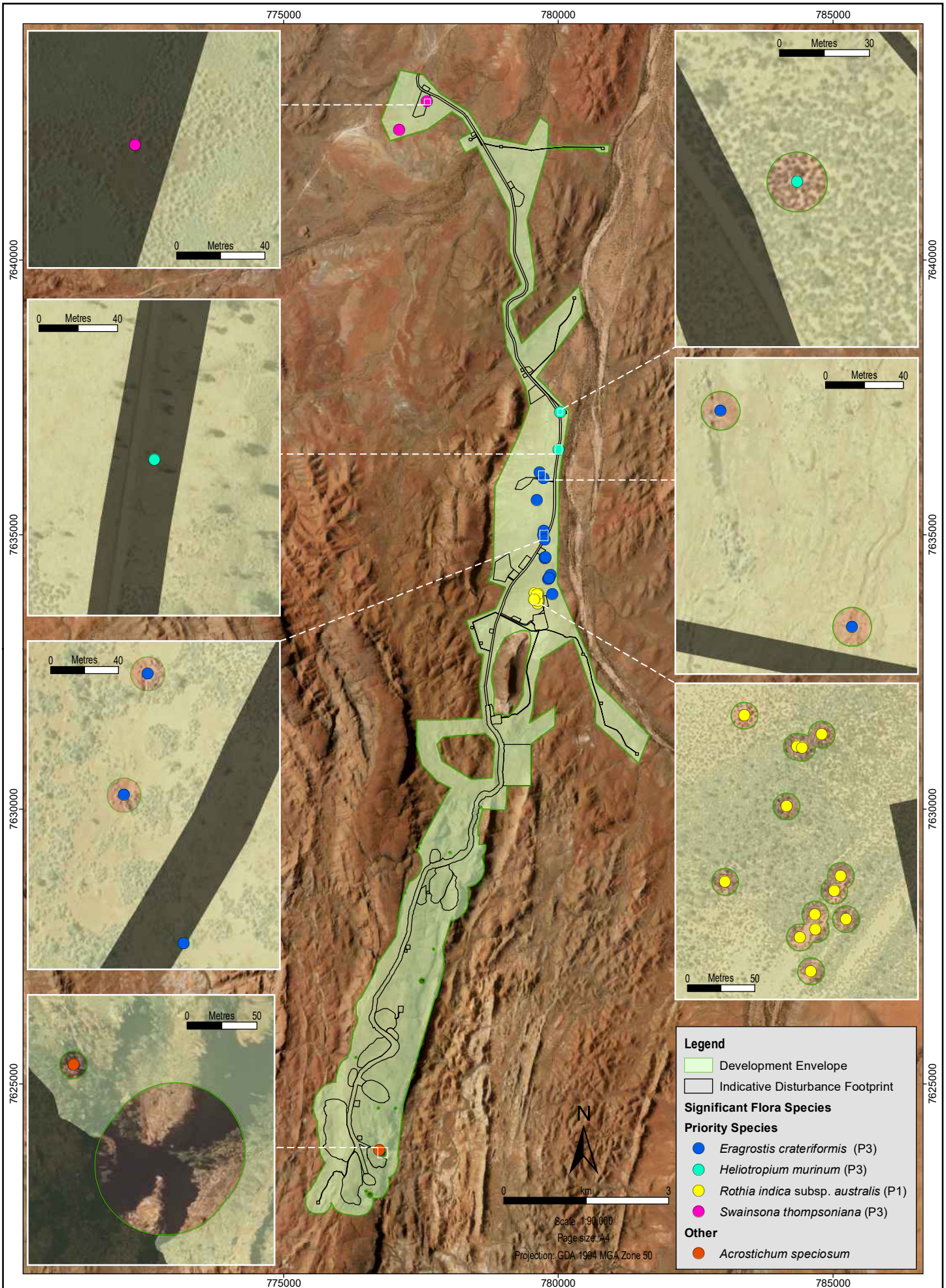
- Cochlospermum macnamarae (P1).
- *Rothia indica* subsp*. australis* (P1).
- *Schoenus* sp. Marble Bar (D. Coultas & S. Coultas DCSC-Opp 07) (P1).
- *Stylidium weeliwolli* (P2).
- *Acacia levata* (P3).
- *Eragrostis crateriformis* (P3).
- *Heliotropium murinum* (P3).
- *Nicotiana umbratica* (P3).
- *Rostellularia adscendens* var*. latifolia* (P3).
- *Swainsona thompsoniana* (P3).
- *Ptilotus mollis* (P4).

A further five species were considered significant as per EPA Guidance Statement No. 51 due to the identification of a taxa having anomalous features (*Abutilon* aff*. Hannii, Oldenlandia* sp*.* and *Portulaca* sp.) or representing a range extension or outlier of the main range (*Acrostichum speciosum* and *Eriocaulon pusillum*) (Woodman, 2016a).

6.4 Potential Impacts

Potential impacts to flora and vegetation from the Proposal include:

- Direct clearing of flora and vegetation resulting in a change to the local or regional representation of vegetation communities and flora species.
- Changes to vegetation composition, condition and/or health resulting from the following indirect impacts:
  - Introduction and/or spread of weeds.
  - Dust deposition.
  - Altered hydrological regimes (i.e., drainage shadowing and ponding).
  - Groundwater drawdown associated with water abstraction activities.



ATLAS	File Name: GIS_2490.mxd Date: 29/05/2019 Author: Drew.Smith	Source & Notes: Woodman, 2016a. *Disclaimer: This figure has been produced for internal review only and may contain inconsistencies or omissions. It is not intended for publication.*	**Conservation Significant Flora**	Figure No: **6-2**

6.5 Assessment of Impacts

The following sections discuss the potential impacts to flora and vegetation identified in Section 6.4 generally prior to applying mitigations (avoidance, minimisation and rehabilitation – discussed in Section 6.6).

6.5.1 Clearing of Flora and Vegetation

Clearing would reduce the size and quality of vegetation types, both directly and indirectly through edge effects and fragmentation, and is likely to heighten the effects of other threatening processes such as introduced flora (Keighery, 2010).

6.5.1.1 Vegetation

All 15 VTs mapped in the Study Area (see Table 6.4 and Figure 6.1) are represented to varying extents within the Development Envelope, and all (excluding VT 13) are at potential risk of impact by the Indicative Disturbance Footprint.

Table 6.5 outlines the VTs mapped in the Indicative Disturbance Footprint. Compared to the known extent of each VT within the Study Area, the area of each VT within the Indicative Disturbance Footprint is relatively small (i.e., less than 8%), therefore the level of local impact to each VT and the significance of this impact are both considered to be low (Woodman, 2016b).

Assuming the maximum impact allowable to each VT within the Development Envelope, the level and significance of this impact to the majority of VTs is still low (i.e., removal of less than 25% of mapped extent of each VT with a local conservation significance ranking of 1 or 2), with the following exceptions:

- VT5 – Moderate level of impact, given removal of between 25-50% of mapped extent within the Study Area, however the significance of this impact is low, given its local conservation significance ranking (i.e., 2).
- VT6 and VT7 – Moderate level and significance of impact, given removal of 25-50% of mapped extent and their local conservation significance ranking (i.e., 3).
- VT3 – Moderate level of impact, given removal of between 25-50% of mapped extent within the Study Area, however the significance of this impact is moderate to high, given its local conservation significance ranking of 4 (i.e., makes up 1% of the Study Area and the landforms and soils it occurs on are locally uncommon and/or restricted).

As described in Section 6.3.3.3, VTs 3, 6, 7 and 8 are considered to be of potential regional significance. While the significance of potential impacts on these VTs ranges from low to moderate- high, it is unlikely these impacts would be significant on a regional scale, particularly given less than 6% of each of these VTs intersects the Indicative Disturbance Footprint.

Furthermore, the Development Envelope and Indicative Disturbance Footprint are not anticipated to reduce the total extent of any Pre-European Vegetation System Associations within the PIL 1 Chichester IBRA Subregion (defined in Section 6.3.2.2) to below the 30% threshold as defined by the EPA (2000, 2002; cited in Woodman 2016b).

Table 6.5 – Potential Impact to Vegetation Types in the Indicative Disturbance Footprint

VT	Local Conservation Significance	Total Area Mapped in Study Area (ha)	Development Envelope[1]		Indicative Disturbance Footprint[2]	
			Area Mapped (ha)	Proportion of Area Mapped	Area Mapped (ha)	Proportion of Area Mapped
VT 1	2	349.6	8.1	2.3%	0.18	0.1%
VT 2	2	334.2	71.4	21.4%	11.96	3.6%
VT 3	4	48.7	14.0	28.7%	0.61	1.2%
VT 4	2	586.6	127.7	21.8%	10.62	1.8%
VT 5	2	836.0	255.3	30.5%	32.54	3.9%
VT 6	3	273.0	76.4	28.0%	15.03	5.5%
VT 7	3	124.9	51.0	40.8%	1.54	1.2%
VT 8	4	65.6	6.7	10.2%	0.13	0.2%
VT 9	1	2,694.4	423.1	15.7%	196.00	7.3%
VT 10	1	6,625.7	221.4	3.3%	51.76	0.8%
VT 11	1	9,767.1	414.8	4.2%	59.73	0.6%
VT 12	2	1,439.7	190.0	13.2%	23.89	1.7%
VT 13	2	694.9	5.0	0.7%	0.00	0.0%
VT 14	2	1,419.4	88.5	6.2%	10.83	0.8%
VT 15	2	502.7	23.0	4.6%	0.14	0.0%
C	–	123.8	12.0	9.7%	7.64	6.2%
NS[3]	–	72.4	3.9	5.4%	0.44	0.6%
Total[4]	–	**25,958.7**	**2,263.3**	–	**423.11**	–

Source: adapted from Woodman (2016b).

(1) These values are calculated from an earlier 2,263.19 ha version of the Development Envelope (Woodman, 2016b), which has since been reduced to 2,257.6 ha to avoid several significant environmental values, a reduction of approximately 5.59 ha. As these impacts are overstated and thus conservative they have not been revised to reflect the current Development Envelope.

(2) Atlas Iron has recalculated impacts to VTs based on the current 423.11 ha Indicative Disturbance Footprint, which was adjusted following the Woodman (2016b) assessment in an attempt to mitigate impacts to a number of significant environmental values. While the total area of the Indicative Disturbance Footprint remains unchanged at 423.11 ha, the area of each individual VT impacted has changed slightly.

(3) This area relates to an earlier boundary around a potential Aboriginal ethnographical site, which was avoided during the time of the survey based on consultation with the Njamal traditional owners.

(4) Totals may include rounding errors.

6.5.1.2 Significant Flora Taxa

At the time of Woodman's impact assessment, the following significant flora taxa were within the Development Envelope and so were considered most likely to be at risk of direct impact (Woodman, 2016b):

- *Rothia indica* subsp. *australis* (P1).
- *Eragrostis crateriformis* (P3).
- *Heliotropium murinum* (P3).
- *Swainsona thompsoniana* (P3).
- *Acrostichum speciosum*.

However, Atlas Iron has since revised the Development Envelope to mitigate direct impacts to the majority of these taxa, by excluding all known locations inclusive of a 10 m buffer from the Development Envelope with the exception of a single location of three of these taxa, which could not be avoided (Table 6.6 and Figure 6.2).

Table 6.6 – Potential Impacts to Significant Flora

Flora Taxa	Study Area			Development Envelope	Indicative Disturbance Footprint		
	Number of Locations	Number of Individuals	Area of Habitat[1] (ha)	Area (%) of Habitat[2]	No. (%) of Locations	No. (%) of Individuals	Area (%) of Habitat[3]
Eragrostis crateriformis (P3)	14	272	1,295.1	377.7 ha (29.2)	1 (7.1)	10 (3.7)	46.0 ha (3.6)
Heliotropium murinum (P3)	3	3	586.6	127.7 ha (21.8)	1 (33.3)	1 (33.3)	10.6 ha (1.8)
Swainsona thompsoniana (P3)	3	3	273.0	76.4 ha (28)	1 (33.3)	1 (33.3)	15.0 ha (5.5)

Source: Adapted from Woodman (2016b).

(1) Habitats for each of the listed flora taxa are as follows; *Eragrostis crateriformis* (P3) – VTs 2, 5 and 7, *Heliotropium murinum* (P3) – VT4 and *Swainsona thompsoniana* (P3) – VT6.

(2) These values are calculated from an earlier 2,263.19 ha version of the Development Envelope (Woodman, 2016b), which has since been reduced to 2,257.6 ha to avoid several significant environmental values, a reduction of approximately 5.59 ha. As these impacts are overstated and thus conservative they have not been revised to reflect the current Development Envelope.

(3) Calculated using the current Indicative Disturbance Footprint (as per Table 6.5).

This Proposal will remove less than one third of the known individuals locally for each of these species (i.e., with the Study Area) and less than 30% of their habitat from the Study Area.

While the Development Envelope may remove more than 25% of *Eragrostis crateriformis* (P3) habitat (i.e., VTs 2, 5 and 7) from the Study Area, resulting in a moderate level of impact to the species, it is highly unlikely that the Indicative Disturbance Footprint would change significantly and result in the complete removal of these VTs from the Development Envelope. In consideration of this and the Indicative Disturbance Footprint, the Proposal is likely to have a relatively low level of impact locally on this species (i.e., remove less than 25% of known local individuals and habitat from the Study Area; Woodman, 2016b).

However, the Proposal is likely to have a moderate level of local impact on both *Heliotropium murinum* (P3) and *Swainsona thompsoniana* (P3) given it will remove more than 25% of the total known individuals within the Study Area. As the potential impact to the total number of know populations of all three of these species regionally is less than 15%, the regional impact to each of these species is low (Woodman, 2016b).

6.5.2 Introduced Flora

Ground disturbance and vehicle and machinery movements all have the potential to spread and introduce weeds. Several introduced flora are already known to occur within or adjacent to the Development Envelope, including *Aerva javanica*, *Calotropis procera*, *Cenchrus ciliaris*, *Chloris barbata*, *Cynodon dactylon*, *Echinochloa colona* and *Passiflora foetida* var. *hispida* (Woodman, 2016a). All of these taxa are known to colonise and proliferate in post-disturbance environments (Woodman, 2016b).

6.5.3 Dust

The development and operation of the Proposal will create dust emissions associated with ground disturbance and construction, blasting, haulage and general traffic activities, the impacts of which may not be confined to the Development Envelope. Dust emissions have the potential to affect surrounding flora and vegetation. Dust deposition on individual taxa may have either a physical impact (such as blocking stomata, or physically smothering leaves), or chemical impacts, either on the individuals themselves or through contact with the soil (Woodman, 2016b). This may place pressure on conservation significant flora located in close proximity of the Indicative Disturbance Footprint (refer to Figure 6.2) if not appropriately managed.

6.5.4 Altered Hydrological Regimes

Where surface water flows are intercepted or modified there is an increase in the potential for localised ponding to occur immediately upstream, water shadows to develop immediately downstream and increased sediment run-off, particularly from pits and waste rock dumps. This includes areas surrounding several small gorge areas, mapped as VT 3, and areas associated with VTs 14 and 15, which comprise of drainage features. Numerous smaller drainage lines are located within the Development Envelope (and intersected by the current Indicative Disturbance Footprint).

An assessment of the Proposal's impact on local hydrology is provided in Section 5.5. In summary surface water impacts are likely to be localised and insignificant, largely associated with the minimal upstream flows entering the Proposal (given its location at the top of the catchment) and the absence of any significant areas of sheet flow across the Development Envelope (Stantec, 2018b).

6.5.5 Groundwater Drawdown

Atlas Iron is proposing to abstract groundwater from up to nine locations within the Development Envelope as detailed in Section 5.5.6, which may result in groundwater drawdown and changes to the availability of groundwater for GDV.

Impacts to GDV from drawdown depend primarily on the sensitivity of groundwater dependent flora species to the extent, duration and rate of drawdown. As supported by monitoring at Atlas Iron's other sites, facultative phreatophytes are unlikely to be impacted by groundwater drawdown (Woodman, 2019). As a result, this assessment only considers

drawdown impacts on areas of obligate GDV. Note Impacts on potential GDV growing in association with significant hydrological features is provided separately in Section 5.5.6.

A review of available literature on GDV in the Pilbara, including previous studies undertaken at Atlas Iron's Pardoo DSO Project, found that groundwater drawdown related impacts are primarily seen in the two recognised obligate phreatophytes that inhabit primarily riverine environments, *M. argentea* and *E. camaldulensis* subsp. *refulgens* (Woodman, 2019).

Predictions of groundwater drawdown at occurrences of obligate GDV have been made using the Proposal's numerical groundwater model, as discussed in Section 5.5.6. Both the base case (i.e. 'business as usual') and maximum pumping case were considered as illustrated on Figure 6.3. Predicted drawdown was then compared against known tolerances to drawdown of *E. camaldulensis* subsp. *refulgens* and *M. argentea* (Woodman, 2019).

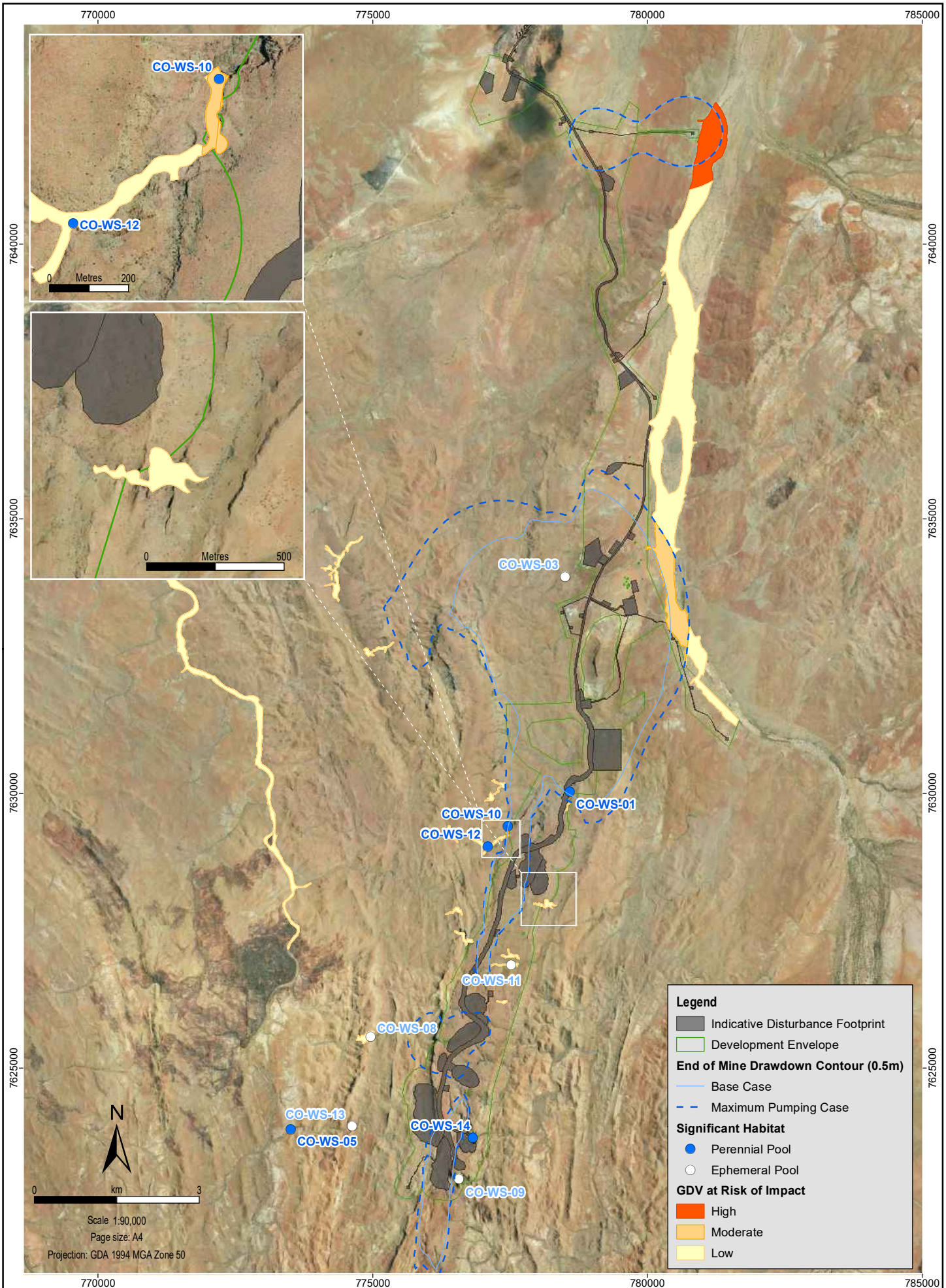
E. camaldulensis subsp. *refulgens* can tolerate up to 8 to 10 m of drawdown at rates of up to 5 m/year before experiencing loss in vigour, or death. As drawdown is expected to remain within these tolerances in both the base case and the maximum pumping case, no drawdown impact to *E. camaldulensis* subsp. *refulgens* is expected.

M. argentea can tolerate up to 0.5 m of drawdown before experiencing loss in vigour. Tree deaths may occur where drawdown exceeds 1 m. Woodman (2019) identified several areas of GDV where drawdown impacts exceed these tolerances, and categorised the risk as either moderate (loss in vigour) or high (loss in vigour and potential tree deaths).

Approximately 55.94 ha of GDV is considered at moderate risk of drawdown impact based on the maximum pumping case (Figure 6.3). Moderate risk areas of GDV may experience increased stress and/or loss of productivity in *M. argentea* individuals. However, given the short duration of the predicted impact in these areas (1 to 2 years), and as *M. argentea* is the only species within the GDV predicted to experience a decline in health, the overall predicted impact to moderate risk areas is not considered significant (Woodman, 2019).

Approximately 56.86 ha of GDV is considered at high risk of drawdown impact based on the maximum pumping case (Figure 6.3). *M. argentea* may experience stress, or even death of some trees, in areas of high risk GDV. However, given the short duration of the predicted impact in these areas (6 months to 1 year), and as *M. argentea* is the only species within the GDV likely to experience a decline in health and/or tree death, the overall predicted impact to high risk areas is not considered significant (Woodman, 2019).

The impacts predicted above are highly conservative given they are based on the maximum pumping case, which is unlikely to eventuate. A lower level of impact based on the base case is the most likely outcome.



ATLAS	File Name: GIS_2502.mxd Date: 11/09/2019 Author: Drew.Smith	Source & Notes: 'Woodman, 2018a' for Groundwater Dependent Vegetation Risk mapping. Other hydrological data from Stantec, 2018b. Freshwater soak from Woodman 2018b. *Disclaimer: This figure has been produced for internal review only and may contain inconsistencies or omissions. It is not intended for publication.*	**Groundwater Dependent Vegetation at Risk of Drawdown Impact**	Figure No: **6-3**

CORUNNA DOWNS *Atlas*

6.6 Mitigation

Atlas Iron has in place a HSEMS supported by an Environmental Management Plan (EMP), which defines Atlas Iron's approach to environmental management and integrates regulatory and HSEMS requirements. Atlas Iron has been operating iron ore mines in the Pilbara since 2008. During this time, Atlas Iron has developed, implemented and refined its Environmental Management Plans and Procedures.

The mitigation hierarchy (avoid, minimise and rehabilitate) has been applied during Proposal design to reduce the Proposal's potential impacts to flora and vegetation. Table 6.7 summarises the mitigations that will be applied during construction and operation of the Proposal.

