NORTHERN STAR
RESOURCES LTD

PRELIMINARY DOCUMENTATION

HEMI GOLD PROJECT

May 2026

Document	Reviewed	Approved
Site Name: Hemi Gold Project	Erin Lee	Duanne Ginger

Version History

Version Number	Summary of Changes	Date
0	Initial version	16.07.2024
1	Addressing DCCEEW comments	30.05.2025
2	Addressing additional comments	11.08.2025
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Prepared by

Prepared for

Executive Summary

Northern Star (Hemi) Pty Ltd (Northern Star) (a wholly owned subsidiary of Northern Star Resources Ltd) is proposing to develop the Hemi Gold Project (Hemi, or the Proposed Action), located approximately 85 km south of Port Hedland in the Pilbara Region of Western Australia (WA). Hemi is a greenfield gold mining project involving the excavation of open pits, mine dewatering, surplus water management, and associated infrastructure. Northern Star Resources Ltd acquired Hemi through the purchase of De Grey Mining Ltd on 5 May 2025.

The Proposed Action was referred to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) on 15 May 2023. On 15 November 2023, De Grey received formal notification from a delegate of the Minister for the Environment and Water that the proposed action is a Controlled Action, to be assessed by Preliminary Documentation for the following controlling provisions:

- Listed Threatened species and communities (sections 18 and 18A of the EPBC Act); and
- Listed migratory species (sections 20 and 20A of the EPBC Act).

This document has been prepared in accordance with the requirements of the '*Request for Further Information for Preliminary Documentation*' provided to De Grey on 18 January 2024. A summary of the related Matters of National Environmental Significance (MNES), potential impacts from the Proposed Action and measures for avoidance and mitigation are provided in Table ES 1.

Table ES 1: MNES Summary

MNES	Discussion
Fringed Fire-Bush *Seringia exastia*	• Current status under EPBC Act – Critically Endangered. • Recently synonymised with *Seringia elliptica* after a taxonomic review. • Delisted under Western Australian *Biodiversity Conservation Act 2016*, waiting for delisting under EPBC Act. • Species was assigned *Seringia exastia* name due to taxonomic nomenclature rules stating the oldest existing name is to be used. • Species is common and widespread, ranging over 2.6 million km^2 in northern and central Western Australia, South Australia and Northern Territory. • Two populations were recorded within the Development Envelope. • No specific avoidance or mitigation measures are proposed as the Proposed Action will not have a significant impact on the species.
Northern Quoll *Dasyurus hallucatus*	• Current status under the EPBC Act – Endangered. • Major River habitat identified as critical habitat, of which a maximum of 10 ha is proposed for low impact clearing for the mine surplus water discharge outfall. • Northern Quoll recorded with camera traps in Yule and Turner Rivers. • Yule River and supporting Major River habitat excluded from Development Envelope. • Rocky Outcrop habitat excluded from Development Envelope. • Quality of mine surplus water discharge to meet specific approved criteria prior to discharge. • Northern Star to implement feral species (foxes and cats) monitoring and control program as required. • Management provisions are detailed within the Fauna Management Plan. • Northern Star proposes to offset 10 ha of Major River habitat through a contribution to the Pilbara Environmental Offset Fund (PEOF). • Northern Star proposes to offset a maximum of 41 ha of foraging and dispersal habitat through a contribution to the PEOF.