Table 6.7 – Mitigation of Impacts to Flora and Vegetation

	Mitigations to be Applied
Avoidance	The Development Envelope was altered to: • Avoid two significant flora taxa; *Rothia indica* subsp. *australis* (P1) and *Acrostichum speciosum*. • Avoid 13 of the 14 locations of *Eragrostis crateriformis* (P3). • Avoid two of the three locations of *Heliotropium murinum* (P3). • Avoid two of the three locations of *Swainsona thompsoniana* (P3).
Minimisation	The following plans and procedures will be implemented to assist in minimising impacts to flora and vegetation: • Ground Disturbance Permit (GDP) Procedure (950-HSE-EN-PRO-0001). • Clearing and Grubbing Procedure (950-HSE-EN-PRO-0004). • Flora Management Procedure (950-HSE-EN-PRO-0010). • Weed Hygiene Procedure (950-HSE-EN-PRO-0002). • Dust Management Procedure (950-HSE-EN-PRO-0026). • Water Management Plan and Site Water Operating Plan (*in preparation*). Key management measures contained in these plans include: • No more than 423.11 ha of vegetation/habitat within the 2,257.6 ha Development Envelope will be cleared/disturbed. • Restricting clearing to the minimum necessary for safe construction and operation of the Proposal and to within approved areas through GDP Procedure. • Surveying and delineation of the GDP boundary in the field prior to any works commencing, including all buffers and values to be avoided and weed infested areas. • Prohibition of off-road driving unless otherwise authorised by Senior Management. • Weed hygiene inspections and certification to ensure all mobile equipment arriving on site is clean and free of material. • Weeds and weed contaminated topsoil will be cleared, handled and stockpiled separately to native vegetation and 'clean' topsoil. • Regular and targeted weed control (e.g. by spraying, physical removal) will be undertaken as appropriate (during all stages of operation including care and maintenance).

	Mitigations to be Applied
	• Implementation of standard dust suppression techniques shall be used on roads, stockpiles and infrastructure areas (e.g., water carts, sprinklers). • Road train trailers will be fitted with covers during product transport to port. • Atlas Iron will abstract water in accordance with 5C Licence to take groundwater (GWL176960) granted under the RIWI Act 1914 and a Water Management Plan 15 and Site Water Operating Plan 16 in accordance with Department of Water requirements. This includes a detailed monitoring program and establishment of appropriate triggers, thresholds and contingencies relevant to GDV (e.g., altering water abstraction rates and/or sourcing water from alternative water abstraction locations).
Rehabilitation	• The removal and stockpiling of all vegetative matter during clearing for future use in rehabilitation. • All areas of the Indicative Disturbance Footprint (except for open pits) will be progressively rehabilitated as soon as practicable and as required by the Mine Closure Plan. Rehabilitation works are expected to return disturbed areas to a stable and vegetated state • A Mine Closure Plan will be updated triennially or as required when significant changes are made to the Proposal. A detailed Mine Closure Plan, which will contain further information on rehabilitation works, will be prepared approximately one year to six months prior to the cessation of mining as stated in the Mine Closure Plan.

6.7 Predicted Outcome

The predicted impacts to Flora and Vegetation from the Proposal after the mitigation hierarchy (avoid, minimise, rehabilitate) are:

- No impact to Threatened Flora, TECs or PECs.
- Removal of a maximum of 423.11 ha of native vegetation within the 2,257.6 ha of Development Envelope.
- Removal of up to 6% of each of the locally significant VTs (3, 6, 7 and 8) from the Study Area, which is unlikely to result in a significant regional impact.
- A 10 m buffer around all locations of conservation significant flora with the exception of a single location of *Eragrostis crateriformis* (P3), *Heliotropium murinum* (P3) and *Swainsona thompsoniana* (P3), low level of regional impact.
- Loss of vigour and/or tree death in a single species, *Melaleuca argentea*, in up to 112.80 ha of obligate GDV, however it is not considered a significant impact.

After the application of mitigation hierarchy (i.e., avoidance, minimisation and rehabilitation measures), Atlas Iron expects that the EPA's objective for Flora and Vegetation can be met.

6.8 Flora and Vegetation Summary

A summary of the key information in this chapter is presented in Table 6.8.

Table 6.8 – Flora and Vegetation Summary

Factor	Flora and Vegetation Summary
EPA Objective	To protect flora and vegetation so that biological diversity and ecological integrity are maintained.
Policy and Guidance	• Environmental Factor Guideline: Flora and Vegetation (EPA, 2016a). • Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016b). • Guidance Statement No. 51, Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA, 2004a). • Position Statement No. 3 Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA, 2002).
Receiving Environment	Fifteen VTs mapped, with five of these (VTs 3, 4, 8, 14 and 15) could represent groundwater dependent vegetation. No VTs represent any TEC or PEC, however VT 3, 6, 7 and 8 were considered locally significant. Majority of the vegetation ranked as being Excellent condition. 413 discrete vascular flora taxa recorded. No BC Act or EPBC Act Threatened Flora taxa, however eleven DBCA classified Priority Flora taxa. A further five species were considered significant flora.
Potential Impacts	• Direct clearing of flora and vegetation resulting in a change to the local or regional representation of vegetation communities and flora species. • Changes to vegetation composition, condition and/or health resulting from the following indirect impacts: – Introduction and/or spread of weeds. – Dust deposition. – Altered hydrological regimes (i.e., drainage shadowing and ponding). – Groundwater drawdown associated with water abstraction activities.
Mitigation	**Avoidance:** The Development Envelope was altered to: • Avoid two significant flora taxa; *Rothia indica* subsp. *australis* (P1) and *Acrostichum speciosum*. • Avoid 13 of the 14 locations of *Eragrostis crateriformis* (P3). • Avoid two of the three locations of *Heliotropium murinum* (P3). • Avoid two of the three locations of *Swainsona thompsoniana* (P3). **Minimisation and management:** The following plans and procedures will be implemented to assist in minimising impacts to flora and vegetation: • GDP Procedure. • Clearing and Grubbing Procedure. • Flora Management Procedure. • Weed Hygiene Procedure.

Factor	Flora and Vegetation Summary
	• Dust Management Procedure. • Water Management Plan and Site Water Operating Plan. Key management measures contained in these plans include: • No more than 423.11 ha of vegetation/habitat within the 2,257.6 ha Development Envelope will be cleared/disturbed. • Restricting clearing to the minimum necessary for safe construction and operation of the Proposal and to within approved areas through GDP Procedure. • Surveying and delineation of the GDP boundary in the field prior to any works commencing, including all buffers and values to be avoided and weed infested areas. • Prohibition of off-road driving unless otherwise authorised by Senior Management. • Weed hygiene inspections and certification to ensure all mobile equipment arriving on site is clean and free of material. • Weeds and weed contaminated topsoil will be cleared, handled and stockpiled separately to native vegetation and 'clean' topsoil. • Regular and targeted weed control (e.g. by spraying, physical removal) will be undertaken as appropriate (during all stages of operation including care and maintenance). • Implementation of standard dust suppression techniques shall be used on roads, stockpiles and infrastructure areas (e.g., water carts, sprinklers). • Road train trailers will be fitted with covers during product transport to port. • Abstraction of water in accordance with 5C Licence to take groundwater granted under the RIWI Act and associated management and operating plans. **Rehabilitation:** • The removal and stockpiling of all vegetative matter during clearing for future use in rehabilitation. • All areas of the Indicative Disturbance Footprint (except for open pits) will be progressively rehabilitated as soon as practicable and as required by the Mine Closure Plan. Rehabilitation works are expected to return disturbed areas to a stable and vegetated state.
Predicted Outcome	• No impact to Threatened Flora, TECs or PECs. • Removal of a maximum of 423.11 ha of native vegetation within the 2,257.6 ha of Development Envelope. • Removal of up to 6% of each of the locally significant VTs (3, 6, 7 and 8) from the Study Area, which is unlikely to result in a significant regional impact. • A 10 m buffer around all locations of conservation significant flora with the exception of a single location of *Eragrostis crateriformis* (P3), *Heliotropium murinum* (P3) and *Swainsona thompsoniana* (P3), low level of regional impact. • Loss of vigour and/or tree death in a single species, *Melaleuca argentea*, in up to 112.80 ha of obligate GDV, however it is not considered a significant impact.

7. Terrestrial Fauna

7.1 EPA Objective

The EPA's objective for the Terrestrial Fauna factor is "to protect terrestrial fauna so that biological diversity and ecological integrity are maintained" (EPA, 2016c).

7.2 Policy and Guidance

The EPA has published a number of guidelines for the Terrestrial Fauna factor. Guidance relevant to the Proposal includes:

- Environmental Factor Guideline: Terrestrial Fauna (EPA, 2016c).
- Technical Guidance: Sampling methods for terrestrial vertebrate fauna (EPA, 2016d).
- Technical Guidance: Terrestrial Fauna Surveys. (EPA, 2016e).
- Technical Guidance: Sampling of short range endemic invertebrate fauna (EPA, 2016f).
- Interim guideline for preliminary surveys of night parrot (*Pezoporus occidentalis*) in Western Australia (DPAW, 2017).

Some assessments relevant to this factor were conducted under older guidelines that have since been replaced. Historical guidance relevant to surveys conducted for this Proposal includes:

- EPA Guidance Statement No. 20, Sampling of Short-Range Endemic Invertebrate Fauna for Environmental Impact Assessment in Western Australia (EPA, 2009).
- EPA Guidance Statement No. 56, Terrestrial Fauna Surveys for Environmental Impact Assessment in WA (EPA, 2004b).
- EPA Position Statement No. 3, Terrestrial Biological Surveys as an element of Biodiversity Protection (EPA, 2002).
- Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA and DEC 2010).

Several guidelines published by the DEE are also of relevance for species listed under the EPBC Act, including:

- Survey Guidelines for Australia's Threatened Bats (DEWHA, 2010a).
- Survey Guidelines for Australia's Threatened Birds (DEWHA, 2010b).
- Survey Guidelines for Australia's Threatened Mammals (DSEWPAC, 2011a).
- Survey Guidelines for Australia's Threatened Reptiles (DSEWPAC, 2011b).

7.3 Receiving Environment

7.3.1 Previous Studies

Terrestrial fauna studies and reports completed for the Proposal and relevant to the consideration of the Terrestrial Fauna factor generally are summarised in Table 7.1.

Table 7.1 – Terrestrial Fauna Studies

Reference	Study Title	Survey Timing	Study Purpose and Limitations
MWH (2018) Appendix J	Terrestrial Vertebrate Fauna Survey	Reconnaissance visit on 19 and 21 November 2013. Level 2 survey (Phase 1) from 24 February to 7 March 2014, including extended deployments of motion-sensor cameras and bat echolocation recording devices collected on 20 March 2014. Level 2 survey (Phase 2) from 22 September to 5 October 2016. Bat echolocation monitoring at cave CO-CA-01 from 15 May to 27 August 2014, 22 to 30 July 2015 and 1 to 8 July 2016.	The overall objective of this study was to gather background biological information on the terrestrial vertebrate fauna, vertebrate fauna assemblages and fauna habitats of the Study Area (MWH, 2018). A fire in late 2013 burnt a large portion of the study area, which may have affected faunal assemblage data from the Phase 1 survey and to a lesser extent from the Phase 2 survey. Additionally, clearing from recent exploration and historical mining activities was identified as a partial constraint.
MWH (2016b) Appendix K	Vertebrate Fauna Impact Assessment	As above.	To assess impacts from the Proposal to, terrestrial vertebrate fauna of conservation significance, fauna assemblages and fauna habitats of the Study Area as identified in the above Terrestrial Vertebrate Fauna Survey (MWH, 2018).
Outback Ecology Services (2014) Appendix M	Terrestrial SRE Invertebrate Fauna Survey	12 March to 19 May 2014. Additional specimens collected during vertebrate fauna survey from 24 February to 7 March 2014. Field sampling methods were endorsed at the time by the then Department of Environment and Conservation.	To assess the occurrence and likely distribution of short range endemic (SRE) invertebrate fauna, and identify and map habitat with the potential to support SRE invertebrate fauna habitat, in the Study Area (Outback Ecology Services, 2014). A fire in late 2013 burnt a large portion of the study area, however the limitation to the survey was minor given the microhabitats favoured by SREs (e.g. Rocky Ridge and Gorge) tended to be sheltered from the fire. Access prevented survey of a small portion in the north of the Study Area.
MWH (2016c) Appendix N	Terrestrial SRE Invertebrate Fauna Impact Assessment	As above.	To assess impacts of the Proposal on terrestrial SRE invertebrate fauna and habitat in the Study Area as identified in the above Terrestrial SRE Invertebrate Fauna Survey (Outback Ecology Services, 2014).

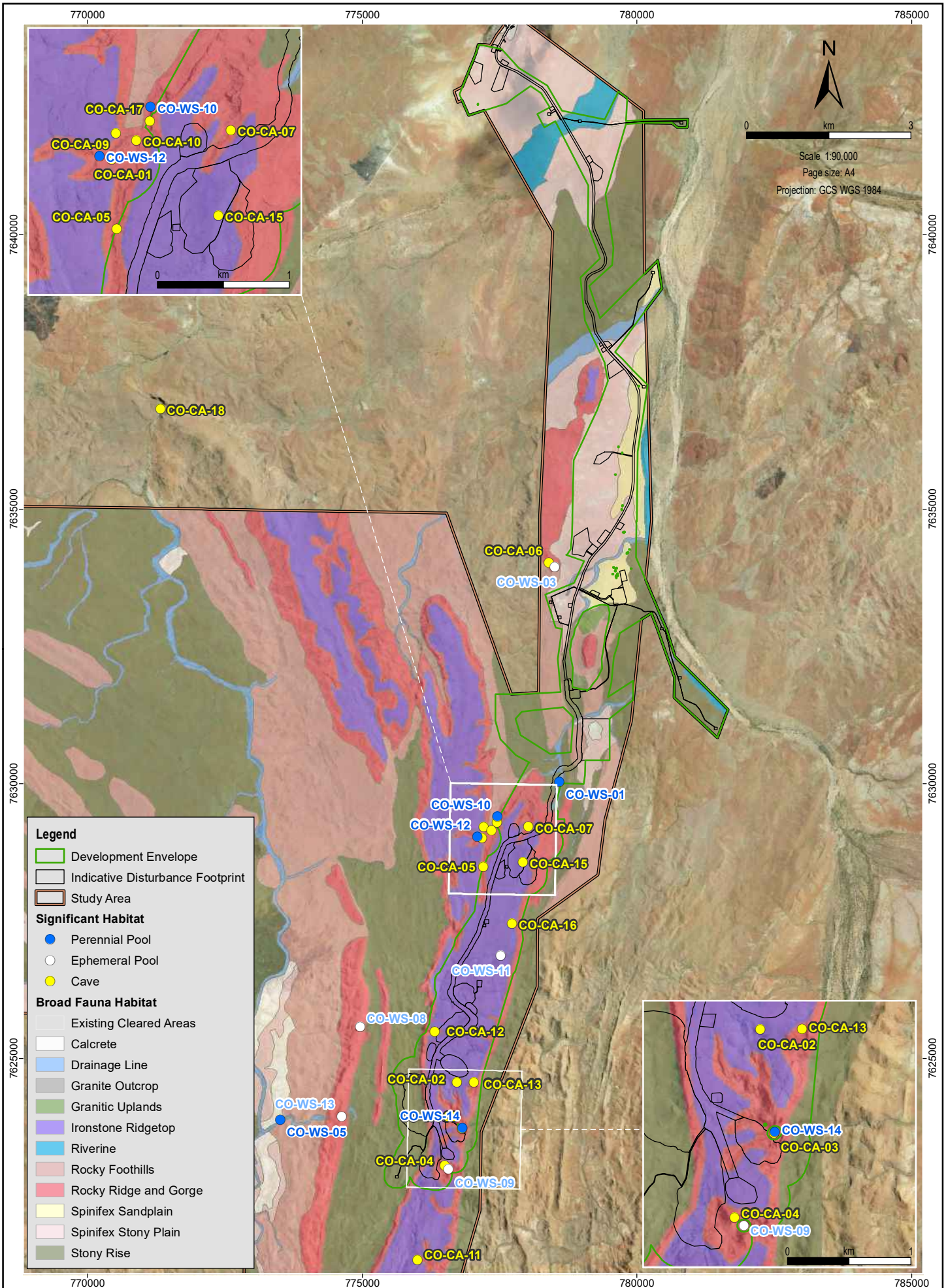
Reference	Study Title	Survey Timing	Study Purpose and Limitations
Stantec (2017) Appendix O	Importance of CO-CA-03 for the Pilbara Leaf-nosed Bat	Bat echolocation monitoring at cave CO-CA-01 and CO-CA-03 for 5 nights in September 2016, and from 31 May to 10 June 2017.	To provide further data on and support assessment of usage of each cave by bats. The number of Pilbara Leaf-nosed Bat calls in June 2017 was likely to be underestimated.
Bat Call (2018) Appendix P	Cave CO-CA-03 Pilbara leaf-nosed bat roost census		The objectives of the census were to (Bat Call, 2018): • Collect high quality video and ultrasonic call recordings of the Pilbara Leaf-nosed Bat entering and exiting cave CO-CA-03. • Provide an understanding of the usage of cave CO-CA-03 at the end of the dry season bottleneck with a view to confirming why this cave is a satellite to CO-CA-01 and not a permanent diurnal roost for the Pilbara Leaf-nosed Bat. • To determine a correlation factor to enable the number of Pilbara Leaf-nosed Bat individuals using the cave to be estimated using audio recordings. The correlation factor was unable to be determined, as bats did not echolocate as expected, likely due to the presence of the infrared light from the video recorder.

The following sections are primarily based on information from the studies and impact assessments listed in Table 7.1. The term Study Area refers to a 18,845 ha portion of land wholly encompassing the Development Envelope, and is used to provide context.

Note that the studies listed in Table 7.1 were conducted using an earlier 2,263.19 ha version of the Development Envelope, which has since been reduced to 2,257.6 ha. Likewise the Indicative Disturbance Footprint has been amended subsequent to this assessment to mitigate a number of significant environmental impacts, however, the total area remains unchanged (423.11 ha).

7.3.2 Fauna Habitat

Eleven broad fauna habitat types were identified and mapped over the Study Area (Figure 7.1 and Table 7.2). All of the broad fauna habitats, excluding Granite Outcrop habitat, intersect the Development Envelope. Vegetation condition ranged from Good to Excellent. Fire, infestation of weeds (particularly Buffel Grass, **Cenchrus ciliaris*) and feral grazing were the most commonly recorded disturbance factors.



ATLAS	File Name: GIS_2491.mxd Date: 11/09/2019 Author: Drew.Smith	Source & Notes: 'MWH (2018)' for fauna habitats and significant microhabitat features. Pool permanency (perennial vs emphemeral) revised (Stantect, 2018b) *Disclaimer: This figure has been produced for internal review only and may contain inconsistencies or omissions. It is not intended for publication.*	**Fauna Habitats**	Figure No: **7-1**

Table 7.2 – Broad Fauna Habitats

Fauna Habitat and Category	Vegetation Association and Substrate	Habitat Condition (Disturbance Types)	Extent Within Study Area (ha)
Stony Rises • Widespread • Limited significance	Scattered *Corymbia hamersleyana* trees over, scattered-open shrubland dominated by *Grevillea wickhamii*, *Acacia inaequilatera* and/or *Hakea lorea*; over open to dense hummock grassland or *Triodia* spp. on skeletal soils of brown clay-loam.	Very Good – Excellent (Recent fire, cattle grazing and trampling)	7,703
Rocky Foothills • Widespread • Significant[1]	Scattered *Corymbia hamersleyana* trees over, scattered- open shrubland dominated by *Grevillea wickhamii* and/or *Acacia inaequilatera* over hard spinifex on stony red clay loam.	Good – Excellent (Recent fire, tracks)	4,458
Spinifex Stony Plain • Widespread • Limited significance	Sparse woodland of *Corymbia hamersleyana* over mixed open shrubland dominated by *Acacia pyrifolia, Acacia inaequilatera, Senna* spp, and *Grevillia wickhamii* over dense hummock grassland of *Triodia* spp. and herbs on reddish brown sandy loam.	Very Good – Excellent (Recent fire, historical mining, tracks)	1,876
Rocky Ridge and Gorge • Widespread • Significant	Gorges dominated by *Eucalyptus camaldulensis* and/or *Melaleuca argentea* with scattered *Ficus* spp. Over mixed *Acacia* spp. shrubland and *Triodia* and *Eriachne* grasses. Ridges with scattered *Eucalyptus leucophloia* and *Ficus* spp. with scattered Acacia spp. over Triodia hummock grassland.	Very Good – Excellent (Recent fire, mining exploration)	1,766
Ironstone Ridgetop • Widespread • Limited significance	Sparse woodland and mallee woodland of *Eucalyptus leucophloia* scattered trees, over shrubland dominated by *Grevillea wickhamii, Acacia orthocarpa* and mixed *Acacia* spp. over open-dense *Triodia* spp. hummock grassland on red-brown skeletal soils.	Good – Excellent (Recent fire, mining exploration)	1,543
Drainage Line • Widespread • Significant	Open woodland dominated by *Eucalyptus victrix* and/or *E. camaldulensis*, over open-dense shrubland of *Acacia tumida* and/or *Melaleuca glomerata* with scattered/clumps of tussock grasses, **Cenchrus ciliaris, Eriachne* spp. and *Triodia* spp. hummock grasses on river sand and alluvial loam.	Good (Cattle, weeds, recent fire)	502

Fauna Habitat and Category	Vegetation Association and Substrate	Habitat Condition (Disturbance Types)	Extent Within Study Area (ha)
Granitic Uplands • Limited extent • Limited significance	Very open shrubland of slender *Acacia* spp over *Triodia* spp on shallow sandy soils over sheets and outcropping of granite stones and boulders.	Very Good – Excellent (Recent fire, cattle trampling and grazing, tracks)	238
Calcrete • Limited extent • Limited significance	Scattered *Corymbia hamersleyana* over scattered *Acacia inaequilatera* shrubland over low hard hummock grassland of *Triodia* spp on clay-loam with calcrete.	Very Good (Recent fire and cattle adjacent)	235
Spinifex Sandplain • Limited extent • Limited significance	Low dense *Acacia* spp. shrubland over dense soft *Triodia* spp. hummock grassland on shallow red/orange sand with underlying hardpan.	Very Good – Excellent (Feral grazing, limited clearing and tracks)	195
Riverine • Limited extent • Significant	Woodland of *Eucalyptus victrix, E. camaldulensis* and/or *Melaleuca argentea* over shrubland of *Hakea Lorea, Melaleuca glomerata* and/or *Grevillea pyramidalis* with pockets of *Triodia* hummock grassland and **Cenchrus ciliaris* tussock grassland on brown sandy river sands and brown sandy loam.	Very Good to Degraded (Cattle and camel grazing, weeds)	167
Granite Outcrop • Limited extent • Significant	Very sparse *Acacia* spp woodland over shrubland of *Acacia* spp. and *Triodia* spp. hummock grassland on stony red sand, interspersed with substantial granite boulder piles.	Not assessed	163

Source: MWH (2016b)

(1) MWH (2016b) reported that Rocky Foothills habitat was of limited significance. However, Atlas Iron has amended this to 'Significant' to align with conclusions of the Proposal's EPBC Act assessment of Northern Quoll habitat.

None of the habitat types recorded in the Study Area are regionally significant, although five of the fauna habitats present within the Study Area are considered locally significant due to their ability to support conservation significant species or distinct faunal assemblages (MWH, 2018). Significant fauna habitats present within the Development Envelope are listed in Table 7.3, including a summary of their values and a list of conservation significant fauna known or likely to be supported by them. The occurrence of conservation significant fauna in the Study Area and within these habitats is discussed later in Section 7.3.6.

Table 7.3 – Significant Fauna Habitats in the Development Envelope

Significant Fauna Habitat	Summary of Value	Conservation Significant Fauna Known or Likely to be Supported
Rocky Ridge and Gorge	Contains features such as outcropping ironstone, fallen boulders, caves, overhangs, crevices and occasional water sources (i.e., pools), many of which are important microhabitats. Similar habitat of similar value is uncommon in the Chichester subregion.	Northern Quoll, Pilbara Leaf-nosed Bat, Pilbara Olive Python, Peregrine Falcon, Ghost Bat, Long-tailed Dunnart, *Anilios ganei*
Rocky Foothills[1]	Transitional habitat between Stony Rise and Rocky Ridge and Gorge habitats, which generally lacks microhabitats and features preferred by conservation significant species in Rocky Ridge and Gorge habitat, but may provide foraging resources for these species. Widespread within the region and not generally of conservation significance.	Northern Quoll, Ghost Bat, Peregrine Falcon, Western Pebble-mound Mouse
Drainage Line	Contains temporary-permanent water sources (i.e., pools). Linear form connecting to other habitat types. Widespread availability of microhabitats such as leaf litter, large trees, hollows and water sources. Well represented in region but limited in extent.	Northern Quoll, Pilbara Leaf-nosed Bat, Ghost Bat, Pilbara Olive Python, Peregrine Falcon, Grey Falcon and migratory waterbirds
Riverine	Stable source of food and water in area surrounded by comparatively resource-poor spinifex plains. Flowering plants of use for some bird species. Migratory species use habitat as movement corridor.	Northern Quoll, Pilbara Leaf-nosed Bat, Ghost Bat, Pilbara Olive Python

Adapted from: MWH (2018)

(1) MWH (2016b) reported that Rocky Foothills habitat was of limited significance. However, Atlas Iron has amended this to 'Significant' to align with conclusions of the Proposal's EPBC Act assessment of Northern Quoll habitat.

7.3.3 Fauna Microhabitat Features

A number of important microhabitat features are present within the Study Area, including caves and water sources (i.e., pools). These features provide important sources of shelter, food and water for species of conservation significance. Many of these features were located within the Rocky Ridge and Gorge habitat and were not commonly recorded in other broad habitat types of the Study Area.

7.3.3.1 Caves

Within the Study Area, 18 caves known to support the Pilbara Leaf-Nosed Bat and/or Ghost Bat, both of which are listed as Vulnerable under the EPBC Act and BC Act, have been identified (see Figure 7.1). Table 7.4 summarises the value of these caves to each bat species.

Table 7.4 – Caves in the Study Area Known to Support the Pilbara Leaf-nosed Bat or Ghost Bat

Cave	Value to Pilbara Leaf-nosed Bat	Value to Ghost Bat
CO-CA-01	Permanent diurnal roost	Temporary diurnal roost
CO-CA-02	Nocturnal refuge	–
CO-CA-03	Non-permanent breeding roost	–
CO-CA-04	Nocturnal refuge	–
CO-CA-05	Nocturnal refuge	–
CO-CA-06	Nocturnal refuge	Nocturnal refuge
CO-CA-07	Nocturnal refuge	–
CO-CA-08	–	Nocturnal refuge
CO-CA-09	Nocturnal refuge	–
CO-CA-10	Nocturnal refuge	–
CO-CA-11	Nocturnal refuge	–
CO-CA-12	Nocturnal refuge	–
CO-CA-13	Nocturnal refuge	–
CO-CA-15	Nocturnal refuge	Nocturnal refuge
CO-CA-16	Nocturnal refuge	–
CO-CA-17	Nocturnal refuge	Nocturnal refuge
CO-CA-18	Nocturnal refuge	–
CO-CA-19	–	Nocturnal refuge

Source: MWH (2016b)

Note: Cave CO-CA-14 is not included in this table as it was not found during the baseline survey to support Pilbara Leaf-nosed Bat or Ghost Bat.

Most caves identified in Table 7.4 are of value only as nocturnal refuges to the Pilbara Leaf-nosed Bat and/or the Ghost Bat. Nocturnal refuges are typically used for foraging and night roosting. They are not considered critical habitat, but do support a species' persistence in an area, facilitating long dispersal and genetic dispersal (TSSC, 2016a; TSSC, 2016b). Although the number of nocturnal refuges in the region is unknown, it is likely to be higher than the number of permanent diurnal roosts in the same area (MWH, 2018).

Two of the surveyed caves are however of particular significance to the Pilbara Leaf-nosed Bat. These are caves CO-CA-01 and CO-CA-03, which are discussed further below.

Cave CO-CA-01 has been identified as a permanent diurnal roost for the Pilbara Leaf-nosed Bat. The 407 to 600 individuals recorded during a video roost census completed in 2016 is considered average size for a permanent Pilbara roost and it is also possible, given the higher activity recorded during February and March 2014, that this permanent roost supports a maternity colony for this species. Ghost bats have also been sporadically recorded visiting this cave and so it is also recognised as a temporary diurnal roost for this species (MWH, 2016b).

This cave is located at the top of a rocky ridge face, in the Rocky Ridge and Gorge habitat. The cave entrance is approximately 6.5 m wide and 1.5 m high and faces north into a narrow gorge, which contains multiple water pools (approximately 40 m from the entrance). The chamber adjoining the cave entrance is approximately 12 m long and 4 m high. A second, rear chamber, where Pilbara Leaf-nosed Bats roost, is approximately 16 m long, 6 m wide and 5 m high. No light penetrates the rear chamber and the walls were found to be visibly wet and seeping water (MWH, 2016b).

Cave CO-CA-03 has been identified as a non-permanent breeding roost for the Pilbara Leaf-nosed Bat. No evidence of Ghost Bats was recorded at this cave (Stantec, 2017; Bat Call, 2018).

This cave is located at the bottom of a major gorge in Rocky Ridge and Gorge habitat. There is a large pool (CO-WS-14, approximately 5 m x 5 m and 1.5 m deep) at the entrance to the cave. The cave entrance faces north-east and is approximately 6 m high and 15 m wide. It is characterised by two major chambers and numerous smaller sub-chambers that could not be defined. The chamber adjoining the entrance is triangular and extends 15 m to the rear where it constricts to 2 m wide and 3 m high. The constriction opens into a rear chamber approximately 4 m wide, 4 m high and 10 m long, with at least two smaller sub-chambers containing Pilbara Leaf-nosed Bats. Seepage of water was observed in the rear chamber on all occasions during survey. These seeps are likely to be a contributing factor to the Pilbara Leaf-nosed Bat using the cave for roosting given the species' preference for humid conditions (Armstrong, 2001 and Churchill, 1991; both cited in MWH, 2018). The cave entrance faces northeast with the rear of the cave in a south-west direction.

7.3.3.2 Pools

Pools are important habitat features in the Pilbara region, and perennial and ephemeral pools are significant due to their ability to provide resources for ecosystems for the most or all of the year (MWH, 2018). For many species, these areas are valuable as a source of drinking water, while some species are attracted to the relative abundance of invertebrate species as a food source (MWH, 2018). Habitat types with ephemeral and perennial pools are also strongly associated with conservation significant terrestrial fauna species.

A total of eleven perennial and/or ephemeral pools were recorded within the Study Area (see Figure 7.1):

- Ephemeral pools are those with large bodies of water large or permanent enough to contain water for the majority of the year, but are not groundwater dependent and do not contain associated groundwater dependent vegetation (MWH, 2018).
- Perennial pools differ from ephemeral pools as they are fed by groundwater and usually have flowing water. Perennial pools typically contain obligate phreatophytic vegetation and/or aquatic vegetation (MWH, 2018).

Pools are discussed further in Section 5.3.2.3.

7.3.4 Vertebrate Fauna Assemblages

The desktop study and field survey determined that the Study Area potentially contained up to 327 species of vertebrate fauna. Of these, 174 (53%) were recorded during the field survey including 28 native mammal, four introduced mammal, 72 bird, 66 reptile and four amphibian species. The fauna assemblage was considered representative of the region (MWH, 2018).

7.3.5 Introduced Fauna

European Cattle (*Bos taurus*), Camel (*Camelus dromedarius*), feral Cat (*Felis catus*) and House Mouse (*Mus musculus*), were recorded in the Study Area during the Survey (MWH, 2018). An additional five species have been recorded within the vicinity of the Study Area; Fox (*Vulpes vulpes*), Donkey (*Equus asinus*), Horse (*Equus caballus*), Rabbit (*Oryctolagus cuniculus*) and Pig (*Sus scrofa*) (MWH, 2018). Only three of these species, the feral Cat, House Mouse and domestic cattle are listed as 'Declared Pests' under the *Biosecurity and Agriculture Management Act 2007* (WA).

7.3.6 Conservation Significant Fauna

Conservation significant fauna includes species listed as:

- Threatened or Migratory under the EPBC Act.
- Threatened or Specially Protected (includes migratory species) under the *Biodiversity Conservation Act 2016* (BC Act).
- Priority species listed by DBCA.

Seven species recorded during the field survey are listed as conservation significant. Based on regional records and habitats identified within the Study Area, a further 23 conservation significant fauna species have the potential to occur in the Study Area. Of these, two were considered Likely to occur and 11 were considered Possible to occur. The remaining 10 potentially conservation significant species were considered Unlikely to occur.

Table 7.5 summarises the 20 conservation significant fauna species that MWH (2016b; 2018) confirmed present or considered likely or possible to occur in the Study Area. In addition, the Night Parrot, which is considered unlikely to occur, has also been included in Table 7.5 given recent records and interest in this species during the Proposal's EPBC Act assessment.

The following discussion provides a brief context to conservation significant species identified in Table 7.5 and is based on MWH (2016b, 2018). For further details on these species, refer to Appendix K.

Table 7.5 – Conservation Significant Fauna in the Study Area

Species	Conservation Status[1]		Likelihood Of Occurrence
	EPBC Act	WA	
Northern Quoll (*Dasyurus hallucatus*)	EN	EN	Confirmed
Ghost Bat (*Macroderma gigas*)	VU	VU	Confirmed
Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*)	VU	VU	Confirmed
Pilbara Olive Python (*Liasis olivaceus barroni*)	VU	VU	Confirmed
Peregrine Falcon (*Falco peregrinus*)	–	OS	Confirmed
Spectacled Hare-wallaby *(Lagorchestes conspicillatus leichardti)*	–	P3	Confirmed
Western Pebble-mound Mouse (*Pseudomys chapmani)*	–	P4	Confirmed
a blind snake (*Anilios ganei*)	–	P1	Likely
Long-tailed Dunnart *(Sminthopsis longicaudata)*	–	P4	Likely
Greater Bilby (*Macrotis lagotis*)	VU	VU	Possible
Grey Falcon (*Falco hypoleucos*)	–	VU	Possible
Pin-striped Finesnout Ctenotus (*Ctenotus nigrilineatus*)	–	P1	Possible
Spotted Ctenotus (*Ctenotus uber johnstonei*)	–	P2	Possible
Brush-tailed Mulgara (*Dasycercus blythi*)	–	P4	Possible
Fork-tailed Swift (*Apus pacificus*)	MI	MI	Possible
Sharp-tailed Sandpiper (*Calidris acuminata)*	MI	MI	Possible
Wood Sandpiper (*Tringa glareola*)	MI	MI	Possible
Common Sandpiper (*Actitis hypoleucos*)	MI	MI	Possible
Common Greenshank (*Tringa nebularia*)	MI	MI	Possible
Glossy Ibis (*Plegadis falcinellus*)	MI	MI	Possible
Night Parrot (*Pezoporus occidentalis*)	EN	CR	Unlikely[2]

Source: MWH (2016b).

Note: The Rainbow Bee-eater (*Merops ornatus*) and Great Egret (*Ardea modesta*) are no longer listed as conservation significant and so are not shown in this table or discussed further within this document.

(1) Conservation status definitions:
EPBC Act: EN – Endangered, VU – Vulnerable, MI – Migratory.
WA (BC Act): CR – Critically Endangered, EN – Endangered, VU – Vulnerable, MI – Migratory species not otherwise listed as threatened, OS – Other specially protected fauna.
WA (DBCA lists): P1 – Priority 1 (species that are known from one or a few locations (generally five or less) which are potentially at risk), P2 – Priority 2 (species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation), P3 – Priority 3 (species that are known from several locations, and the species does not appear to be under imminent threat, or from few or widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat), P4 – Priority 4 (rare, near threatened and other species in need of monitoring).

(2) The Night Parrot has been added to this table given recent records of this species and resulting increased interest in the species during the Proposal's assessment under the EPBC Act.

Northern Quoll

In the Pilbara, the Northern Quoll occurs in fragmented populations primarily associated with rocky ridgeline and outcrop type habitats (Woinarski, et al. 2014). It has been recorded in most surveys within the vicinity (approximately 75 km) of the Proposal.

There were 38 records of the Northern Quoll from the Study Area, nine of which were within the Development Envelope (Figure 7.2). Areas of high abundance were recorded outside the Development Envelope. The majority of records were within the Rocky Ridge and Gorge habitat, with a further eight records within the adjacent transitional Rocky Foothills habitat. Additional records were from Drainage Line, Spinifex Stony Plain and Riverine habitats. The Rocky Ridge and Gorge habitat provides foraging and denning habitat, while the other habitats provide foraging and dispersal habitat. The following four habitats are considered critical habitat for this species: Rocky Ridge and Gorge, Rocky Foothills, Drainage Line and Riverine habitats.

Ghost Bat

The Ghost Bat has a widespread but patchy distribution in the Pilbara (Armstrong and Anstee, 2000). The Klondyke Queen Mine and Comet Mine provide two regionally important maternity roosts (25 km northeast and 20 km north of the Proposal respectively). Individuals from these roosts are likely to forage within the Development Envelope (TSSC, 2016b).

There were 10 records of the Ghost Bat from six caves all within Rocky Ridge and Gorge habitat (refer also to Table 7.4) of the Study Area, four of which were within the Development Envelope (Figure 7.3). While there were no significant diurnal roosts or maternity caves identified in the Development Envelope; Cave CO-CA-01 is a temporary diurnal roost for this species. The remaining five caves were identified as nocturnal refuges for this species. While not a regular visitor in the Study Area, Rocky Ridge and Gorge habitat is generally recognised as critical habitat for this species, which may also utilise all habitats within the Study Area for foraging (MWH, 2016b). Notably, habitats important to the species within the Development Envelope are connected to similar habitat outside the Development Envelope and Study Area. The extent of the regional population is likely to be limited by the extent and condition of diurnal roost sites rather than foraging habitat.

Pilbara Leaf-nosed Bat

The Pilbara Leaf-nosed Bat's distribution is limited by the scarcity of caves with appropriate microclimates for roosting (Armstong, 2001; Churchill, 1991). There are 30 known roosts within the Pilbara, many of which are in unstable disused mine shafts. Six permanent diurnal roosts are known to occur within 60 km of Marble Bar, as well as several non-permanent breeding roosts and transitory diurnal roosts (TSSC, 2016a). Atlas Iron has also identified two additional permanent diurnal roosts near the Mount Webber DSO Project (MW-AN-27 and MW-CA-02), approximately 45 km west of the Proposal.

This species was recorded on 41 occasions within the Study Area, including 21 records from within the Development Envelope (Figure 7.4). This species was recorded from 16 caves within the Study Area (refer to Table 7.4). Both Cave CO-CA-01, a permanent diurnal roost, and Cave CO-CA-03, a non-permanent breeding roost, for the Pilbara Leaf-nosed Bat are considered critical habitat for the species. The remaining 14 caves provide nocturnal refuge for the species (refer to Table 7.4).

Pools are also important for the persistence of local populations due to the species' dependence on humid microclimates (Baudinette et al., 2000). There are a number of important perennial pools located within the Development Envelope as discussed in Sections 7.3.3.2 and **5.3.2.3**. However, both cave CO-CA-01 and cave CO-CA-03 are known to contain seeps, which are more likely to control the humidity of these caves and thus the caves' suitability for this species.

Rocky Ridge and Gorge habitat is recognised as critical habitat for this species. All other habitats within the Development Envelope are considered suitable foraging habitat, given the approximately 10 km nightly foraging range of this species (Armstrong, 2007 and Cramer et al., 2016a) and the locations of both CO-CA-01 and cave CO-CA-03.

Pilbara Olive Python

The Pilbara Olive Python has a widespread but patchy distribution in the Pilbara (DPaW, 2016). Although it has been recorded from eight of eleven surveys conducted in the vicinity of the Study Area (MWH, 2018), the limited occurrence of Rocky Ridge and Gorge habitat in the surrounding area (10 km) likely limits the Pilbara Olive Python's ability to move to similar habitat in nearby areas (MWH, 2016b).

Rocky Ridge and Gorge habitat provides sheltering and hunting microhabitats for the Pilbara Olive Python, and represents habitat critical to the survival of the species (MWH, 2016b). It also contains pools, which attract prey. Drainage Line and Riverine habitats provide foraging and dispersal habitat for the species and are also considered to be critical habitat for the species (MWH, 2016b). The Pilbara Olive Python was recorded within the Study Area on four occasions in Rocky Ridge and Gorge, Drainage Line and Ironstone Ridgetop habitats. Three of these records were within the Development Envelope (Figure 7.5).

Spectacled Hare-wallaby

The Spectacled Hare-wallaby is considered relatively rare within the Pilbara (Woinarski et al. 2014), with very few recent records of the species (DPaW**,** 2016).

The Spectacled Hare-wallaby was recorded on one occasion from the Stony Rises habitat, outside the Development Envelope (MWH, 2016b) (Figure 7.6). The Spinifex Stony Plain, Spinifex Sandplain and Stony Rises habitats are all likely to provide suitable habitat for this species in areas where the spinifex is long unburned (MWH, 2018).

Western Pebble-mound Mouse

The Western Pebble-mound Mouse is endemic to the Pilbara region (Ford and Johnson, 2007, Start et al., 2000) and has been recorded in 10 of the 11 surveys conducted in the vicinity of the Study Area (MWH, 2018).

This species was recorded 13 times within the Study Area, including one record of an active mound and two direct captures (MWH, 2016b) (Figure 7.6), The remaining records were of inactive mounds. Spinifex Stony Plain and Stony Rises habitats are the most suitable habitat for the species within the Study Area, although Ironstone Ridgetop habitat may also provide suitable habitat. The Study Area is unlikely to be of particular conservation significance to the species due to the number of previous records and widespread availability of suitable habitats outside the Study Area (MWH, 2016b, 2018).

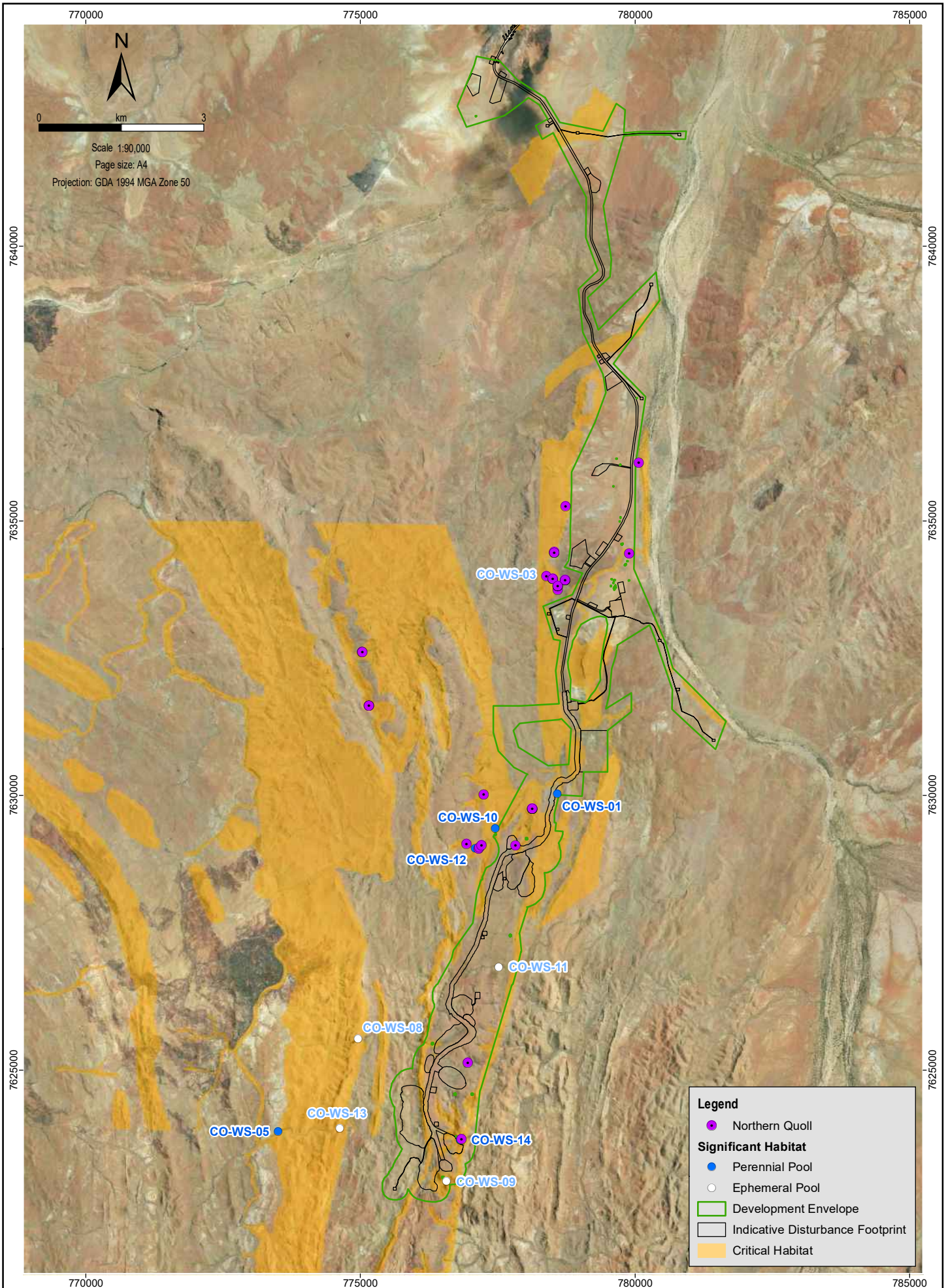
Night Parrot

There is limited information about the habitat preferences of the Night Parrot in the Pilbara bioregion. Consultation with DBCA has suggested that any area containing long unburnt (i.e., has not been burnt in the last 15 years) spinifex (Triodia sp.) is likely to be classified as potential habitat. The nearest known record of the Night Parrot is about 135 km southwest (DPaW, 2016) from near the Fortescue Marsh (Davis and Metcalf 2008). Atlas Iron understands the record is located in habitat consistent with that generally defined for the species within Western Australia: treeless or sparsely wooded long unburnt spinifex hummock plains and/or chenopod shrublands (TSSC, 2016c).