MNES	Discussion
Night Parrot *Pezoporus occidentalis*	• Current status under the EPBC Act – Endangered. • No Night Parrot recordings during field surveys through deployment of Song Meters (SM4s). • Spinifex habitat is located within the Development Envelope, however consistent fires over the past 25 years have reduced its suitability for roosting and breeding for the Night Parrot. • Northern Star to implement feral species (foxes and cats) monitoring and control program as required. • Northern Star will implement pre-clearance surveys prior to land disturbance. • A residual significant impact is considered unlikely to the Night Parrot; therefore, no offsets are proposed.
Greater Bilby *Macrotis lagotis*	• Status under the EPBC Act – Vulnerable. • 5,759 ha of the indicative disturbance footprint is considered critical habitat for the Greater Bilby. • Secondary signs of Greater Bilby were recorded during field surveys with no active burrows recorded within the Development Envelope. • Greater Bilby habitat is widespread and common throughout the Pilbara bioregion. • The proposed Development Envelope covers 0.16% of Greater Bilby habitat within Pilbara bioregion. • The proposed indicative disturbance footprint impacts 0.04% of Greater Bilby habitat within Pilbara bioregion. • Clearing will be limited to minimum extent required for the Proposed Action. • Northern Star to implement feral species (foxes and cats) monitoring and control program as required. • Northern Star will implement pre-clearance surveys prior to land disturbance, relocating Greater Bilby individuals by qualified personnel if required. • Management provisions are detailed within the Fauna Management Plan. • Northern Star proposes to offset 5,759 ha of sandplain habitats through a contribution to the PEOF.
Grey Falcon *Falco hypoleucos*	• Current status under the EPBC Act – Vulnerable. • No nests or individuals were recorded during field surveys. • Major River habitat identified as critical habitat, of which 10 ha is proposed for low impact clearing for the mine surplus water discharge outfall. • Trees suitable for nesting will be avoided where possible from clearing within the Major River habitat. • Northern Star to implement feral species (cats) monitoring and control program as required. • A residual significant impact is considered unlikely for the Grey Falcon therefore no environmental offset is proposed; however up to 10 ha of Major River is proposed to be offset for the Northern Quoll.
Pilbara Leaf-nosed Bat *Rhinonicteris aurantia*	• Current status under the EPBC Act – Vulnerable. • No roosts were recorded within the Development Envelope, with the closest known roost 17 km south of Development Envelope. • Recordings across Development Envelope from echolocation recorders (AnaBat) in Priority 5 foraging habitat. • No Priority1 or 2 foraging habitats identified within the Development Envelope. • Priority 3 foraging habitat is avoided, 10 ha of disturbance to Priority 4 foraging habitat and the remaining Project disturbance is to Priority 5 foraging habitat. • A residual significant impact is not anticipated for the Pilbara Leaf-nosed bat; therefore, no environmental offsets are proposed. Nevertheless, Major River habitat identified as Priority 4 foraging habitat is proposed to be offset for

MNES	Discussion
	Northern Quoll and Priority 5 foraging habitat (excluding Stony Hills habitat) is proposed to be offset for Greater Bilby.
Ghost Bat *Macroderma gigas*	• Current status under the EPBC Act – Vulnerable. • No roosts were recorded within the Development Envelope, with the closest known roost 35 km south of the Proposed Action. • No habitat suitable to provide caves, rocky shelters or mine adits is located within the Development Envelope. • Foraging habitat that supports a roosting colony is unlikely to occur within the Development Envelope, as the closest known roost is 35 km south of the Proposed Action (Ghost Bat foraging habitat within 12 km of a diurnal roost). • No specific avoidance or mitigation measures specific to Ghost Bat are proposed, with measures overlapping with other species • A residual significant impact is considered unlikely from the Proposed Action; therefore no environmental offsets are proposed for Ghost Bat.
Pilbara Olive Python *Liasis olivaceus barroni*	• Current status under the EPBC Act – Vulnerable. • No recordings from field surveys or eDNA analysis. • Major River habitat identified as potential critical habitat, of which a maximum of 10 ha is proposed for low impact clearing for the mine surplus water discharge outfall. • Rocky Outcrop habitat identified as potential critical habitat is excluded from Development Envelope. • Northern Star to implement feral species (foxes and cats) monitoring and control program as required. • Northern Star proposes to offset 10 ha of Major River habitat through a contribution to the PEOF.
Migratory Birds	• One recording of Fork-tailed Swift was noted in the fauna study area, however this was outside of Development Envelope. • No important populations or important wetlands recorded within the Development Envelope. • Northern Star to implement feral species (foxes and cats) monitoring and control program as required. • A residual significant impact is considered unlikely from the Proposed Action on Migratory species; therefore, no environmental offsets are proposed.

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GLOSSARY

Abbreviation	Meaning
ACHMP	Aboriginal cultural heritage management plan
AEP	Annual exceedance probability
AMD	Acid and metalliferous drainage
ANE	Ammonium nitrate emulsion
ANZG	Australian and New Zealand Fresh and Marine Water Quality
CASA	Civil Aviation Safety Authority
COA	Commonwealth of Australia
CSSMP	Conservation Significant Species Management Plan
DAWE	Department of Agriculture, Water and the Environment
DBCA	Department of Biodiversity, Conservation and Attractions
DCCEEW	Department of Climate change, Energy, the Environment and Water
DEMIRS	Department of Energy, Mines, Industry Regulation and Safety
DISR	Department of Industry, Science and Resources
DMPE	Department of Mines, Petroleum and Exploration
DoEE	Department of Environment and Energy
DWER	Department of Water and Environmental Regulation
DPAW	Department of Parks and Wildlife
DPLH	Department of Planning, Lands and Heritage
EAAF	East Asian-Australasian Flyway
eDNA	environmental DNA - organismal DNA that can be found in the environment
EIA	Environmental Impact Assessment
EP Act	*Environmental Protection Act 1986*
EPA	Environmental Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ERA	Ecological Risk Assessment
GDV	Groundwater dependent vegetation
GIS	Geographical Information System
GHG	Greenhouse gas
GL/year	Gigalitres per year
GPS	Global Positioning System
GWOS	Groundwater operating strategy
ha	Hectares
IBRA	Interim Biogeographic Regionalisation for Australia
IWL	Integrated waste landform
KAC	Kariyarra Aboriginal Corporation
km	Kilometre
km²	Square kilometres
km/h	Kilometres per hour