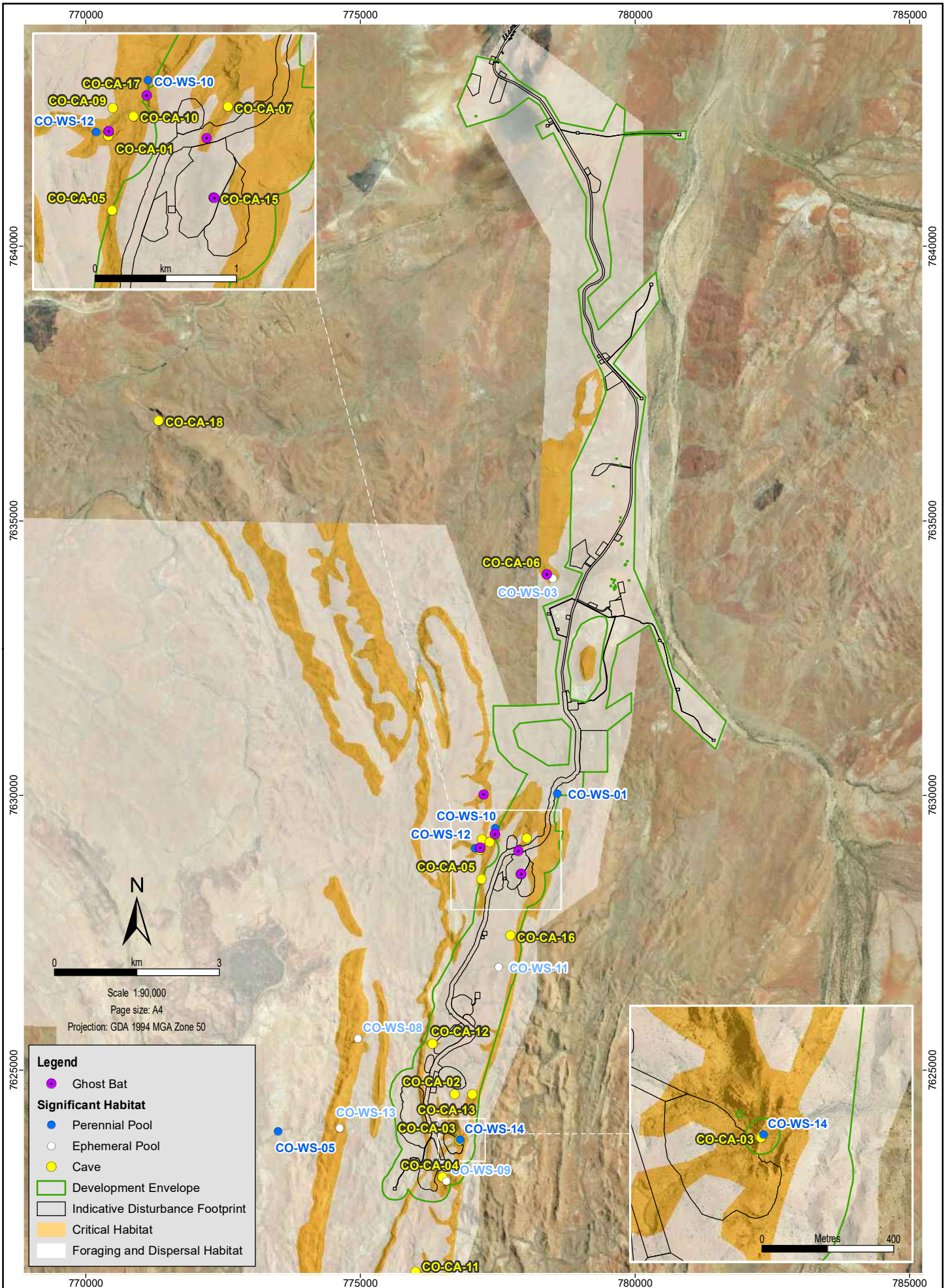
All habitat types described and mapped within the Study Area contain Triodia species, as does most of arid Australia (MWH, 2018). However, large mature spinifex is largely absent from the Study Area as a result of a fire in October 2013 (Figure 7.7).

Given that the presence of Triodia grasslands and or chenopod shrublands are very broad habitat description, Figure 7.7 shows vegetation units (Woodman, 2016) whose descriptions correspond to potential Night Parrot habitat, based on ecological descriptions of the species (TSSC, 2016c). The ‘low’ and ‘moderate’ value potential habitat identified through this desktop exercise is shown on Figure 7.7.

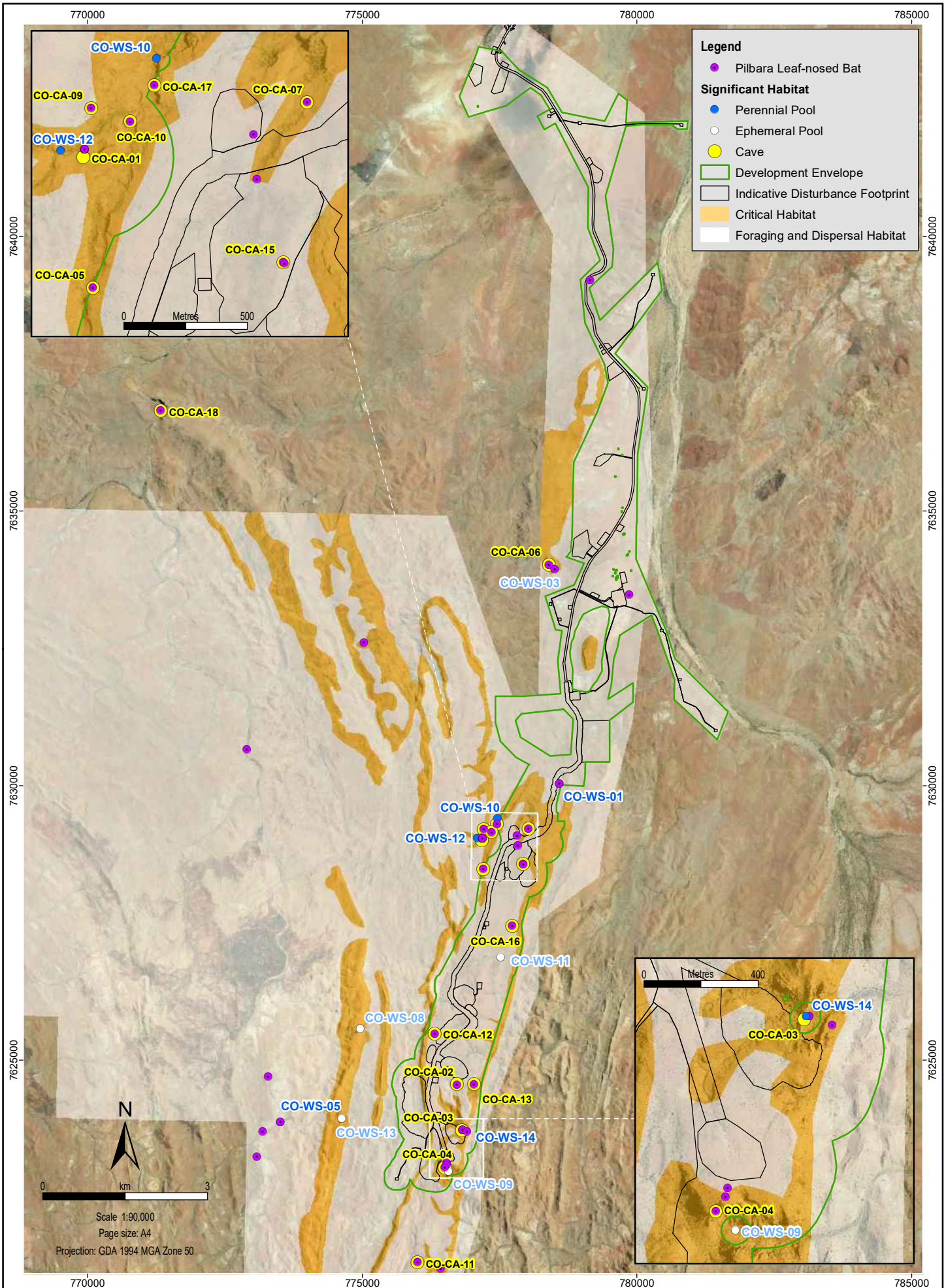
Given that the species is considered unlikely to occur, primarily due to the lack of high potential habitat and the availability of habitats elsewhere in the region, the Night Parrot is not discussed further in this assessment.



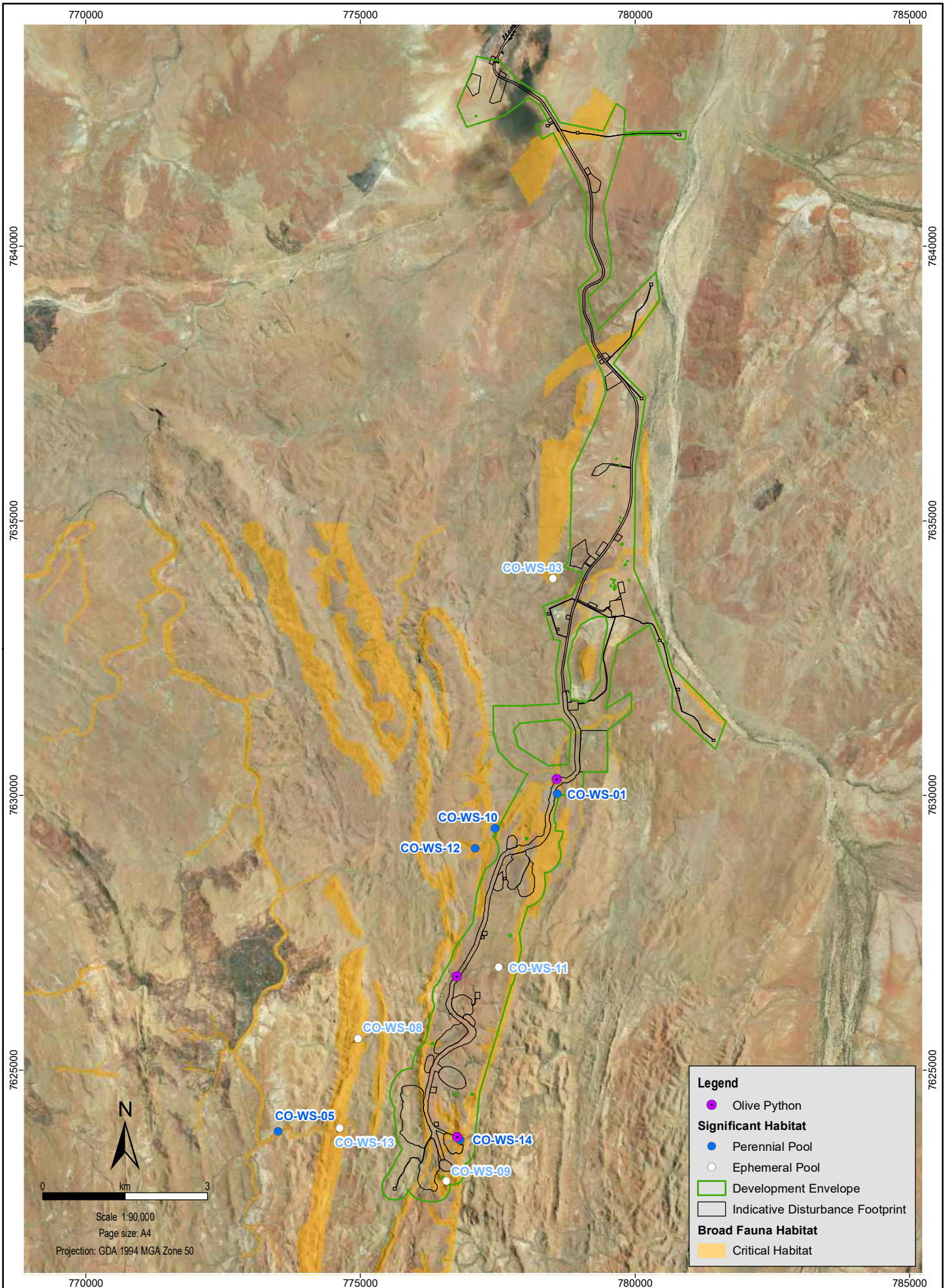
ATLAS	File Name: GIS_2492.mxd Date: 11/09/2019 Author: Drew.Smith	Source & Notes: ' MWH (2018)' for fauna records, fauna habitats and water sources Pool permanency (perennial vs emphemeral) revised (Stantect, 2018b) Critical Habitat includes - Rocky Ridge and Gorge, Rocky Foothills, Riverine & Drainage Lines. *Disclaimer: This figure has been produced for internal review only and may contain inconsistencies or omissions. It is not intended for publication.*	**Northern Quoll Habitat and Records**	Figure No: **7-2**



ATLAS	File Name: GIS_2493.mxd Date: 11/09/2019 Author: Drew.Smith	Source & Notes: ' MWH (2018)' for fauna records, fauna habitats and water sources Pool permanency (perennial vs emphemeral) revised (Stantect, 2018b) Critical Habitat includes - Rocky Ridge and Gorge Foraging and Dispersal Habitat - All other habitats *Disclaimer: This figure has been produced for internal review only and may contain inconsistencies or omissions. It is not intended for publication.*	**Ghost Bat Habitat and Records**	Figure No: **7-3**



ATLAS	File Name: GIS_2497.mxd Date: 11/09/2019 Author: Drew.Smith	Source & Notes: ' MWH (2018)' for fauna records, fauna habitats and water sources Pool permanency (perennial vs emphemeral) revised (Stantect, 2018b) Critical Habitat includes - Rocky Ridge and Gorge Foragin and Disperal Habitat - All other habitats *Disclaimer: This figure has been produced for internal review only and may contain inconsistencies or omissions. It is not intended for publication.*	**Pilbara Leaf-nosed Bat Habitat and Records**	Figure No: **7-4**



File Name: GIS_2495.mxd
Date: 11/09/2019
Author: Drew.Smith

Source & Notes: ' MWH (2018)' for fauna records, fauna habitats and water sources
Pool permanency (perennial vs emphemeral) revised (Stantect, 2018b)
Critical Habitat includes - Rocky Ridge and Gorge, Riverine & Drainage Lines.

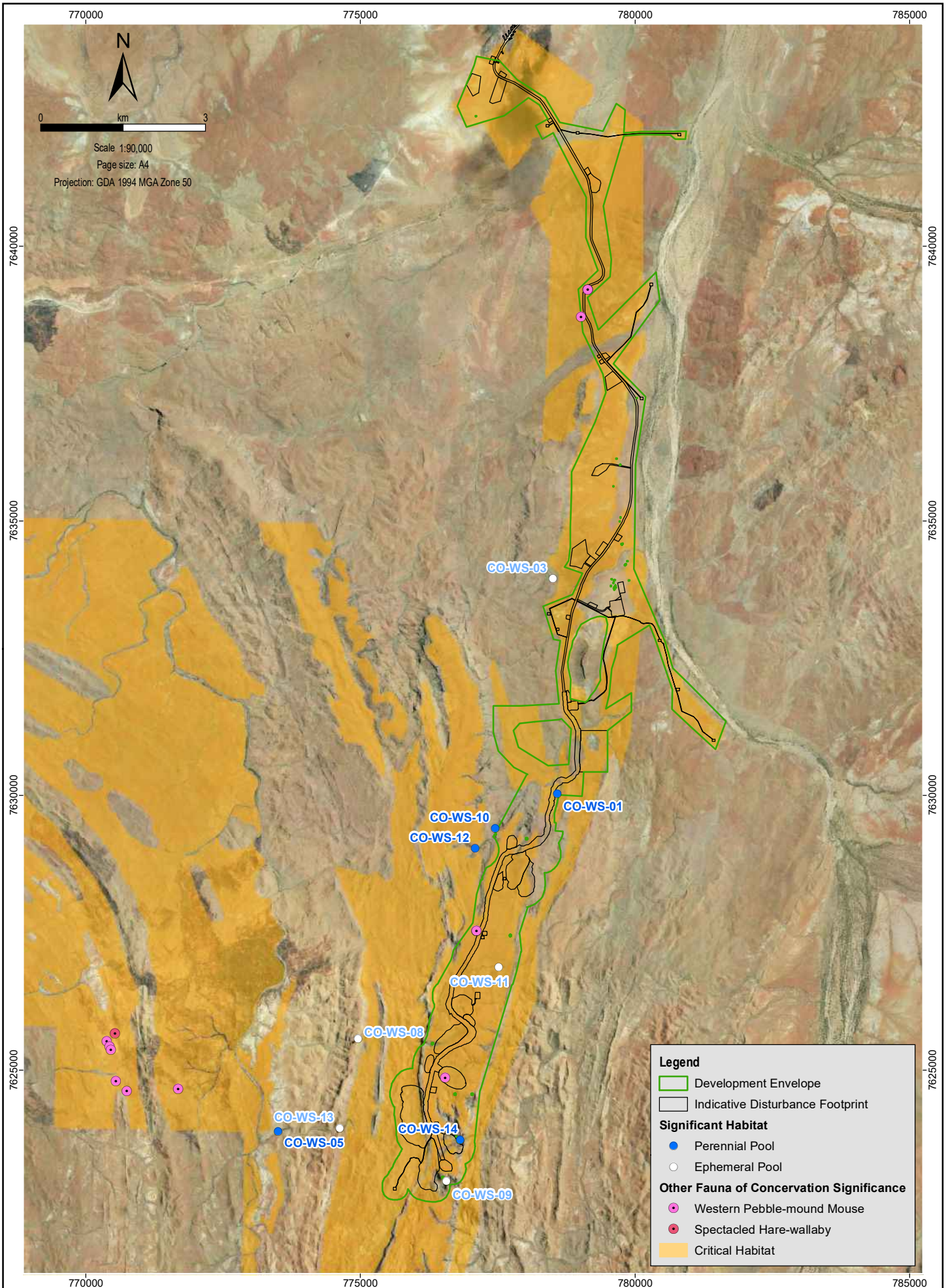
Disclaimer: This figure has been produced for internal review only and may contain inconsistencies or omissions. It is not intended for publication.

Pilbara Olive Python Habitat and Records

Figure No: 7-5

CORUNNA DOWNS

Atlas



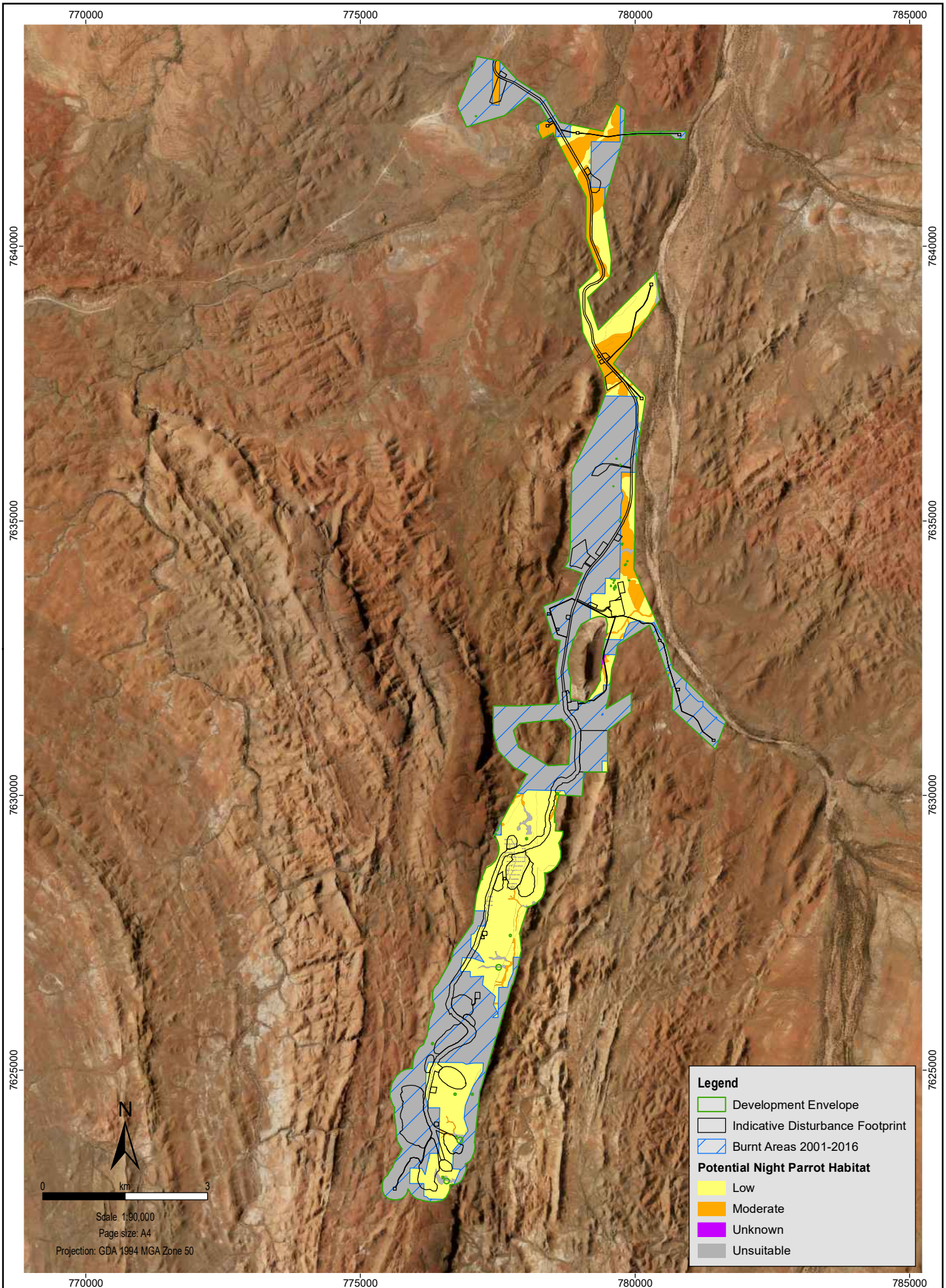
File Name: GIS_2496.mxd
Date: 11/09/2019
Author: Drew.Smith

Source & Notes: ' MWH (2018)' for fauna records, fauna habitats and water sources
Pool permanency (perennial vs emphemeral) revised (Stantect, 2018b)
Critical Habitat includes - Spinifex Stony Plain, Stony Rise, Ironstone Ridgetop & Spinifex Sandplain

Disclaimer: This figure has been produced for internal review only and may contain inconsistencies or omissions. It is not intended for publication.

Other Conservation Significant Fauna Records

Figure No: 7.6



File Name: GIS_2500.mxd Date: 29/05/2019 Author: Drew.Smith	*Disclaimer: This figure has been produced for internal review only and may contain inconsistencies or omissions. It is not intended for publication.*	**Potential Night Parrot Habitat**	Figure No: **7-7**

CORUNNA DOWNS *Atlas*

7.3.7 Short Range Endemic Fauna

The mapped terrestrial fauna habitats (see Section 7.3.2) were categorised as having a high, medium or low potential to support terrestrial short range endemic (SRE) fauna taxa based on the presence of microhabitats and whether the habitat was restricted, isolated, widespread and/or connected in the landscape (MWH, 2016b).

The majority of the Development Envelope is comprised of habitats with a low potential to support SRE fauna species. However, two habitats found within the Development Envelope have a medium or high potential to support SRE fauna:

- Rocky Ridge and Gorge – high potential.
- Drainage Lines – medium potential.

Both of these habitats were found within the wider Study Area and neither is restricted to the Development Envelope.

A total of 761 invertebrate specimens (from targeted groups) from 31 species were collected form the Study Area. Slaters were the most diverse group to be collected (514 specimens from 9 species), followed by scorpions (147 specimens from 6 species), pseudoscorpions (80 specimens from 8 species), snails (8 specimens from 2 species), selenopid spiders (8 specimens from 3 species), mygalomorph spiders (3 specimens from 2 species) and millipedes (1 specimen). The desktop study identified a further three species with potential to occur comprising of two millipede species and one snail species (MWH, 2016b).

Within the Study Area, two species were considered to be Confirmed SRE species, three as Likely SRE species and 13 as Potential SRE species. Of these, two taxa considered Likely SRE species and six taxa considered Potential SRE species were recorded within the Development Envelope (Table 7.6).

Table 7.6 – SRE Fauna Species Recorded Within the Development Envelope

SRE Status	Group	Taxa
Likely	Slater	*Buddelundiinae* ‘mw’
		Philosciidae ‘corunna’
Potential	Selenopid spider	*Karaops* sp. ‘indet. 2’
	Snail	*Rhagada* sp. ‘nov’
	Scorpion	*Lychas* ‘bituberculatus complex’
		Lychas ‘hairy tail complex’
	Slater	*Buddelundia* ‘11’
		Buddelundia ‘86’

Source: MWH (2016b)

All species collected within the Development Envelope for the Proposal have also been collected outside the Development Envelope, either locally or regionally.

7.4 Potential Impacts

Potential impacts to terrestrial fauna from the Proposal include:

- Loss and/or degradation of fauna habitat, resulting in a direct loss of species, habitat fragmentation and a reduction in the extent of breeding and/or foraging habitat.
- Loss and/or degradation of terrestrial fauna habitat due to increased presence of weed species.
- Injuries to and mortalities of fauna caused by interactions with vehicles, infrastructure, machinery and the workforce.
- Reduced diversity or abundance of foraging resources due to altered hydrological regimes.
- Alteration in behaviour of fauna due to noise, vibration, artificial light emissions and dust.
- Increased presence of non-indigenous fauna species due to introduction of workforce and vehicles, inappropriate waste collection and storage practices, and inadequate rehabilitation of disturbed land, resulting in native terrestrial fauna mortality and/or competition for resources.
- Alteration to fire regimes (e.g. increased frequency, intensity, extent) from the presence of human activity in the area, resulting in the modification or loss of fauna habitat and conservation significant terrestrial fauna.

7.5 Assessment of Impacts

The following sections discuss the potential impacts to terrestrial fauna identified in Section 7.4 generally prior to applying mitigations (avoidance, minimisation and rehabilitation – discussed in Section 7.6).

Sections 7.5.1 to 7.5.8 discuss impacts arising from threatened processes and key impact pathways, while Section 7.5.9 provides a summary of these impacts to key species of conservation significance.

7.5.1 Clearing of Fauna Habitat

Clearing would reduce the size and quality of habitats, through edge effects and habitat fragmentation, and is likely to heighten the effects of other threatening processes such as introduced flora (Keighery, 2010), introduced fauna (Doherty, et al., 2015) and altered fire regimes (Knorr, et al., 2014). The impact of clearing is particularly high when landforms, such as caves, cliff lines and overhangs are removed, as there is limited opportunity and ability to recreate and rehabilitate such habitat features post mine closure.

7.5.1.1 Fauna Habitats

MWH assessed the impact to fauna habitats of clearing a 423.11 ha Indicative Disturbance Footprint (MWH, 2016b) within a 2,263.19 ha Development Envelope. After this impact assessment was conducted and in an attempt to mitigate impacts to significant environmental values, Atlas Iron adjusted both the Indicative Disturbance Footprint and the Development Envelope. As a result, the Development Envelope was reduced to 2,257.6 ha and while the total area of the Indicative Disturbance Footprint remains unchanged at 423.11 ha, the area of each individual habitat impacted has changed slightly.

Table 7.7 presents the impact to each fauna habitat based on MWH (2016b) but updated to reflect the current 423.11 ha Indicative Disturbance Footprint.

Table 7.7 – Impacts to Fauna Habitats

Fauna Habitat	Development Envelope[1]		Indicative Disturbance Footprint[2]	
	Extent (ha)	Proportion of total in Study Area	Extent (ha)	Proportion of total in Study Area
Stony Rises	532.74	6.9%	75.27	1.0%
Rocky Foothills	76.27	1.7%	11.43	0.3%
Spinifex Stony Plain	607.97	32.4%	100.45	5.4%
Rocky Ridge and Gorge	249.26	14.1%	39.82	2.3%
Ironstone Ridgetop	537.93	34.9%	163.95	10.6%
Drainage Line	55.72	11.1%	3.40	0.7%
Granitic Uplands	0.17	0.1%	–	–
Calcrete	7.79	3.3%	6.71	2.9%
Spinifex Sandplain	157.60	80.8%	20.35	10.4%
Riverine	37.72	22.6%	1.73	1.0%
Granite Outcrop	–	–	–	–
Total[3]	**2,263.19**	**–**	**423.11**	**–**

Note: Fauna habitats listed in Table 7.3 as significant fauna habitats are shaded.

(1) These values are calculated from an earlier 2,263.19 ha version of the Development Envelope (MWH, 2016b), which has since been reduced to 2,257.6 ha to avoid several significant environmental values, a reduction of approximately 5.59 ha. As these impacts are overstated and thus conservative they have not been revised to reflect the current Development Envelope.

(2) Atlas Iron has recalculated impacts to fauna habitats based on the current 423.11 ha Indicative Disturbance Footprint, which was adjusted following the MWH (2016b) assessment in an attempt to mitigate impacts to a number of significant environmental values. While the total area of the Indicative Disturbance Footprint remains unchanged at 423.11 ha, the area of each individual habitat impacted has changed slightly. Impacts to significant fauna habitats have reduced by 1.37 ha as a result.

(3) Totals may include rounding errors.

The habitats with the largest extents of clearing are those associated with the location of the ore deposits along the ridgeline, including Ironstone Ridgetop (38.7% of the Indicative Disturbance Footprint), Spinifex Stony Plain (23.7%), Stony Rises (17.8%) and Rocky Ridge and Gorge (9.4%). These habitats account for approximately 90% of the Indicative Disturbance Footprint.

Compared to the known extent of each habitat within the Study Area, the impact to each fauna habitat is relatively small, with the largest impacts to Ironstone Ridgetop and Spinifex Sandplain habitats, both of which will have approximately 10 to 11% of mapped extent removed. Impacts to all other habitat types is less than 6% of their mapped extent.

Impacts to significant fauna habitats, i.e. those providing critical habitat for conservation significant fauna species, are very small when compared to the availability of these habitats within the Study Area (i.e., less than 3%). All habitats (including significant fauna habitats) are well connected to areas outside the Development Envelope.

7.5.1.2 Significant Microhabitat Features

Significant microhabitat features, as identified in Section 7.3.3, provide important habitat for conservation significant fauna species. The Proposal has the potential to directly impact significant microhabitat features, primarily through clearing.

At the time of MWH's impact assessment, the following caves and pools were within the Development Envelope and so were considered most likely to be at risk of direct impact (MWH, 2016b):

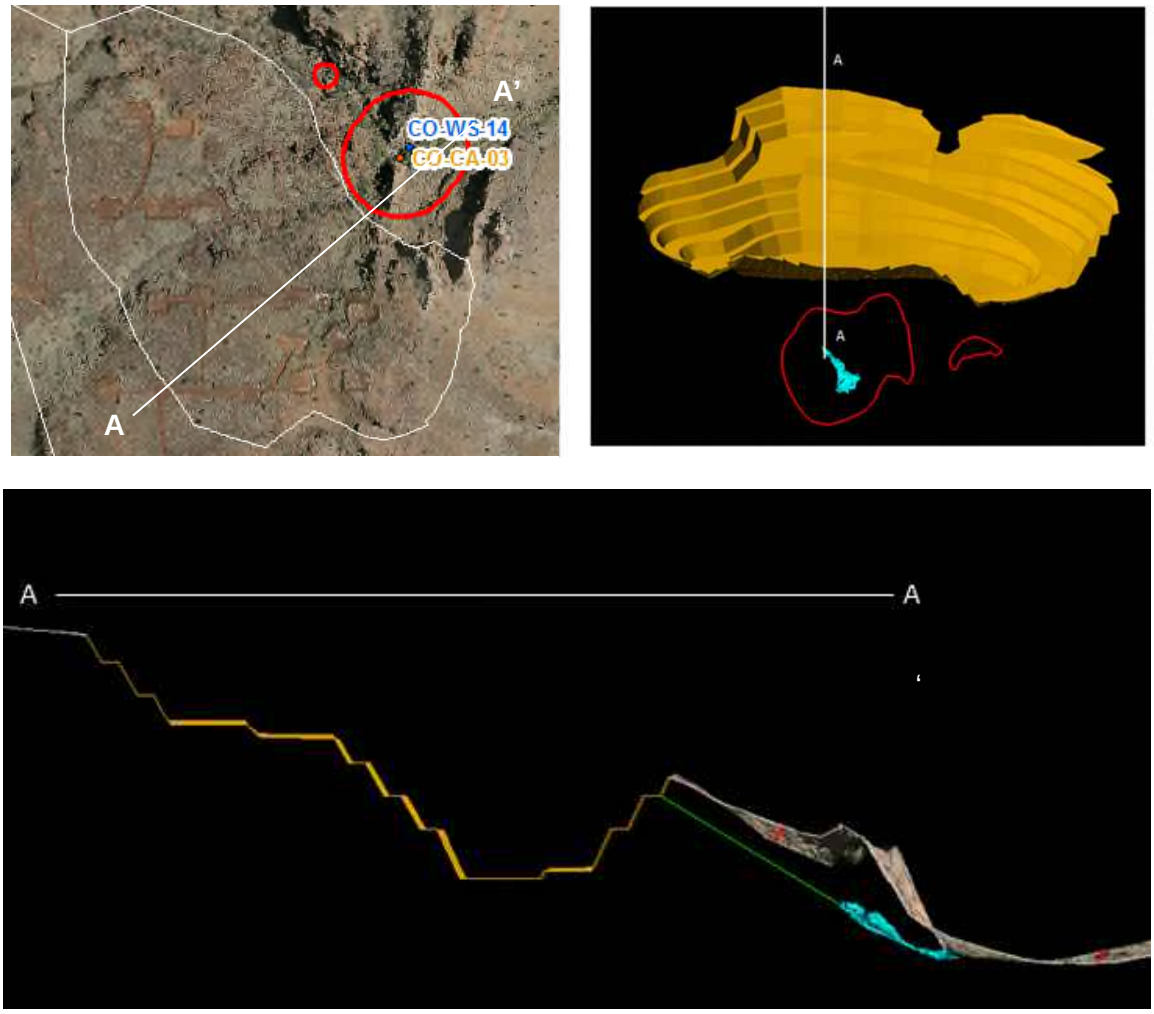
- One permanent diurnal roost for the Pilbara Leaf-nosed Bat (cave CO-CA-01).
- One non-permanent breeding roost for the Pilbara Leaf-nosed Bat (cave CO-CA-03).
- Ten nocturnal refuges for the Pilbara Leaf-nosed Bat and/or Ghost Bat (caves CO-CA-02, CO-CA-04, CO-CA-05, CO-CA-07, CO-CA-08, CO-CA-12, CO-CA-13, CO-CA-15, CO-CA-16 and CO-CA-17).
- Two ephemeral pools (CO-WS-09 and CO-WS-11).
- Two perennial pools (CO-WS-01 and CO-WS-14).

However, Atlas Iron has since revised the Development Envelope to mitigate impacts to the majority of these values. This included reducing the size of the Development Envelope to:

- Maintain a 340 m buffer from the permanent diurnal roost for the Pilbara Leaf-nosed Bat (cave CO-CA-01).
- Avoid the non-permanent breeding roost for the Pilbara Leaf-nosed Bat (cave CO-CA-03) inclusive of a 50 m buffer (lateral distance). This translates to a 68 m buffer between the back of the cave and the Razorback pit (Figure 7.8).
- Avoid all nocturnal refuges inclusive of a 20 m buffer, with the exception of caves CO-CA-08 and CO-CA-15, which could not be avoided.
- Avoid all pools inclusive of a 50 m buffer, with the exception of pool CO-WS-01, which was limited to a 20 m buffer.

Given the above changes to the Development Envelope, the Proposal is not expected to directly impact any of the above values with the exception of the two nocturnal refuges, caves CO-CA-08 and CO-CA-15.

Potential indirect impacts to significant microhabitat features are discussed separately in Section 5.5 (changes to hydrology) and Disturbance from Noise and Vibration (Section 7.5.4).



Note: The green line denotes a distance of 68 m between the Razorback pit (in orange) and the rear of cave CO-CA-03 (in light blue).

Figure 7.8 – Plan and Cross-section Illustrating the 2D Buffer and 3D Distance Between Non-Permanent Breeding Roost CO-CA-03 and Razorback Pit

7.5.1.3 Short Range Endemic Fauna Habitat

As none of the SRE species recorded are restricted to the Development Envelope and as the Proposal is impacting less than 2% of potential SRE habitat within the Study Area, the Proposal is unlikely to have a significant impact on SRE species (MWH, 2016b).

7.5.2 Fauna Mortalities from Collisions with Vehicles

The construction and operation of roads within the Development Envelope poses a risk to fauna through mortalities arising from collisions with vehicles. Mortalities may occur during initial clearing works, particularly for smaller and/or less mobile species that are unable to disperse from the Indicative Disturbance Footprint once construction works have commenced. During operations, collisions with animals along roads are more likely to occur at night (Rowden et al., 2008). The presence of roadkill may attract species that feed on roadkill, potentially driving other species away from the area and altering the species assemblage at a localised scale (Dickman, 1996).

Ground-dwelling species that forage within intersecting habitat are most likely to be at risk, including species of conservation significance such as the Northern Quoll (Cramer et al., 2016b), Pilbara Olive Python (Burbidge, 2004; Pearson, 2003), macropods such as the Spectacled Hare-wallaby (Rowden et al., 2008) and larger reptiles. Aerial species, such as the Pilbara Leaf-nosed Bat and the Ghost Bat, may also be at risk when foraging at low altitudes. The Pilbara Leaf-nosed Bat, in particular, has a curiosity for light sources, which has on occasion resulted in an extensive number of vehicle collisions (Cramer et al., 2016a; van Dyck and Strahan, 2008).

7.5.3 Introduced Fauna

Introduced fauna, both herbivorous and predatory, can cause fundamental changes to ecosystems and are thought to have contributed to the decline and extinction of many species in Australia (Abbott, 2002; Burbidge & McKenzie, 1989; Ford et al., 2001). Of the 20 key threatening processes listed under the EPBC Act, 12 are concerned with introduced flora and fauna, including predation by the Red Fox (*Vulpes vulpes*) and the feral Cat (*Felis catus*), which are known to have major negative impacts on small and medium-sized native vertebrates in Australia (Dickman, 1996).

The Proposal may provide additional resources or habitat that may attract and support a greater abundance of feral animals in the area. Introduced predators may also be attracted into the Development Envelope as a result of the scavenging opportunities generated by the presence of road kill along roads (Dickman, 1996), which may in turn adversely affect populations of native fauna. Of particular concern would be an increase in the size or density of the local population of feral Cats, which are not only a direct predator of the Northern Quoll, Pilbara Olive Python and other ground-dwelling fauna, but also compete for food resources and habitat requirements with these and others.

7.5.4 Disturbance from Noise and Vibration

The development and ongoing operation of the Proposal is likely to generate noise and vibration due to blasting, general operation of heavy machinery and vehicles, diesel generators and the presence of personnel. The effects of noise on wildlife have been well studied, although responses vary depending on age and sex (for a comprehensive summary see Newport, et al., 2014). Impacts caused by noise range from interruptions in feeding and resting behaviour, to complete abandonment of an area (Newport, et al., 2014). Noise may lead to reduced population densities in small mammals, nest failure and decreased population densities in birds (Slabbekoorn & Ripmeester, 2008), abandonment of roost sites for bats (K. Armstrong pers. comm. in Woinarski et al. 2014), and reduced hunting efficiency in bats due to disturbance of their echolocation system (Siemers & Schaun, 2010). Constant levels of noise may also interfere with species communication, via acoustic interference (Parris & Scheider, 2009). Species that may be especially at risk of disturbed communication are those that use calls to communicate or navigate.

The Pilbara leaf-nosed Bat is known to be susceptible to noise, vibration and dust impacts. As these impacts are largely associated with blasting activities, which will be restricted to daytime operations, habitat most likely to be at risk are those caves that support diurnal roosting, including the permanent diurnal roost (CO-CA-01) and the non-permanent breeding roost (CO-CA-03):

- The 340 m buffer around the permanent diurnal roost (CO-CA-01) is considered to be adequate, primarily because of the topography between the cave and the Proposal. Specifically, the Proposal is located on a separate ridge on the opposite side of a deep gully, which acts as a natural shield and prevents noise and vibration impacts (from haulage, drilling and blasting activities) from reaching the cave (Bullen, pers. comm. 2017a).
- A 50 m buffer (lateral distance), which translates to a 68 m buffer between the back of the cave and the Razorback pit, has been applied. It is anticipated that given the proximity of this cave to the pit and the Pilbara Leaf-nosed Bat's sensitivity to blasting noise, vibration and dust impacts, that it is possible that this species may temporarily abandon this roost during the period over which this pit is mined. However, it is probable that this species will continue to use this cave as a nocturnal refuge during this time. The temporary disuse of this cave as a diurnal roost during operation is not anticipated to have a significant impact on the population given the likely relocation of individuals to the permanent diurnal roost CO-CA-01 and the proximity of other permanent diurnal roosts in the region (Bullen, pers. comm. 2017b).

The Proposal is not anticipated to have a significant indirect impact from noise and vibration on the remaining nocturnal refuges for Pilbara Leaf-nosed Bat and/or Ghost Bat due to the caves' distance from the Proposal (particularly the distance from open pits). Indirect impacts from blasting operations will be further limited to daytime operations. This prediction is based on long term monitoring of a nocturnal roost at Atlas Iron's Mount Dove operation, which was approved to operate within 20 m of a nocturnal refuge for Pilbara Leaf-nosed Bat. Long-term monitoring of the nocturnal refuge at Mount Dove showed that while there was some minor physical damage to the entrance of the cave, mining had little to no negative effect on Pilbara Leaf-nosed Bat visitation (MWH, 2016b and MWH, 2015). This long-term Mount Dove data suggests that secondary impacts to nocturnal roosts within the Development Envelope are expected to be low and are unlikely to negatively affect the population.

7.5.5 Disturbance from Artificial Light

Exposure of fauna to artificial light may interfere with biological and behavioral activities that are governed by the length of day (photoperiod), including reproduction, dormancy, foraging and migration (Bradshaw and Holzapfel, 2007; Le Corre et al., 2002; Stone et al., 2015).

As aspects of the Proposal will be in operation on a 24-hour basis, the presence of artificial lighting for night operations may have an impact on mammal, bird, reptile and amphibian species occurring within the vicinity of the light sources. Excessive light is likely to have an effect on the natural foraging behaviour of bats, in particular the Pilbara Leaf-nosed Bat, which is thought to be attracted to light sources (Cramer et al., 2016a). Long-term studies at Mt Dove have however shown that Pilbara Leaf-nosed Bat activity is not impacted by artificial illumination, and perhaps increase species activity presumably due to increased foraging resources (C. Knuckey, unpub. data).

7.5.6 Dust

The development and operation of the Proposal will create dust emissions due to construction, blasting, haulage and general traffic activities, the impacts of which may not be confined to the Development Envelope. Dust emissions have the potential to affect surrounding vegetation and pools that fauna rely on, as well as impacting individuals directly. High levels of dust have been associated with a reduction in plant growth and productivity and, alteration of soil chemistry leading to changes in vegetation community structure (Farmer, 1993). Such effects are likely to impact on faunal assemblages via a reduction in food resource availability and shelter.

Studies in semi-arid regions of Western Australia have however failed to prove negative effects of dust on arid-zone flora, suggesting that the impact of dust emissions within such ecosystems is not as prominent as witnessed in other systems (Matsuki, et al., 2016).

Dust may directly pollute water bodies by increasing turbidity or potentially altering water chemistry. Pools most at risk include pools CO-WS-01, CO-WS-09 and CO-WS-14 given their proximity to the Indicative Disturbance Footprint. This may in turn affect fauna and flora dependent on these pools including but not limited to the Pilbara Olive Python, Northern Quoll and Pilbara Leaf-nosed Bat.

Atlas Iron commissioned Pacific Environment Limited to undertake an Air Quality Assessment for the Proposal (Pacific Environment, 2017), which found the Proposal would not have a significant impact on the region's air quality. (Air quality is discussed in Chapter 8).

7.5.7 Altered Fire Regimes

The development and ongoing operation of the Proposal may alter the fire regime of the Development Envelope through the introduction of unplanned fire caused by vehicle movements and/or other Proposal activities such as hot work. Fire may impact fauna via direct contact, or indirectly by long-term habitat modification brought about by inappropriate fire frequency and intensity (Woinarski, et al., 2001). The value of many habitats to fauna lies in the mosaic of ages (Parr & Andersen, 2006; Southgate, et al., 2007; Woinarski, 1999). Introduction of too frequent, hot or extensive fires during hot, dry times of the year can eliminate this mosaic, and reduce the capacity of these habitats to support diverse assemblages of terrestrial vertebrate fauna (Law & Dickman, 1998).

Inappropriate fire regimes, such as large, hot fires late in the dry season, are likely to have adverse effects on fauna habitat and could alter fauna assemblages present in the Development Envelope. For example, fire is known to be of fundamental importance to habitat suitability for the Spectacled Hare-wallaby (van Dyck & Strahan, 2008). Species most at risk of direct impact include small, sedentary species which occur in homogenous, fire-prone habitats, such as the Western Pebble-mound Mouse, *Ctenotus nigrilineatus*, and species which occur primarily in fire refuge habitats, such as the Rocky Ridge and Gorge, like the Northern Quoll (Woinarski, et al., 2001) and Pilbara Olive Python (Pearson, 2003). Additionally, due to their life histories, some species are susceptible to fire, such as the Ghost Bat (Bullen & McKenzie, 2011) and Spectacled Hare-wallaby (Ingleby & Westoby, 1992).

7.5.8 Degradation of Fauna Habitat from Groundwater Drawdown

The abstraction of groundwater for the construction and operation of the Proposal is predicted to result in groundwater drawdown (refer to Section 5.5.6). Depending on the extent of drawdown, fauna habitats containing GDV may be indirectly impacted.

An analysis of groundwater dependent flora species potentially impacted by drawdown is presented in Section 6.5.5. This analysis concluded that only a single species, *Melaleuca argentea*, within areas of GDV was at risk of being impacted by proposed drawdown. The risk to *M. argentea* was categorised as moderate where a loss in vigour was possible, and high where a loss of vigour and tree death was possible.

To approximate the area of fauna habitat that may be degraded due to indirect impacts to *M. argentea*, areas of moderate and high risk were overlaid with fauna habitats. Table 7.8 presents the fauna habitats at risk of degradation from groundwater drawdown under the maximum pumping case. Note that the risk areas identified in Table 7.8 are in addition to direct impacts to fauna habitats identified in Section 7.5.1.1.

Table 7.8 – Fauna Habitat at Risk of Degradation from Groundwater Drawdown under the Maximum Pumping Case

Fauna Habitat	Moderate Risk (ha)	High Risk (ha)	Total at Risk (ha)
Stony Rises	0.97	–	0.97
Rocky Foothills	0.02	–	0.02
Spinifex Stony Plain	>0.005	–	>0.005
Rocky Ridge and Gorge	0.63	0.15	0.78
Drainage Line	0.62	–	0.62
Spinifex Sandplain	0.14	–	0.14
Riverine	53.56	56.72	110.28
Total	**55.94**	**56.86**	**112.80**

Note: GDV risk areas extend beyond the extent of the fauna habitat mapping provided in MWH (2018) and presented in Table 7.2 and Figure 7.1. Areas for which no fauna habitat mapping is available have been included in the table above as Riverine habitat based on their floristic characteristics, examination of aerial imagery and further specialist advice (Bolton, pers. comm., 2019).

It is important to note that while fauna habitats consist of many flora species, the predicted impact is only to *M. argentea* and only where it occurs within the areas identified in Table 7.8.

A loss of vigour in *M. argentea* individuals, as predicted within moderate risk areas, is expected to have a negligible impact on the overall quality of any habitat within which it occurs. Furthermore, the moderate area of risk (i.e., 55.94 ha) is highly conservative given it is based on the maximum pumping case, which is unlikely to eventuate. The area of moderate risk is most likely to be smaller as seen under the base case (i.e., 5.08 ha in total).

Tree death of *M. argentea* individuals, as may occur within high risk areas, may reduce the quality of the fauna habitat within which it occurs. Note the area of high risk is not substantially different between the base case and maximum pumping case. This impact is expected to be insignificant, given:

- This impact occurs within the first six months of water abstraction, after which no further impact is predicted (Woodman, 2019).
- This impact is restricted to a single flora species present within the habitat (Woodman, 2019).
- Any dead individuals remaining in situ can still provide habitat value such as bank stabilisation in riverine environments (Woodman, 2019) and provision of shelter (i.e., hollows).
- *M. argentea* is not known to be a key habitat resource for fauna of conservation significance. Particularly in areas of critical habitat where the value of this habitat for fauna of conservation significance is associated with the presence of roosting/denning habitat, which will not be impacted by groundwater drawdown.

Potential indirect impacts to significant microhabitat features from groundwater drawdown are discussed separately in Section 5.5.6.

7.5.9 Impacts to Conservation Significant Vertebrate Fauna Species

MWH (2016b) conducted an assessment of impacts to vertebrate fauna species of conservation significance known, or considered likely to occur, within the Development Envelope. Impacts considered the threatening processes discussed in Sections 7.5.1 to 7.5.7 and were assessed on a pre-mitigation basis, i.e. before the application of avoidance, minimisation and rehabilitation measures. Impacts were ranked on a scale according to predicted population decline (Table 7.9).

Table 7.9 – Fauna Impact Criteria and Rankings

Impact to Population	Description	Species
Negligible	No perceived effect on population.	Fork-tailed Swift, various migratory shorebirds
Minimal	No population decline expected.	Spotted Ctenotus
Low	Short-term population decline expected within Development Envelope (recovery expected after life of the Proposal)	Peregrine Falcon, *Anilios ganei*, Spectacled Hare-wallaby, Brush-tailed Mulgara, Western Pebble-mound Mouse, Long-tailed Dunnart
Moderate	Permanent population decline expected – no perceived threat to population persistence	Northern Quoll, Pilbara Leaf-nosed Bat, Ghost Bat, Pilbara Olive Python
High	Permanent population decline expected – persistence of local population threatened	–
Extreme	Local population extinction likely	–

Source: MWH (2016b)

A summary of impacts relevant to each of the four moderately impacted species – i.e. those with the greatest predicted impacts from the Proposal – is presented in Table 7.10. Potential high risk areas of indirect habitat degradation associated with groundwater drawdown, as identified in Section 7.5.8, has also been interpreted with respect to each species' critical habitat, and is discussed in Table 7.10.

Table 7.10 – Summary of Impacts on Moderately Impacted Vertebrate Fauna Species

Species	Impact Summary
Northern Quoll	Loss of 56.39 ha of critical habitat, which comprises 39.82 ha of Rocky Ridge and Gorge (suitable for denning and foraging), 3.40 ha of Drainage Line (foraging and dispersal), 1.73 ha of Riverine (foraging and dispersal) and 11.43 ha of Rocky Foothills (foraging and dispersal) (see Figure 7.2). Potential indirect impact (i.e., degradation of habitat) from groundwater drawdown on an additional 56.72 ha of foraging and dispersal habitat (Riverine habitat) and 0.15 ha of critical habitat (Rocky Ridge and Gorge). However, as discussed in Section 7.5.8, this impact is on a single flora species, *M. argentea* and is not likely to result in a significant impact to this species. No direct or significant indirect impact on pools are anticipated as detailed in Section 5.5.5 and 5.5.6. Mortalities due to vehicle collisions may increase, especially at night and where the Indicative Disturbance Footprint intersects species habitat. An increase in Dog/Dingo and/or feral Cats may result in impacts to this species.
Pilbara Leaf-nosed Bat	Loss of 39.82 ha of critical habitat suitable for roosting and foraging (i.e., Rocky Ridge and Gorge habitat). Loss of 366.73 ha of foraging and dispersal habitat (i.e., all other habitat within 10 km of a diurnal roost) (see Figure 7.4). Loss of one nocturnal refuge (CO-CA-15). This impact is not anticipated to significantly impact the population, because utilisation of all nocturnal refuges was low (Bat Call WA, 2016) and as there are a number of alternative nocturnal refuges available to the species which have been recorded within the surrounding area (MWH, 2016b). Additionally, as survey effort was focused on the areas proposed to be impacted, it is considered likely that other currently unknown nocturnal refuges are available to the species outside the development envelope. No direct or indirect impact to the permanent diurnal roost (cave CO-CA-01) as detailed in Sections 7.5.1 and 7.5.4. Potential temporary relocation/abandonment of the species from cave CO-CA-03 (non-permanent breeding roost), given its proximity to the Razorback pit (i.e., 50 m lateral buffer from cave entrance) and the species' sensitivity to blasting noise, vibration and dust impacts. However, it is probable that this species will continue to utilise this cave as a nocturnal refuge and for foraging during this time, as supported by monitoring at Atlas Iron's Mount Dove operations (Bullen, pers. comm. 2017c). Mount Dove was approved for mining within a 20 m buffer measured from the entrance of Cave MD-AN-2, a night/transitory roost for this species. Monitoring at Mount Dove showed that while there was some minor physical damage to the entrance of the cave, mining had little to no effect on Pilbara Leaf-nosed Bat visitation, and so was unlikely to have negatively affected the population as stated by MWH (2016b and 2015a). Furthermore, results of monitoring at Atlas Iron's Abydos DSO Project, where the cave nearest to disturbance was also within 50 m, also suggest that mining activity is not impacting the local population of Pilbara Leaf-nosed Bat (MWH, 2016d). An assessment of the geology and review of Atlas Iron's other operations determined that the 50 m buffer from cave CO-CA-03 is considered to be adequate to maintain a suitable level of structural integrity of the cave to ensure its ongoing suitability as a diurnal roost following

Species	Impact Summary
	cessation of mining (Atlas Iron, 2017) (Appendix Q). Atlas Iron has subsequently revised and optimised the pit design outside of this 50 m buffer, and surveyed and laser scanned this cave. Consequently, this 50 m lateral buffer is now known to translate to a distance of 100 m overland from the entrance of the cave to the nearest edge of the Razorback pit, and 68 m from the back of the cave to the nearest point inside the Razorback pit (see Figure 7.8), further reducing the risk of structural damage to this cave. Furthermore, temporary abandonment of this non-permanent breeding roost in consideration of the likely relocation of individuals to the nearby permanent diurnal roost (CO-CA-01, approximately 5 km to the north) is unlikely to have a significant impact on the population (Bullen, pers. comm. 2017b). Other possible permanent diurnal (and potential maternity roost) relocation sites include Klondyke Queen located within 27 km, Copper Hills and Mt Webber cave both located within 38 km and Dalton Green cave located within 45 km (Bullen, pers. comm. 2017b). Potential indirect impact (i.e., degradation of habitat) from groundwater drawdown on an additional 56.72 ha of foraging and dispersal habitat (Riverine habitat) and 0.15 ha of critical habitat (Rocky Ridge and Gorge). However, as discussed in Section 7.5.8, this impact is on a single flora species, *M. argentea* and is not likely to result in a significant impact to this species. No direct or significant indirect impact on pools are anticipated as detailed in Section 5.5.5 and 5.5.6. Note pool CO-WS-14 is intrinsically associated with the non-permanent breeding roost (CO-CA-03). Catchment impacts associated with the siting/proximity of the Razorback pit on these values is considered unlikely to have a detrimental impact on the seep within this roost or the water level at this pool (Stantec, 2018a). Therefore hydrological and hydrogeological impacts on the roost's microclimate and its ongoing use by the Pilbara Leaf-nosed Bat is not anticipated (although temporary abandonment of this cave during mining/water abstraction has already been assumed as a potential worst case impact with regard to noise and vibration impacts). Mortalities due to vehicle collisions may increase, especially at night and where the Indicative Disturbance Footprint intersects Rocky Ridge and Gorge habitat or is near to nocturnal refuges. The generation of dust may affect nocturnal foraging behaviour (Bat Call WA, 2016; MWH, 2016b).
Ghost Bat	Loss of 39.82 ha of critical habitat suitable for roosting and foraging (i.e., Rocky Ridge and Gorge habitat). Loss of 366.73 ha of foraging habitat (i.e., all other habitat) (see Figure 7.3). Loss of two nocturnal refuges (CO-CA-08 and CO-CA-15). These caves do not appear to be important for the species given the low levels of calls recorded (Bat Call WA, 2016). Accordingly, the loss of these caves is not anticipated to be a significant impact on the Ghost Bat population, because utilisation of all nocturnal refuges by this species was low (Bat Call WA, 2016) and there are a number of known alternative nocturnal refuges available within the surrounding area (MWH, 2016b). Additionally, as survey effort was focused on the areas proposed to be impacted, it is considered likely that other currently unknown nocturnal refuges are available to the species outside the development envelope. Ghost Bats do not appear to be reliant on habitat within the Study Area (i.e., no significant roosts/only sporadic visitation recorded), so this loss of habitat is not anticipated to have a significant impact on the population. No direct or significant indirect impact on pools are anticipated as detailed in Section 5.5.5 and 5.5.6. Potential indirect impact (i.e., degradation of habitat) from groundwater drawdown on an additional 56.72 ha of foraging and dispersal habitat (Riverine habitat) and 0.15 ha of critical

Species	Impact Summary
	habitat (Rocky Ridge and Gorge). However, as discussed in Section 7.5.8, this impact is on a single flora species, *M. argentea* and is not likely to result in a significant impact to this species. Mortalities due to vehicle collisions may increase, especially at night and where the Indicative Disturbance Footprint intersects Rocky Ridge and Gorge habitat or is near to nocturnal refuges. The impact of dust generation on this species is unknown but may affect nocturnal foraging behaviour given it has caused decline at other mines in the region (TSSC, 2016b).
Pilbara Olive Python	Loss of 44.95 ha of critical habitat, including 39.82 ha of Rocky Ridge and Gorge habitat, 3.40 ha of Drainage Line habitat and 1.73 ha of Riverine habitat. Potential indirect impact (i.e., degradation of habitat) from groundwater drawdown on an additional 56.86 ha of critical habitat (Rocky Ridge and Gorge, Drainage Line and Riverine). However, as discussed in Section 7.5.8, this impact is on a single flora species, *M. argentea* and is not likely to result in a significant impact to this species. No direct or significant indirect impact on pools are anticipated as detailed in Section 5.5.5 and 5.5.6. Mortalities due to vehicle collisions may increase, especially at night and where the Indicative Disturbance Footprint intersects species habitat. An increase in Dog/Dingo and/or feral Cats may result in impacts to this species, particularly to juveniles which are more likely to be preyed on.

Note: Adapted from MWH (2016b). Potential impacts to critical habitats based on groundwater drawdown as discussed in Section 7.5.8 have been added by Atlas Iron.

7.6 Mitigation

Atlas Iron has in place a Health Safety and Environmental Management System (HSEMS) supported by an Environmental Management Plan (EMP), which defines Atlas Iron's approach to environmental management and integrates regulatory and HSEMS requirements. Atlas Iron has been operating iron ore mines in the Pilbara since 2008. During this time Atlas Iron has developed, implemented and refined its Environmental Management Plans and Procedures.

As part of the assessment and approval of the Proposal under the EPBC Act, Atlas Iron developed and is required to implement a SSMP specific to this Proposal (Appendix R). The SSMP is targeted at conservation significant species protected under the EPBC Act which have the potential to be impacted by the Proposal. The species currently included in the SSMP include all of the conservation significant species discussed in Section 7.5.9 to be at most risk, namely the Northern Quoll, Pilbara Leaf-nosed Bat, Ghost Bat and Pilbara Olive Python. With the implementation of the management strategies in the SSMP, the expected impact on these species is considered to be low.

The mitigation hierarchy (avoid, minimise and rehabilitate) has been applied during Proposal design to reduce the Proposal's potential impacts to terrestrial fauna. Table 7.11 summarises the mitigations that will be applied during construction and operation of the Proposal.

Table 7.11 – Mitigation of Impacts to Terrestrial Fauna

	Mitigations to be Applied
Avoidance	• The Development Envelope was altered to provide: – A 340 m buffer around the Pilbara Leaf-nosed Bat permanent diurnal roost (cave CO-CA-01), which is also a temporary diurnal roost for the Ghost Bat. – A 50 m buffer (lateral distance) from the Pilbara Leaf-nosed Bat non-permanent breeding roost (cave CO-CA-03), which effectively provides a 100 m buffer (overland distance) from the cave entrance and a 68 m buffer from the rear of the cave to the Razorback pit. – A 20 m buffer around all Pilbara Leaf-nosed Bat and/or Ghost Bat nocturnal refuges, except for caves CO-CA-08 and CO-CA-15. – A 50 m buffer around all perennial and ephemeral pools, with the exception of pool CO-WS-01, which was limited to a 20 m buffer.
Minimisation	The following plans and procedures will be implemented to assist in minimising impacts to fauna and fauna habitat: • GDP Procedure (950-HSE-EN-PRO-0001). • Clearing and Grubbing Procedure (950-HSE-EN-PRO-0004). • Fauna Management Procedure (950-HSE-EN-PRO-0012). • Landfill Management Procedure (950-HSE-EN-PRO-0020). • Waste Management Procedure (950-HSE-EN-PRO-0023). • Introduced Fauna / Pest Control Procedure (950-HSE-EN-PRO-0022). • Significant Species Management Plan (179-LAH-EN-PLN-0001). • Water Management Plan and Site Water Operating Plan (*in preparation*). Key management measures contained in these plans include: • No more than 423.11 ha of vegetation/habitat within the 2,257.6 ha Development Envelope will be cleared/disturbed. • Clearing in/of sensitive habitats including caves, cliff lines, waterholes, gorges, ridges, outcrops, drainage lines, scree slopes and crevices will be kept to the minimum necessary for safe construction and operation of the Proposal. • Signage identifying the presence of conservation significant fauna will be installed along the roads, where they intersect suitable habitat, specifically: – Drainage Line habitat. – Riverine habitat. – Rocky Ridge and Gorge habitat. – Rocky Foothills habitat. • Borrow pits will be designed and constructed to permit egress of fauna. • Turkey's nests will be fenced to at least 1.8 m (to prevent fauna entry/mortality) and constructed to ensure a point of fauna ingress/egress. • Speed limits on roads will be 50 km/h south of the run-of-mine pad (i.e., where it intersects the majority of significant fauna habitat types) and 80 km/h north of the run-of-mine pad to limit vehicle interactions with fauna. • Off-road driving will be prohibited unless otherwise authorised by senior management to minimise potential vehicle strikes.

	Mitigations to be Applied
	• Night-time vehicle movements will be restricted where possible to minimise potential vehicle strikes. • All bins storing putrescible waste will have tightly secured lids to avoid fauna attraction and entry. • The landfill will be operated and managed in accordance with the Environmental Protection (Rural Landfill) Regulations 2002. This will include fencing to reduce the potential for attracting fauna. • Blasting operations will be limited to daytime only to limit disturbance to fauna including bats. • Noise, dust and light emissions will be controlled where possible to avoid excessive disturbance to native fauna, including directing lights to working areas, shielding lights to reduce glow, and using conventional dust suppression techniques (i.e. water trucks). • Awareness training will identify conservation significant fauna and habitat and discuss relevant management measures, personnel/contractor responsibilities, and incident reporting requirements (i.e. reporting of fauna observations and/or incidents). • All fauna mortalities and injuries will be reported to the Corunna Downs Environmental Advisor within 24 hours and recorded within Atlas Iron's incident reporting system. • All sightings of conservation significant fauna will be reported to the Corunna Downs Environmental Advisor. • Where required, fauna will be handled and transported in accordance with the procedures outlined in the DBCA Standard Operating Procedure Transport and Temporary Holding of Wildlife (DBCA, 2017). • Interactions with fauna (e.g. feeding, harassment, capture, killing) are not permitted unless specifically authorised by the Senior Environmental Advisor. • Domestic pets are prohibited to avoid interactions with or disturbance to conservation significant fauna. • Record all introduced fauna sightings and the implement feral animal control program, as required (i.e., where sightings are regular and/or if nuisance or dangerous individuals are recorded). • Clearing will occur in accordance with Atlas Iron's Ground Disturbance Permit Procedure. No clearing will occur without prior authorisation from Atlas Iron's Ground Disturbance Permitting System. This will ensure that clearing does not occur outside the Development Envelope or exceed 423.11 ha. • Atlas Iron will abstract water in accordance with 5C Licence to take groundwater (GWL176960) granted under the RIWI Act 1914 and a Water Management Plan 15 and Site Water Operating Plan 16 in accordance with Department of Water requirements. This includes a detailed monitoring program and establishment of appropriate triggers, thresholds and contingencies relevant to pools and GDV, and so by association indirect impacts on fauna habitat (e.g., altering water abstraction rates and/or sourcing water from alternative water abstraction locations).

	Mitigations to be Applied
Rehabilitation	• All areas of the Indicative Disturbance Footprint (except for open pits) will be progressively rehabilitated as soon as practicable and as required by the Mine Closure Plan. • A Mine Closure Plan will be updated triennially or as required when significant changes are made to the Proposal. A detailed Mine Closure Plan, which will contain further information on rehabilitation works, will be prepared approximately one year to six months prior to the cessation of mining as stated in the Mine Closure Plan. • Rehabilitation works are expected to return disturbed areas (other than pits) to a stable and vegetated state. Revegetation is expected to provide some value for fauna although it is acknowledged that fauna habitats will not be restored to their pre-disturbance state. • Should structural damage to either of caves CO-CA-01 and CO-CA-03 be observed which would prevent ongoing use by the Pilbara Leaf-nosed Bat, Atlas Iron is committed to undertaking practical corrective rehabilitation in accordance with the SSMP.
Offset	The Proposal has been granted approval under the EPBC Act (EPBC 2017/7861). Under this approval, Atlas Iron is required to offset significant habitat impacts, including 56.39 ha of critical habitat and 366.73 ha of foraging and/or dispersal habitat for the Pilbara Leaf-nosed Bat and the Ghost Bat (i.e., the entire Proposal footprint), through contribution to the Pilbara Offset Fund as detailed in Chapter 9.

The SSMP also includes monitoring programs for:

- Pilbara Leaf-nosed Bat and Ghost Bat.
- Northern Quoll.

Both monitoring programs include annual monitoring, opportunistic monitoring and rehabilitation monitoring to ensure the continued presence of the species in Development Envelope and wider region.

7.7 Predicted Outcome

The predicted impacts to Terrestrial Fauna from the Proposal after applying the mitigation hierarchy (avoid, minimise, rehabilitate) are:

- Clearing of 56.39 ha of critical habitat for the Northern Quoll.
- Clearing of 39.82 ha of critical habitat for both the Pilbara Leaf-nosed Bat and Ghost Bat and an additional 366.73 ha of foraging and/or dispersal habitat for both species.
- Clearing of 44.95 ha of critical habitat for the Pilbara Olive Python.
- Loss of two nocturnal refuges (CO-CA-08 and CO-CA-15), both of which support the Ghost Bat and one of which supports the Pilbara Leaf-nosed Bat.
- No direct impact to any of the 11 pools identified as significant microhabitat features.
- Temporary daytime abandonment of the non-permanent breeding roost (cave CO-CA-03) by the Pilbara Leaf-nosed Bat due to disturbance from blasting operations in the Razorback pit, however the impact is not considered significant given the availability of the permanent diurnal roost (cave CO-CA-01). It is also probable that the species will continue to use cave CO-CA-03 as a nocturnal refuge and foraging resource during this

time and will return to using this cave as a non-permanent breeding roost on cessation of mining.

- While habitats present within the Study Area are generally recognised as suitable roosting and foraging habitat for the Ghost Bat, no significant impact to this species is anticipated given it does not appear to be reliant on habitat within the Study Area (i.e., no significant roosts and only sporadic visitation recorded).
- No significant impact to SRE fauna or habitat.
- No significant indirect impact to pool water quality or levels. Specifically, no loss of permanent pools.
- Potential decline in the quality of an additional 56.86 ha of fauna habitat associated with the potential tree death of a single flora species (*M. argentea*) in area of GDV considered to be at high risk of drawdown. However, this is not considered to be a significant impact for any species of conservation significance.

After the application of mitigation hierarchy (i.e., avoidance, minimisation and rehabilitation measures) and application of the offset package, Atlas Iron expects that the EPA's objective for Terrestrial Fauna can be met.

7.8 Terrestrial Fauna Summary

A summary of the key information in this chapter is presented in Table 7.12.

Table 7.12 – Terrestrial Fauna Summary

Factor	Terrestrial Fauna Summary
EPA Objective	To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.
Policy and Guidance	• Environmental Factor Guideline: Terrestrial Fauna (EPA, 2016c). • Technical Guidance: Sampling methods for terrestrial vertebrate fauna (EPA, 2016d). • Technical Guidance: Terrestrial Fauna Surveys. (EPA, 2016e). • Technical Guidance: Sampling of short range endemic invertebrate fauna (EPA, 2016f).
Receiving Environment	Eleven fauna habitat types mapped, five of which are significant fauna habitats (Rocky Ridge and Gorge, Rocky Foothills, Granite Outcrop, Drainage Line and Riverine). Eighteen caves known to support the Pilbara Leaf-nosed Bat and/or Ghost Bat, including cave CO-CA-01 (permanent diurnal roost for Pilbara Leaf-nosed Bat and temporary diurnal roost for Ghost Bat) and CO-CA-03 (non-permanent breeding roost for Pilbara Leaf-nosed Bat). Eleven perennial and ephemeral pools of value for fauna. Seven conservation significant fauna confirmed present including the Northern Quoll, Ghost Bat, Pilbara Leaf-nosed Bat, Pilbara Olive Python, Peregrine Falcon, Spectacled Hare-wallaby and Western Pebble-mound Mouse. Two further species considered likely to occur (the Long-tailed Dunnart and a blind snake) and eleven considered possible to occur.

Factor	Terrestrial Fauna Summary
Potential Impacts	• Loss and/or degradation of fauna habitat, particularly for conservation significant fauna. • Loss and/or degradation of terrestrial fauna habitat due to increased presence of weed species. • Injuries to and mortalities of fauna caused by interactions with vehicles, infrastructure, machinery and the workforce. • Reduced diversity or abundance of foraging resources due to altered hydrological regimes. • Alteration in behaviour of fauna due to noise, vibration, artificial light emissions and dust. • Increased presence of non-indigenous fauna species. • Alteration to fire regimes.
Mitigation	**Avoidance:** • A 340 m buffer provided between the Development Envelope and Pilbara Leaf-nosed Bat permanent diurnal roost (cave CA-CO-01). • A 50 m buffer provided between the Development Envelope and Pilbara Leaf-nosed Bat non-permanent breeding roost (cave CA-CO-03) (effective distance 68 m from rear of cave and 100 m overland). • A 20 m buffer provided between the Development Envelope and all Pilbara Leaf-nosed Bat and/or Ghost Bat nocturnal refuges (except caves CO-CA-08 and CO-CA-15). • A 50 m buffer provided between the Development Envelope and all perennial and ephemeral pools except for CO-WS-14, which is limited to a 20 m buffer. **Minimisation and management:** The following plans and procedures will be implemented to assist in minimising impacts to fauna and fauna habitat: • Ground Disturbance Permit. • Clearing and Grubbing Procedure. • Flora Management Procedure. • Significant Species Management Plan. • Water Management Plan and Site Water Operating Plan. Key management measures contained in these plans include: • No more than 423.11 ha of vegetation/habitat within the 2,257.6 ha Development Envelope will be cleared/disturbed. • Speed limits on roads will be 50 km/h south of the run-of-mine pad (i.e., where it intersects the majority of significant fauna habitat) and 80 km/h north of the run-of-mine pad to limit vehicle interactions with fauna. • Night-time vehicle movements will be restricted where possible to minimise potential vehicle strikes. • Blasting operations will be limited to daytime only to limit disturbance to fauna including bats. • Noise, dust and light emissions will be controlled where possible to avoid excessive disturbance to native fauna, including directing lights to working areas, shielding lights to reduce glow, and using conventional dust suppression techniques (i.e. water trucks).

Factor	Terrestrial Fauna Summary
	Rehabilitation: • All areas of the Indicative Disturbance Footprint (except for open pits) will be progressively rehabilitated as soon as practicable and as required by the Mine Closure Plan. • Should structural damage to either of caves CO-CA-01 and CO-CA-03 be observed which would prevent ongoing use by the Pilbara Leaf-nosed Bat, Atlas Iron is committed to undertaking practical corrective rehabilitation in accordance with the SSMP. **Offset:** • Atlas Iron is required to offset significant habitat impacts, including 56.39 ha of critical habitat and 366.73 ha of foraging and/or dispersal habitat for the Pilbara Leaf-nosed Bat and the Ghost Bat (i.e., the entire Proposal footprint), through contribution to the Pilbara Offset Fund as detailed in Chapter 9.
Predicted Outcome	• Clearing of 56.39 ha of critical habitat for the Northern Quoll. • Clearing of 39.82 ha of critical habitat for both the Pilbara Leaf-nosed Bat and Ghost Bat and an additional 366.73 ha of foraging and/or dispersal habitat for both species. • Clearing of 44.95 ha of critical habitat for the Pilbara Olive Python. • Loss of two nocturnal refuges (CO-CA-08 and CO-CA-15), both of which support the Ghost Bat and one of which supports the Pilbara Leaf-nosed Bat. • No direct impact to any of the 11 pools identified as significant microhabitat features. • Temporary daytime abandonment of the non-permanent breeding roost (cave CO-CA-03) by the Pilbara Leaf-nosed Bat due to disturbance from blasting operations in the Razorback pit. • While habitats present within the Study Area are generally recognised as suitable roosting and foraging habitat for the Ghost Bat, no significant impact to this species is anticipated given it does not appear to be reliant on habitat within the Study Area (i.e., no significant roosts and only sporadic visitation recorded). • No significant impact to SRE fauna or habitat. • No significant indirect impact to pool water quality or levels. Specifically, no loss of permanent pools. • Potential decline in the quality of an additional 56.86 ha of fauna habitat associated with the potential tree death of a single flora species (*M. argentea*) in area of GDV considered to be at high risk of drawdown. However, this is not considered to be a significant impact for any species of conservation significance.

8. Other Environmental Factors and Matters

In addition to the key environmental factors discussed in previous sections, the Proposal has the potential to interact with several other environmental factors considered by the EPA, including:

- Subterranean Fauna.
- Landforms.
- Terrestrial Environmental Quality.
- Air Quality.
- Social Surroundings.

Given the Proposal's location, and in the absence of asbestiform and radioactive material, the marine factors and Human Health factor are not considered relevant to this Proposal.

Atlas Iron anticipate that the EPA's objectives for the above listed other environmental factors will be met, given the low level of impact anticipated and the application of proposed mitigation measures and other regulatory mechanisms.

Table 8.1 presents a brief overview of each of these other environmental factors.

Table 8.1 – Other Environmental Factors

Item	Details
Subterranean Fauna	
EPA objective	To protect subterranean fauna so that biological diversity and ecological integrity are maintained.
Policy and guidance	• Environmental Factor Guideline: Subterranean Fauna (EPA, 2016g). • Technical Guidance: Subterranean Fauna Survey (EPA, 2016h). • Technical Guidance: Sampling Methods for Subterranean Fauna (EPA, 2016i). Historical guidance applicable at time of studies conducted for this Proposal: • EPA Environmental Assessment Guideline 12 (EPA, 2013). • EPA Guidance Statement No. 54a (EPA, 2007).
Receiving Environment	No stygofauna species were recorded from the sampled aquifer systems within or near the Development Envelope (MWH, 2016c; Appendix S). A total of 13 troglofauna species from nine higher level taxonomic groups: *Blattodea, Coleoptera, Diplura, Isopoda, Polydesmida, Polyxenida, Pseudoscorpiones, Scolopendromorpha* and *Symphyla*, were collected from the Study Area. Of the 13 species recorded, eight have been found to occur in two or more areas (MWH, 2016c). These species are not considered to be of conservation concern as each species has records in several areas including those of minimal or no impact (Stantec, 2019; Appendix T). While the five remaining troglofauna species are known from only one record each, troglofauna habitat in which they (and the other eight species) occur has been demonstrated to be largely contiguous along the main ironstone ridge system (Stantec, 2019; Appendix T).

Item	Details
Potential impacts	As no stygofauna species were recorded, the following impacts relate to troglofauna: • Direct removal of habitat through the open pit mining (i.e., excavation) of the proposed Runway, Razorback, Shark Gully and Split Rock pits. • Indirect impact to troglofauna habitat through lowering of the groundwater table associated with water abstraction.
Mitigation	**Minimisation and management:** Atlas Iron will manage water abstraction in accordance with 5C Licence to take groundwater granted under the *RIWI Act* and associated Water Management Plan and Site Water Operating Plan.
Predicted Outcome	No impacts to stygofauna are expected. The Proposal is expected to pose a low risk to the long term conservation of troglofauna species on the basis that habitat is highly likely to occur beyond the modelled extent of drawdown (both lateral and vertical) (Stantec, 2019). This Proposal is expected to meet the EPA's objective for Subterranean Fauna.
Landforms	
EPA objective	To maintain the variety and integrity of significant physical landforms so that environmental values are protected.
Policy and guidance	• Environmental Factor Guideline: Landforms (EPA, 2018b).
Receiving Environment	As discussed in Section 6.3.2.1, eight land systems occur within the Study Area, mapped and classified according to similarities in landform, soil, vegetation, geology and geomorphology, as listed in Table 6.2 (Woodman, 2016a). The Development Envelope intersects six land systems: Boolgeeda, Capricorn, River, Rocklea, Satirist and Talga. Less than 0.4% of each of these land systems falls within the Development Envelope. Landform association mapping has also been undertaken over the Study Area, based on field observations of morphological differences between soil profiles and their occurrence within different landscapes. Seven landform associations were identified within the Study Area, namely 'calcrete', 'granite hillock' 'undulating hills and valleys', 'drainage lines', 'flats', 'scree slopes' and 'ridgelines' (MWH, 2016a). The Development Envelope is dominated by the following landform associations; ridgelines and scree slopes, scree slopes (foothills and stony rises) and undulating hills and valleys. None of these landforms are restricted to the Development Envelope or Study Area. A small mesa has also been identified within the Study Area and classified as a potential heritage site (see Social Surroundings Factor below), CRD-12-14.
Potential impacts	Removal or degradation of landforms resulting in: • Reduced landform diversity. • Reduced landform integrity. • Loss or degradation of associated ecological and heritage values.

Item	Details
Mitigation	**Avoidance:** The Development Envelope has been refined to: • Exclude the mesa landform associated with potential heritage site CRD-12-14. • Exclude various significant caves and pools, minimising impacts to significant habitat types and associated landforms, e.g., Rocky Ridge and Gorge (Table 7.11). **Minimisation and management:** The following plans and procedures will be implemented to assist in minimising impacts to significant fauna and flora habitat and associated landforms: • Ground Disturbance Permit. • Clearing and Grubbing Procedure. Key management measures contained in these plans include: • No more than 423.11 ha of vegetation/habitat within the 2,257.6 ha Development Envelope will be cleared/disturbed. • Clearing in/of sensitive habitats including caves, cliff lines, waterholes, gorges, ridges, outcrops, drainage lines, scree slopes and crevices will be kept to the minimum necessary for safe construction and operation of the Proposal. • Surveying and delineation of the GDP boundary in the field prior to any works commencing, including all buffers and values to be avoided. **Rehabilitation:** • All areas of the Indicative Disturbance Footprint (except for open pits) will be progressively rehabilitated as soon as practicable and as required by the Mine Closure Plan. Rehabilitation works are expected to return disturbed areas to a stable and vegetated state. • A detailed Mine Closure Plan, which will contain further information on rehabilitation works, will be prepared approximately one year to six months prior to the cessation of mining as stated in the Mine Closure Plan.
Predicted Outcome	Impacts to landform systems are negligible, with less than 0.4% of any of the six landform systems occurring within the Development Envelope. None of the landform associations occurring in the Development Envelope are restricted to the Study Area and so landform diversity is unlikely to be affected by the Proposal. No impact to the small mesa associated with potential heritage site CRD-12-14. This Proposal is expected to meet the EPA's objective for Landforms.
Terrestrial Environmental Quality	
EPA objective	To maintain the quality of land and soils so that environmental values are protected.
Policy and guidance	• Environmental Factor Guideline Terrestrial Environmental Quality (EPA, 2016j). • National Environment Protection (Assessment of Site Contamination) Measure (NEPM, 2013).
Receiving Environment	Soils within the Study Area are broadly characterised as follows (MWH, 2016a; Appendix U): • Generally shallow (particularly within the 'scree slopes' and 'ridgelines' landform associations). • Typically classed as 'sandy loams' or 'sandy clay loams'.

Item	Details
	• Generally contain a high percentage of coarse material (>2 mm). • Predominantly single-grained to weakly aggregated in structure. • Exhibit partial clay dispersion upon severe disturbance. • Prone to hardsetting. • 'Moderate' to 'moderately rapid' drainage class. • Low' to 'moderate' water holding capacity. • Neutral pH. • Predominately non-saline. • Typically low in organic carbon and moderate in plant-available nutrients. • Non-sodic. • Typically, below the limit of reporting for the majority of total metals tested, with some samples reporting concentrations of total Cu and Ni above the site-specific Ecological Investigation Levels. As identified above under the Landforms factor, landform association mapping has been undertaken based on field observations of morphological differences between soil profiles and their occurrence within different landscapes (MWH, 2016a). The Development Envelope is dominated by ridgelines and scree slopes, scree slopes (foothills and stony rises) and undulating hills and valleys and consequently, surface soils are typically shallow and dominated by high coarse fragment content (MWH, 2016a). Surface soils (0 to 0.2 m) from the drainage lines, flats, scree slopes and ridgelines landform associations are considered to be a valuable resource for rehabilitation material, and generally have a high coarse rock fragment content, moderately rapid hydraulic conductivity, are non-hardsetting or slightly hardsetting, and are predominately non-saline and non-sodic, indicating a low inherent potential for erosion (MWH, 2016a). As outlined in Section 2.3.3, the majority of waste rock material is likely to be relatively resistant to surface erosion, with the exception of the shale unit and clay-rich BIF (MWH, 2016a). The majority of waste rock samples have also been found to be entirely non-acid forming (NAF) and geochemically benign. The exception is the clastic sediment/shale waste unit within the Split Rock and Runway South pits, which may have discrete locations of potentially acid forming (PAF) shale, although this is considered unlikely (Mine Earth, 2018; Appendix A). Additionally, elevated mercury (Hg) concentrations have been recorded from some shale samples. While the solubility of Hg in both acidic and neutral conditions was found to be negligible, this material if exposed on the surface of waste rock dumps can be readily absorbed by plants (Mine Earth, 2018). Shale makes up less than 15% (658 kbcm) of the Proposal's total waste rock volume.
Potential impacts	• Inadequate transport, handling and storage of hydrocarbons and chemicals resulting in soil contamination. • Poor management of problematic waste rock material (i.e. clay-rich BIF and shale), resulting in impacts to soil quality (e.g. lowering of pH and release of metals) and/or erodible waste dump surfaces. • Ground disturbance, resulting in changes to soil quantity, quality and structure. • Inadequate surface water management, resulting in accelerated soil erosion. All of these impacts in turn can reduce vegetation and habitat quality and rehabilitation success.

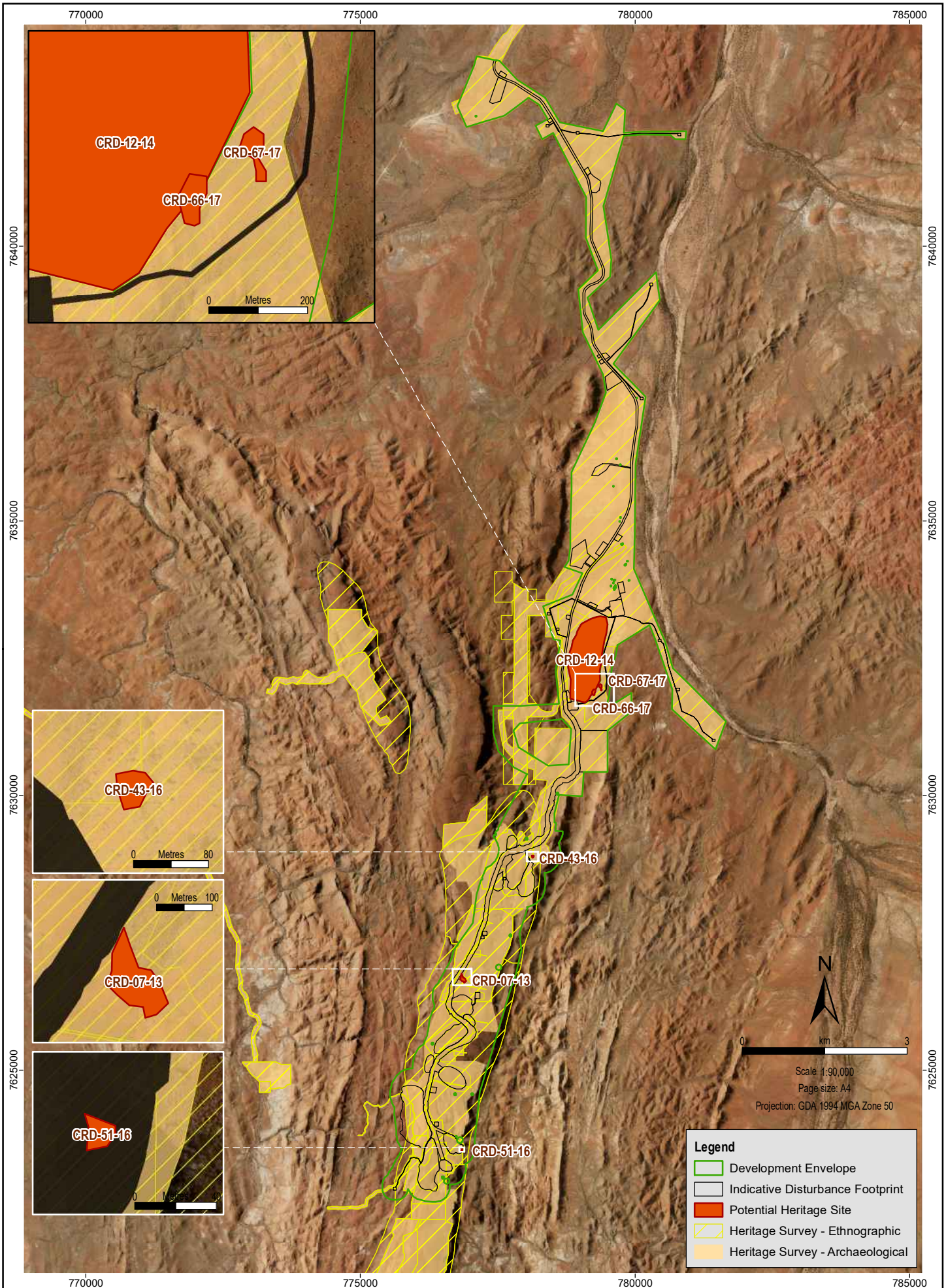
Item	Details
Mitigation	**Minimisation and management:** The following procedures will be implemented to reduce impacts to soils and to ensure impacted soils are appropriately salvaged and managed for use in rehabilitation: • GDP Procedure (950-HSE-EN-PRO-0001). • Clearing and Grubbing Procedure (950-HSE-EN-PRO-0004). • Weed Hygiene Procedure (950-HSE-EN-PRO-0002). • Hydrocarbon Management Procedure (950-HSE-EN-PRO-0005). • Hydrocarbon (and Chemical) Spill Management Procedure (950-HSE-EN-PRO-0007). • Bioremediation Management Procedure (950-HSE-EN-PRO-0013). Key management measures contained in these plans include: • No more than 423.11 ha of land within the 2,257.6 ha Development Envelope will be cleared/disturbed. • Restricting clearing to the minimum necessary for safe construction and operation of the Proposal and to within approved areas through internal GDP Procedure. • Where practicable, topsoil shall be stripped to a minimum depth of 200 mm below the natural surface unless otherwise stated in GDP conditions. Topsoil (and subsoil) shall be stripped to a greater depth where available and necessary (i.e. when the site has a topsoil deficit). • Weeds and weed-contaminated topsoil will be cleared, handled and stockpiled separately to native vegetation and 'clean' topsoil. • Topsoil stripping shall only be undertaken in dry conditions to prevent compaction and poor seed viability. • Topsoil shall paddock dumped into stockpiles not exceeding 2 m in height. • Containment of hydrocarbons in accordance with *AS1940:2004 – The Storage and Handling of Flammable and Combustible Liquids*, this includes sitting and bunding/containment restrictions, provision and maintenance of relevant MSDS and regular inspections. • Refuelling procedures, including the provision of a spill kit at all refuelling stations. • Spill recovery and clean up materials maintained at all hazardous material storage areas. Relevant employees and contractors will be trained in the use of this equipment. • All spills, irrespective of volume, will be reported internally through the INX system. Spills to ground / outside of a bund are reported as an environmental incident and cleaned up appropriately. Spills inside a bund are reported as a hazard and cleaned up appropriately. • Contaminated soil shall be taken to the site bioremediation facility (where present), or stockpiled for removal offsite by a licenced controlled waste contractor. Atlas Iron will ensure that waste units are correctly classified prior to mining during infill and grade control drilling and managed in accordance with Atlas Iron's Waste Rock Management Strategy (refer to Section 2.3.3; Appendix B), including: • Adequate encapsulation of any PAF shale within the Split Rock waste rock dump to prevent soil and water contamination (see Figure 2.2). • Clay rich BIF and geochemically benign NAF shale will not to be placed on sloped surfaces of waste rock dumps, given their susceptibility to surface erosion.

Item	Details
	• Any NAF shale with elevated Hg will be buried 10 m below final surface of profiled landform (i.e., below rooting zone of most vegetation) to prevent absorption by plants. Atlas Iron is currently undertaking a drilling program to support additional sampling and characterisation of waste rock, specifically to confirm the presence/absence of PAF shale in the Split Rock deposit. Atlas Iron will ensure appropriate surface water management is incorporated into the final mine design, in general accordance with the following objectives and design principles: • Diverting naturally occurring local surface water around mine infrastructure by means of drainage channels, earth bunds, and road culverts with adequate scour protection where necessary. Note Atlas Iron will not be actively diverting clean runoff around pits, instead allowing surface water flows to drain into and collect within pit (where not diverted by safety bunds/windrows). • Isolating the waste rock dump areas from external runoff (i.e., clean stormwater) by bunding around the perimeter and encouraging the minimal internal flows to be retained and infiltrate and/or evaporate. Internal flows will otherwise be directed to a sedimentation pond, where the bulk of the suspended material will be settled out prior to any discharge to the downstream environment. • Waste rock dumps will be designed to minimise infiltration and leachate development, and to resist erosion and sediment migration to the downstream environment. **Rehabilitation:** • All areas of the Indicative Disturbance Footprint (except for open pits) will be progressively rehabilitated as required by the Mine Closure Plan. Rehabilitation works are expected to return disturbed areas to a stable and vegetated state. • The use/placement of the salvaged topsoil on waste rock landforms will be strategic in that it will only occur in areas likely to be successful in vegetation establishment in the long term. • Ripping of the surface of the waste rock dumps will follow redeployment of topsoil to improve rainfall infiltration and increase root penetrability. • A Mine Closure Plan will be updated triennially or as required when significant changes are made to the Proposal. A detailed Mine Closure Plan, which will contain further information on rehabilitation works, will be prepared approximately one year to six months prior to the cessation of mining as stated in the Mine Closure Plan.
Predicted Outcome	Typical of the landforms being mined by iron ore operations in the Pilbara, and as seen at Atlas Iron's other Pilbara operations, there is likely to be a topsoil deficit with regard to rehabilitation which will need to be addressed through the salvage of any additional topsoil and/or subsoils and targeted application of topsoil during rehabilitation. The risk of significant contamination from hydrocarbon and/or chemical spills and the handling of problematic waste material is considered low with the implementation of the above hydrocarbon and waste rock management. Furthermore, the Proposal is unlikely to result in significant erosion given the Proposal's location in the top of the catchment (i.e., minimum upstream flows) and the implementation of the above surface water management. Atlas Iron expects that the EPA's objective for Terrestrial Environmental Quality can be met.

Item	Details
Air Quality	
EPA objective	To maintain air quality and minimise emissions so that environmental values are protected.
Policy and guidance	• Environmental Factor Guideline: Air Quality (EPA, 2016k). • National Environment Protection (Ambient Air Quality) Measure (NEPM, 2016).
Receiving Environment	The development and operation of the Proposal will create dust emissions due to construction, blasting, haulage and general traffic activities, the impacts of which may not be confined to the Development Envelope. Dust emissions have the potential to affect surrounding vegetation and fauna; these impacts are considered separately in Chapters 6 and 7. An assessment on air quality found that the Proposal, in isolation of other emission sources in the region, presents minimal impact on the air quality in the region. And that the cumulative impact of the Proposal, with other emission sources, presents no significant impact on the air quality in the region (Pacific Environmental Limited, 2017; Appendix V).
Potential impacts	Reduced air quality due to dust emissions associated with construction, blasting, haulage and general traffic activities.
Mitigation	**Minimisation and management:** Compliance with the Proposal's Works Approval (W6043) and Operating Licence (pending) and implementation of the Ground Disturbance Permit Procedure (950-HSE-EN-PRO-0001), Clearing and Grubbing Procedure (950-HSE-EN-PRO-0004) and Dust Management Procedure (950-HSE-EN-PRO-0026) to ensure dust emissions and impacts are minimised. These procedures include the following management measures: • Planning clearing so that only the areas of land required for immediate use (within 6 months) is cleared and exposed. • Implementation and enforcement of speed limits on unsealed roads. • Implementation of appropriate dust suppression mechanisms (e.g., sprinklers, water sprays and water carts) on roads, stockpiles and infrastructure areas.
Predicted Outcome	As the Proposal will not significantly affect air quality and will implement measures to minimise impacts on environmental values, this Proposal is expected to meet the EPA's objective for Air Quality.
Social Surroundings	
EPA objective	To protect social surroundings from significant harm.
Policy and guidance	• Environmental Factor Guideline: Social Surroundings (EPA, 2016m). • Aboriginal Heritage Due Diligence Guidelines (DAA, 2013). • Environmental Protection (Noise) Regulations 1997 (*Environmental Protection Act 1986*). • State Planning Policy 5.4 – Road and Rail Transport Noise and Freight Considerations in Land Use Planning (WAPC, 2009)

Item	Details
Receiving Environment	The majority of the Development Envelope lies within the Panorama (90%) and Eginbah (1%) Pastoral Stations and the remaining comprises unallocated crown land (see Figure 2.4). The Development Envelope also lies wholly within the Njamal (WC1999/008) registered Native Title claim. No registered Aboriginal heritage sites have been identified within the Development Envelope, however, six potential sites (CRD-07-13, CRD-12-14, CRD-43-16, CRD-51-16, CRD-66-17 and CRD-67-17) have been identified which are likely to meet the definition of a 'registered aboriginal site' under Section 5 of the *Aboriginal Heritage Act 1972* (see Figure 8.1). The development and ongoing operation of the Proposal is likely to generate noise and vibration due to blasting, general operation of heavy machinery and vehicles, diesel generators and the presence of personnel. The impact of noise emissions on fauna is considered separately in Section 7.5.4. There are three noise sensitive receivers relevant to the Proposal. A noise assessment predicts the Proposal will comply with the assigned noise levels at all sensitive receivers (Talis, 2016; Appendix W). Noise levels at sensitive receivers associated with road haulage were also predicted to be within the noise limits set out in State Planning Policy 5.4 (SPP 5.4) (Talis, 2016; Appendix W). In response to EPA concerns about the predicted exceedance of the SPP 5.4 noise target at a residence in Marble Bar, the noise model was re-run with a number of mitigations (i.e., newer model prime movers on road trains and reduced 20 km/h speed limit 400 m either side of the residence (Talis, 2019; Appendix X). As a result of these mitigations, noise levels at this residence are now predicted to be below both the SPP 5.4 noise limit and noise target.
Potential impacts	• Impacts on pastoral activities (e.g., loss of grazing area, pressure on water resources, vehicle interacts with/ loss of cattle). • Impacts to Aboriginal heritage sites. • Noise impacts to sensitive receivers from road haulage operations.
Mitigation	**Avoidance:** • Development Envelope was refined to exclude potential site CRD-12-14. • The Indicative Disturbance Footprint has been adjusted to avoid potential sites, CRD-07-13, CRD-43-16, CRD-66-17 and CRD-67-17. **Minimisation and management:** • Atlas Iron will continue to work in accordance with the Njamal Deed of Agreement, including: – Ensuring all areas of proposed disturbance are surveyed for Aboriginal heritage (ethnographic and archaeological) prior to disturbance. – In the event that an Aboriginal heritage site cannot be avoided, Atlas Iron will submit a Section 18 application and obtain consent from the Minister for Aboriginal Affairs under the *Aboriginal Heritage Act 1972* prior to disturbance. – In the event that an item of indigenous heritage interest is identified during construction or operations, ground disturbance will cease and the item of interest will be left in-situ until such time that the area can be appropriately viewed. Approval for recommencement of ground disturbing activities will only occur after consultation with native title claimants or their representatives and the Department of Planning, Lands and Heritage (DPLH) as required.

Item	Details
	• Atlas Iron will implement the following management plans and procedures to ensure impacts of clearing are minimised: – Ground Disturbance Permit (GDP) Procedure (950-HSE-EN-PRO-0001). – Clearing and Grubbing Procedure (950-HSE-EN-PRO-0004). • Should the DPLH determine that CRD-51-16 meets the definition of a 'registered aboriginal site' under Section 5 of the *Aboriginal Heritage Act 1972*, Atlas Iron will obtain Section 18 consent prior to disturbance. • Atlas Iron will continue to consult with affected pastoralists to ensure impacts of the Proposal on their activities/land use are minimised. • To minimise noise to sensitive receivers, the following management measures will be applied to road haulage operations: – A 20 km/h speed limit will apply to the 800 m section of Limestone-Marble Bar Road immediately east of the intersection with Corunna Downs Road (i.e. 400 m either side of the Marble Bar residence). – The public speed limit in the vicinity of the Comet and Alexander mines is currently 60 km/h. However, Atlas has committed to a 40 km/h heavy vehicle haulage speed restriction along the section of the public road adjacent to the Alexander and Comet mines (i.e., starts approximately 500 m south of the Alexander mine and extends approximately 1.5 km north of the Comet mine). – Road trains will avoid the use of engine compressive braking within the 20 km/h speed zone identified above. – Road trains will be hauled by newer model prime movers with quieter noise characteristics, e.g. similar noise output to a Volvo FH16 as modelled in the Talis (2019) noise assessment.
Predicted Outcome	The Proposal will: • Remove CRD-51-16, one of the six potential sites, which may meet the definition of a 'registered aboriginal site' under Section 5 of the *Aboriginal Heritage Act 1972*. • Compensate affected pastoralists for loss of resources (e.g., grazing land and water) and any loss of cattle, due to vehicle interactions/strike. • Comply with the assigned noise levels and SPP 5.4 noise limits at all sensitive receivers. Predicted noise levels at the Marble Bar residence will also be within SPP 5.4 noise target. This Proposal is expected to meet the EPA's objective for Social Surroundings.



File Name: GIS_2494.mxd Date: 29/05/2019 Author: Drew.Smith	Source & Notes: Heritage data provided by Gavin Jackson Cultural Resource Management Pty Ltd (2014) *Disclaimer: This figure has been produced for internal review only and may contain inconsistencies or omissions. It is not intended for publication.*	**Aboriginal Heritage**	Figure No: **8-1**

9. Matters of National Environmental Significance and Offsets

In January 2017, Atlas Iron referred the Proposal to the DEE under the EPBC Act. The DEE determined that the Proposal was a controlled action under Section 75 of the EPBC Act, on the basis it was likely to have a significant impact on listed threatened species and communities (sections 18 and 18A), specifically the Northern Quoll (EN), Pilbara Leaf-nosed Bat (VU), Ghost Bat (VU) and Pilbara Olive Python (VU). The Proposal was assessed by preliminary documentation and approval was granted on 23 February 2018 (EPBC 2017/7861).

Chapter 7 (Terrestrial Fauna) provides a description of each of these listed threatened species in the context of the Proposal's Study Area and an assessment of impacts both pre- and post-mitigation. Importantly, the Development Envelope and Indicative Disturbance Footprint were both adjusted following the EPBC Act approval to mitigate impacts to significant environmental values and comply with conditions of the Commonwealth approval (e.g., application of buffers around the permanent diurnal (cave CO-CA-01) and non-permanent breeding roost (cave CO-CA-03) for Pilbara Leaf-nosed Bat).

While the Development Envelope has been reduced and the Indicative Disturbance Footprint remains generally unchanged (now 423.11 ha, compared to 423.19 ha), the area of critical habitat impacted by the Proposal has increased by 1.86 ha since the Commonwealth assessment.

In summary, the DEE assessed, and in some cases conditioned, the following:

- Indicative Disturbance Footprint clearing no more than 423.19 ha. (*Note: Current indicative footprint now 423.11 ha.*)
- The removal of two nocturnal refuges (CO-CA-08 and CO-CA-15), both of which support the Ghost Bat and one of which supports the Pilbara Leaf-nosed Bat.
- No direct impact to any of the 11 water sources (i.e., pools) identified as significant microhabitat features.
- Maintenance of at least a 340 m buffer around the lateral extent of cave CO-CA-01, a permanent diurnal roost for the Pilbara Leaf-nosed Bat.
- Maintenance of a 25 m buffer around the lateral extent of cave CO-CA-03, a non-permanent breeding roost for the Pilbara Leaf-nosed Bat. (*Note: The buffer between the Proposal and the back of the cave is now 68 m.*)
- Temporary daytime abandonment of the non-permanent breeding roost (cave CO-CA-03) by the Pilbara Leaf-nosed Bat due to disturbance from blasting operations in the Razorback pit.
- The removal of 57.76 ha of critical habitat for Northern Quoll, specifically Rocky Ridge and Gorge, Rocky Foothill, Drainage Line and Riverine habitats. (*Note: as identified above this has reduced by 1.37 ha to 56.39 ha since the time of this assessment*). This area also encompasses 39.82 ha of critical habitat for the Pilbara Olive Python and 44.95 ha of critical habitat for both the Pilbara Leaf-nosed Bat and Ghost Bat.

- The removal of an additional 358.03 ha of foraging and dispersal habitat for Pilbara Leaf-nosed Bat (which may also support the Ghost Bat). This is equivalent to the area of the Indicative Disturbance Footprint, excluding critical habitat and the 7.4 ha of 'cleared habitat' mapped by Woodman (2016a). (*Note: Now 366.73 ha associated with realignment of the footprint and reduction to critical habitat value above.*)
- No significant impact to the Ghost Bat given it does not appear to be reliant on habitat within the Study Area (i.e., no significant roosts and only sporadic visitation recorded).

To address potential impacts to the Pilbara Leaf-nosed Bat associated with impacts to cave CO-CA-03 and associated pool CO-WS-14, Atlas Iron is required to prepare a Monitoring Strategy, in accordance with Condition 4 of this approval, to demonstrate that these two values continue to provide suitable habitat for this species. Mining in Razorback Pit cannot commence until this Monitoring Strategy has been approved by the Commonwealth Minister.

Furthermore, Atlas Iron is required to offset significant habitat impacts, through funding contribution to the Pilbara Conservation Offset Fund, at the following rate and in accordance with Condition 5(a):

- AUD $3,000 (excluding GST) per hectare of critical habitat.
- AUD $1,500 (excluding GST) per hectare of foraging habitat for Pilbara Leaf-nosed Bat.

In the instance the Pilbara Conservation Offset Fund is not established in time to receive these funds, Atlas Iron will need to submit an Offset Strategy in accordance with condition 5(b) and (c) to address these impacts.

10. Holistic Impact Assessment

Various biological and physical studies have been completed over the last five years to identify key environmental values and assess the risk of impact to these values from the Proposal. Where there has been information gaps or scientific uncertainty, Atlas Iron has sought to address these through additional investigations and specialist advice and has otherwise applied a conservative approach when assessing risk.

Careful evaluation has been made of options to avoid or minimise any potential environmental impacts, followed by the identification and development of management measures and rehabilitation considerations for any residual risks to key environmental factors in consideration of the Environmental Objectives for each environmental factor, as well as the EPA's Environmental Principles (detailed further in Chapter 4). Key environmental values avoided include:

- Both significant diurnal roosts for the Pilbara Leaf-nosed Bat and the majority of nocturnal refuges for this species and/or the Ghost Bat (i.e., 14 of the 16).
- All five perennial and six ephemeral pools.
- Two of the five conservation significant flora species (*Rothia indica* subsp. *australis* (P1) and *Acrostichum speciosum* (other)) and the majority of locations of the remaining three species (*Eragrostis crateriformis* (P3), *Heliotropium murinum* (P3) and *Swainsona thompsoniana* (P3)) so that only one location of each of these species will be disturbed.

Detailed assessment of the Proposal's impact on each of the environmental factors, including relevant mitigation, management and rehabilitation commitments and the residual/predicted outcomes is provided in Chapters 5, 6, 7 and 8. In accordance with Atlas Iron's HSEMS, an EMP will be developed and implemented to capture these commitments and ensure impacts to environmental values are mitigated to ALARP. The EMP will also capture any relevant conditions and requirements of other regulatory mechanisms, including the following existing approvals held by this Proposal, EPBC 2017-7861 and Works Approval W6043.

When assessing the Proposal's impacts, it is important to be aware of and consider the various connections and interactions between environmental factors. For instance, Terrestrial Environmental Quality, specifically soil type and availability, is directly linked to and associated with the type of Landform. Landform and Terrestrial Environmental Quality (soils) are also linked to Flora and Vegetation and Terrestrial Fauna, as they control species composition and thus the vegetation types present, and provide differing habitat values. Specifically, this Proposal recognises that those habitats and VTs that are recognised as significant are most often associated with landforms that are uncommon and/or restricted (e.g., Rocky Ridge and Gorge). Landforms also; provide habitat for Subterranean Fauna, are shaped by Inland Waters and can be a significant value for Social Surroundings, as is the small mesa excised from the Development Envelope because of its potential value as a heritage site (i.e., CRD-51-16).

Another specific relationship between key environmental factors is the relationship between Inland Waters, Flora and Vegetation and Terrestrial Fauna, specifically the presence of permanent pools and groundwater seeps, which support groundwater dependent vegetation, provide an important water resource for terrestrial fauna, and may support the maintenance of diurnal roosts (i.e., humidity) for the Pilbara Leaf-Nosed Bat (e.g., Cave CO-CA-03).

Because of these relationships, impacts of the Proposal on one environmental factor also often have implications for other environmental factors. Table 10.1 provides a holistic overview of the potential risks of the Proposal on the various environmental factors, both directly and indirectly. It also demonstrates how key management measures often address multiple impacts across various environmental factors.

A summary of the findings for each key environmental factor, including potential impacts, proposed mitigation and predicted outcomes can be found in the Executive Summary (Table ES3).

In summary, with the exception of Terrestrial Fauna, the Proposal is not currently predicted to have a significant residual impact on any environmental factor and so is anticipated to meet the EPAs environmental objectives. While significant residual impacts on Terrestrial Fauna are anticipated (refer to Section 7.7), Atlas Iron believes the EPA's objective for this factor can be met with the implementation of the SSMP and EMP and execution of the offset package required by EPBC 2017/7861 (refer to Chapter 9) which is anticipated to result in positive outcomes for the environment that counterbalances the predicted outcomes.

Table 10.1 – Holistic Impact Assessment Summary

Contributing Activity/ Cause	Risk Summary by EPA Theme and Factor								Mitigations and Key Regulatory Mechanisms
	Land					Water	Air	People	
	Flora & Vegetation	Terrestrial Fauna	Subterranean Fauna	Landforms	Terrestrial Environmental Quality	Inland Waters	Air Quality	Social Surroundings	
Clearing, earthworks and vehicle movements (including haulage)	Direct loss of vegetation and flora. Decline in vegetation quality and poor revegetation/ rehabilitation success associated with introduction and/or spread of weeds, dust and loss of soil and changes to soil structure.	Direct loss and fragmentation of habitat. Vehicle interactions with fauna resulting in death/ injury. Decline in habitat quality and poor revegetation/ rehabilitation success associated with introduction and/or spread of weeds, dust, loss of soil and changes to soil structure.	Removal of troglofauna habitat/ individuals.	Reduced landform diversity/ integrity.	Changes to soil availability, quality and structure.	Increased sediment/ turbidity.	Reduced air quality.	Direct loss of known/ unknown heritage sites. Dust/ noise impacts on sensitive receivers.	Compliance with EPBC 2017/7861, including the provision of environmental offsets and implementation of the SSMP. Development of a Project EMP, which will include reference to the following procedures: • GDP Procedure (950-HSE-EN-PRO-0001). • Clearing and Grubbing Procedure (950-HSE-EN-PRO-0004). • Flora Management Procedure (950-HSE-EN-PRO-0010). • Fauna Management Procedure (950-HSE-EN-PRO-0012) • Weed Hygiene Procedure (950-HSE-EN-PRO-0002). • Dust Management Procedure (950-HSE-EN-PRO-0026). This will include the following key mitigation: • No more than 423.11 ha of vegetation/habitat within the 2,257.6 ha Development Envelope will be cleared/disturbed. • Clearing in/of sensitive habitats including caves, pools, gorges, ridges, outcrops, drainage lines, scree slopes and crevices will be kept to the minimum necessary for safe construction and operation of the Proposal. • Restricting clearing to the minimum necessary for safe construction and operation of the Proposal and to within approved areas through internal GDP Procedure. • Surveying and delineation of the GDP boundary in the field prior to any works commencing, including all buffers and values to be avoided and weed infested areas. • Signage identifying the presence of conservation significant fauna will be installed along the roads, where they intersect suitable habitat, specifically: – Drainage Line habitat. – Riverine habitat. – Rocky Ridge and Gorge habitat. – Rocky Foothills habitat. • Implementation of standard dust suppression techniques on roads, stockpiles and infrastructure areas (e.g., water carts, sprinklers).
Water abstraction	Indirect loss of and/or change in health of GDV and/or vegetation of the ‘soak’.	Indirect loss of and/or change in health of habitat associated with GDV (i.e., perennial pools or drying up of the seep in the back of cave CO-CA-03).	Drying out of habitat through the lowering of the groundwater table.			Reduced groundwater availability. Loss of perennial pools. Localised upwelling of saline groundwater and associated		Reduced groundwater availability/ quality for other groundwater users.	The key regulatory mechanism relevant to this activity is the 5C Licence to take water under the RIWI Act and associated Water Management Plan and Site Water Operating Plan (*in preparation*). These documents are currently being prepared following completion of recent hydrological investigation and revised drawdown modelling and will contain site-specific triggers, thresholds and contingencies for GDV (and associated habitat) and perennial pools developed in collaboration with the relevant regulatory agencies (i.e., DWER). Development of a Project EMP which will include reference to the above documentation/approval requirements.

Contributing Activity/ Cause	Risk Summary by EPA Theme and Factor								Mitigations and Key Regulatory Mechanisms
	Land					Water	Air	People	
	Flora & Vegetation	Terrestrial Fauna	Subterranean Fauna	Landforms	Terrestrial Environmental Quality	Inland Waters	Air Quality	Social Surroundings	
		Alteration of fauna behaviour associated with loss of habitat (i.e., possible permanent abandonment of PLNB from cave CO-CA-03).				aquifer degradation.			
Mining of pits (including drilling and blasting)	Removal of landforms support significant VTs (and associated flora). Dust emissions resulting in a decline in vegetation quality.	Removal of landforms/ significant habitat. Structural damage to cave CO-CA-03 and/or change in humidity preventing ongoing use by Pilbara Leaf-nosed Bat on cessation of mining. Dust/noise emissions resulting in decline in habitat quality and/or altered fauna behaviour, including abandonment of significant diurnal roosts by PLNB.	Removal of troglofauna habitat/ individuals.	Reduced landform diversity/ integrity.		Dust resulting in increased turbidity in pools.	Reduced air quality.	Dust/noise impacts on sensitive receivers. Reduced vegetation/ grazing quality.	Compliance with EPBC 2017/7861, including the provision of environmental offsets, development and implementation of a monitoring strategy for Cave CO-CA-03 and implementation of the SSMP. Development of a Project EMP, which will include reference to the above documentation/approval requirements and Atlas Iron's Dust Management Procedure (950-HSE-EN-PRO-0026), which includes the implementation of standard dust suppression techniques on roads, stockpiles and infrastructure areas (e.g., water carts, sprinklers).
Excavation, handling and disposal of problematic waste rock (i.e., PAF shale, clay-rich BIF and shale, shale with elevated mercury)	Mercury absorption by plant and/or poor revegetation/ rehabilitation success resulting from erodible waste dump surfaces.	Poor revegetation/ rehabilitation success. Mercury toxicity resulting from erodible waste dump surfaces			Erosion of waste dump surfaces. Soil contamination (elevated mercury).	Water contamination (lowering of pH, release of mercury, increased turbidity).			Completion of an additional waste characterisation-drilling program, to confirm the presence/absence of PAF shale. Development of a Project EMP, which will include reference to the Waste Rock Management Strategy (Appendix B) and Split Rock waste rock dump design (Figure 2.2). This will include the following key mitigation: • Ensure any PAF shale waste rock material if present is appropriately managed (i.e., encapsulated). • Ensure clay rich BIF and geochemically benign NAF shale are not placed on sloped surfaces of waste rock dumps, or used initially in the construction of mine site infrastructure (e.g., access ramps) given their susceptibility to surface erosion. • Any NAF shale with elevated Hg is buried 10 m below final surface of profiled landform (i.e., below rooting zone of most vegetation) to prevent absorption by plants.

Contributing Activity/ Cause	Risk Summary by EPA Theme and Factor								Mitigations and Key Regulatory Mechanisms
	Land					Water	Air	People	
	Flora & Vegetation	Terrestrial Fauna	Subterranean Fauna	Landforms	Terrestrial Environmental Quality	Inland Waters	Air Quality	Social Surroundings	
									• Ensure appropriate surface water management is incorporated into the final mine design, in accordance with the objectives and design principles.
Transport, handling, use and storage of hydrocarbons and chemicals	Reduced vegetation quality and revegetation/ rehabilitation success.	Reduced habitat quality and revegetation/ rehabilitation success.			Soil contamination.	Water contamination.			Development of a Project EMP, which will include reference to the following procedures: • Hydrocarbon Management Procedure (950-HSE-EN-PRO-0005). • Hydrocarbon (and Chemical) Spill Management Procedure (950-HSE-EN-PRO-0007). This will include the following key mitigation: • Containment of hydrocarbons in accordance with *AS1940:2004 – The Storage and Handling of Flammable and Combustible Liquids*, this includes sitting and bunding/containment restrictions, provision and maintenance of relevant MSDS and regular inspections. • Refuelling procedures, including the provision of a spill kit at all refuelling stations. • Spill recovery and clean up materials maintained at all hazardous material storage areas. Relevant employees and contractors will be trained in the use of this equipment. • The storage and regular disposal offsite by a licenced controlled waste contractor, of waste hydrocarbons (e.g., waste oil and used oil filters).
Generation and disposal of waste materials, (excluding waste rock)	Reduced vegetation quality and rehab. success associated with soil and water contamination	Introduction/attraction of introduced species, which may predate on/compete for resources with native fauna. Reduced habitat quality and rehabilitation success associated with soil and water contamination.			Soil contamination.	Water contamination.		Wind-blown waste/ loss visual amenity.	Compliance with EPBC 2017/7861, DWER Works Approval (W6043) and associated licence (L9045) conditions. Development of a Project EMP, which will include reference to the above approvals and the following procedures: • Wastewater Treatment Plant (WWTP) Care and Maintenance Plan (950-HSE-EN-PLN-0001) • WWTP Management Plan (950-HSE-EN-PLN-0002) • WWTP Sampling Procedure (950-HSE-EN-PRO-0025) • Bioremediation Management Procedure (950-HSE-EN-PRO-0013) • Landfill Management Procedure (950-HSE-EN-PRO-0020) • Introduced Fauna/Pest Control Procedure (950-HSE-EN-PRO-0022) • Waste Management Procedure (950-HSE-EN-PRO-0023) This will include the following key mitigation: • The landfill will be operated and managed in accordance with the Environmental Protection (Rural Landfill) Regulations 2002. This will include fencing to reduce the potential for attracting fauna. • Record all introduced fauna sightings and the implement feral animal control program, as required (i.e., where sightings are regular and/or if nuisance or dangerous individuals are recorded). • All waste shall be segregated appropriately to enable effective reuse, recycling, transport and disposal as appropriate.

Contributing Activity/ Cause	Risk Summary by EPA Theme and Factor								Mitigations and Key Regulatory Mechanisms
	Land					Water	Air	People	
	Flora & Vegetation	Terrestrial Fauna	Subterranean Fauna	Landforms	Terrestrial Environmental Quality	Inland Waters	Air Quality	Social Surroundings	
Crushing and screening of ore	Dust emissions resulting in a decline in vegetation quality.	Dust/noise emissions resulting in decline in habitat quality and/or altered fauna behaviour,					Reduced air quality.	Dust/noise affects sensitive receivers. Reduced vegetation/ grazing quality.	Compliance with EPBC 2017/7861, DWER Works Approval (W6043) and associated licence (L9045) conditions. Development of a Project EMP, which will include reference to the above approvals and the Dust Management Procedure (950-HSE-EN-PRO-0026). This will include the following key mitigation: • Implementation of appropriate dust suppression mechanisms (e.g., sprinklers, water sprays and water carts) on roads, stockpiles and infrastructure areas.
Physical presence of Proposal (including human presence)	Changes to surface water flows, drainage shadowing/ ponding and/ or erosion affecting vegetation quality and rehabilitation success. Loss of vegetation associated with Proposal related fire	Changes to surface water flows, drainage shadowing/ponding and/or erosion affecting vegetation/habitat quality and rehabilitation success. Loss of habitat and/or individuals associated with fire.			Changes to surface water flows resulting in scour/ erosion.	Changes to surface water flows resulting in drainage shadowing/ponding and/or erosion affecting surface water contribution to pools and increased turbidity.		Reduced availability of grazing resources (i.e., pastoralists).	Development of a Project EMP, to ensure appropriate surface water management is incorporated into the final mine design and maintained, in accordance with the following objectives and design principles: • Diverting naturally occurring local surface water around mine infrastructure by means of drainage channels, earth bunds, and road culverts with adequate scour protection where necessary. Note Atlas Iron will not be actively diverting clean runoff around pits, instead allowing surface water flows to drain into and collect within pit (where not diverted by safety bunds/windrows). • Isolating the waste rock dump areas from external runoff (i.e., clean stormwater) by bunding around the perimeter and encouraging the minimal internal flows to be retained and infiltrate and/or evaporate. Internal flows will otherwise be directed to a sedimentation pond, where the bulk of the suspended material will be settled out prior to any discharge to the downstream environment. • Waste rock dumps will be designed to minimise infiltration and leachate development, and to resist erosion and sediment migration to the downstream environment.

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Appendix A Waste Rock Geotechnical Assessment

Appendix B Waste Rock Management Strategy

Appendix C Stakeholder Consultation Register

Appendix D Mine Closure Plan

Appendix E Surface Water Environmental Impact Assessment

Appendix F Hydrogeological Investigation

Appendix G H3 Hydrogeological Study

Appendix H Baseline Flora and Vegetation Assessment

Appendix I Flora and Vegetation Impact Assessment

Appendix J Groundwater Dependent Vegetation Drawdown Impact Assessment

Appendix K Baseline Vertebrate Fauna Survey

Appendix L Vertebrate Fauna Impact Assessment

Appendix M Baseline SRE Invertebrate Fauna Survey

Appendix N SRE Invertebrate Fauna Impact Assessment

Appendix O Importance of CO-CA-03 for the Pilbara Leaf-nosed Bat

Appendix P Cave CO-CA-03 Pilbara Leaf-nosed Bat Roost Census

Appendix Q Razorback Cave CA-CO-03 Geotechnical Memorandum

Appendix R Significant Species Management Plan (including Pilbara Leaf-nosed Bat/Ghost Bat and Northern Quoll Monitoring Programs)

Appendix S Subterranean Fauna Assessment

Appendix T Subterranean Fauna EIA Re-Assessment

Appendix U Soil Resource Assessment and Waste Characterisation

Appendix V Air Quality Assessment

Appendix W Noise Impact Assessment

Appendix X Revised Noise Impact Assessment