Abbreviation	Meaning
LG	Low-grade
m	Metre
mbgl	Metres below ground level
MCP	Mine Closure Plan
mg/L	Milligrams per litre
ML/day	Megalitres per day
mm	Millimetre
MNES	Matters of National Environmental Significance
MP	Mining Proposal
MRF	Mine Rehabilitation Fund
MRWA	Main Roads Western Australia
Mtpa	Million tonnes per annum
NAF	Non-acid forming
NMD	Neutral metalliferous drainage
NVCP	Native Vegetation Clearing Permit
NWIS	North West Interconnected System
PDWSA	Public Drinking Water Source Area
PEC	Priority Ecological Community
POx	Pressure oxidation
RBN	Reinjection Borefield North
RBS	Reinjection Borefield South
RFDS	Royal Flying Doctor Service
RIWI Act	*Rights in Water and Irrigation Act 1914*
ROM	Run of Mine
SBIA	Social Baseline and Impact Assessment
SPRAT	Species Profile and Threats
SRE	Short Range Endemics
TEC	Threatened Ecological Communities
TSF	Tailings Storage Facility
TSSC	Threatened Species Scientific Committee
µg/L	Microgram per litre
µS/cm	Microsiemens per centimetre
VHF	Very High Frequency
VT	Vegetation type
WA	Western Australia
WoNS	Weed of National Significance
WRL	Waste Rock Landform
WWTP	Wastewater Treatment Plant
YRWR	Yule River Water Reserve

1 Introduction

1.1 Background

Northern Star (Hemi) Pty Ltd (Northern Star) (a wholly owned subsidiary of Northern Star Resources Ltd) is proposing to develop the Hemi Gold Project (Hemi, or the Proposed Action), located approximately 85 km south of Port Hedland in the Pilbara Region of Western Australia (WA) shown in Figure 1-1. The Proposed Action was referred to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) on 15 May 2023. Northern Star acquired Hemi through the purchase of De Grey Mining Ltd (De Grey) on 5 May 2025.

On 15 November 2023, De Grey received formal notification from a delegate of the Minister for the Environment and Water that the proposed action is a Controlled Action, to be assessed by Preliminary Documentation for the following controlling provision:

- Listed Threatened species and communities (sections 18 and 18A of the EPBC Act); and
- Listed migratory species (sections 20 and 20A of the EPBC Act).

1.2 Proponent

The proponent for the Proposed Action is Northern Star (Pilbara) Pty Ltd (Northern Star, the Proponent). The contact details of the proponent are provided below:

Proponent: Northern Star (Hemi) Pty Ltd

Address: Level 4/500 Hay St, Subiaco, WA, 6008

Contact: Duanne Ginger

Title: Environment Manager

Phone: +61 8 6188 2100

Email: mailto:dginger@nsrltd.com

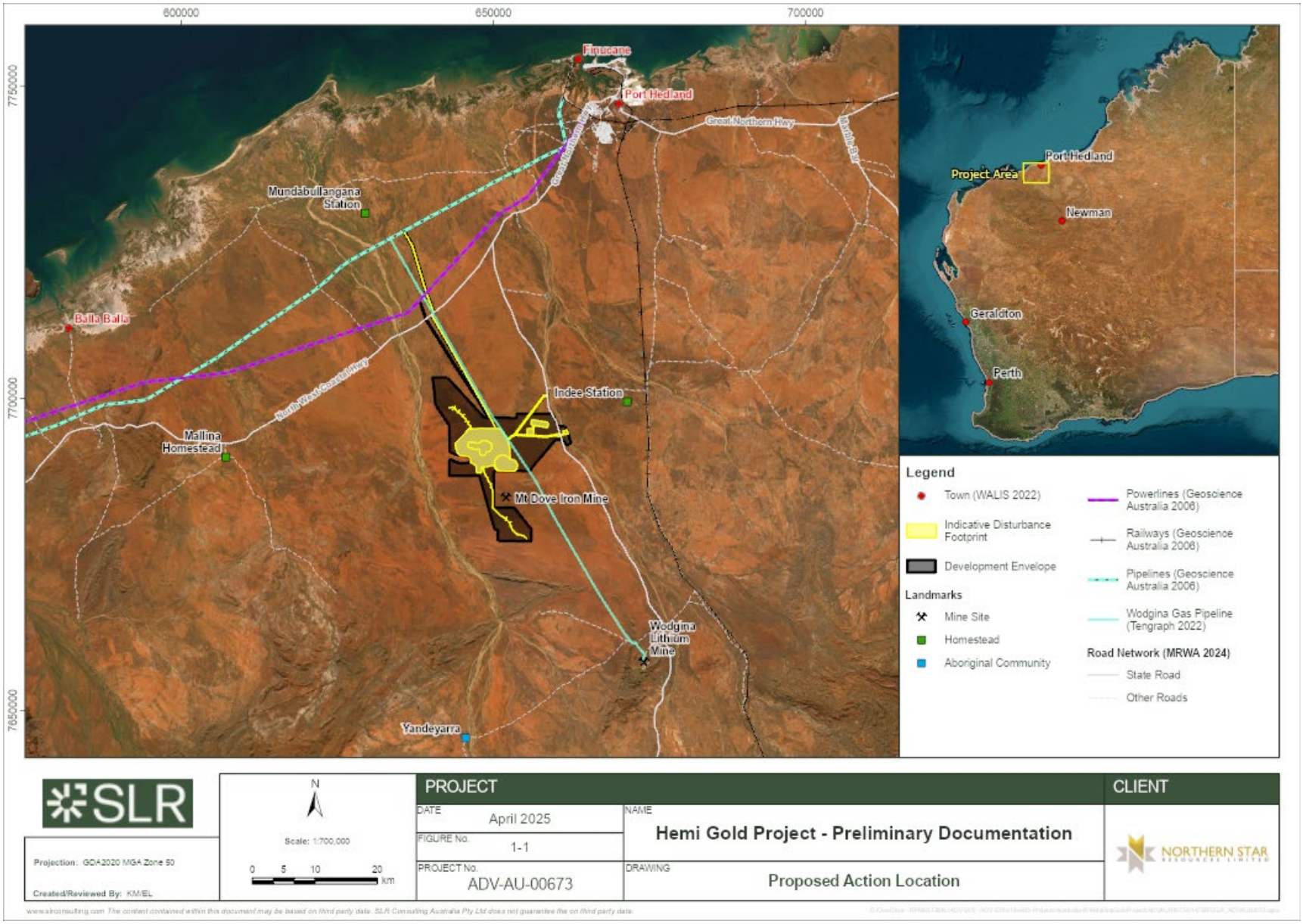
1.3 Purpose and Scope

This Preliminary Documentation is provided to DCCEEW to allow the assessment of the Proposed Action in accordance with Section 95A (2) of the EPBC Act as outlined in the 'Request for Further Information for Preliminary Documentation' provided to De Grey on 18 January 2024. Compliance with Table A, B and C of the request is provided in Appendix 1.

This document has been developed to:

- Describe the Proposed Action and its potential to directly and indirectly impact Matters of National Environmental Significance (MNES).
- Describe the regional and local environment where the Proposed Action would be implemented.
- Provide detailed information for each MNES species listed by DCCEEW, considering the appropriate policy and guidance.
- Identify the potential direct and indirect impacts to MNES from the Proposed Action.
- Describe management measures using the mitigation hierarchy to avoid, minimise and restore.
- Where a residual significant impact to MNES is proposed after the implementation of management measures, an offset provision is provided.

Figure 1-1: Proposed Action Location



2 Proposed Action

2.1 Proposed Action Elements

Hemi is a greenfield gold mining project in the Pilbara region of Western Australia. The site is located within the Shire of the Town of Port Hedland, accessed via the Great Northern Highway. The Proposed Action will initially proceed on the following mining tenure (changes to underlying tenure may occur over the life of the Project):

- Mining Lease M47/1628 held by Northern Star (Hemi) Pty Ltd, a wholly owned subsidiary of Northern Star Resources Ltd. This lease application includes the Hemi deposits and the surrounding area.
- Miscellaneous Licences L45/600, L45/604, L 45/605, L45/612, L47/1047 (pending), L47/1048, L47/1049, L47/966, L47/963, L45/642, L47/1069, L47/1070, L47/1071 held or submitted by Northern Star or Northern Star (Pilbara) Pty Ltd (wholly owned subsidiaries of Northern Star Resources Ltd). These will be used for supporting infrastructure.

The Proposed Action involves the excavation of open pits, mine dewatering, surplus water management including reinjection and controlled discharge. Associated supporting infrastructure includes onsite processing facilities, run of mine pad and ore stockpiles, an integrated waste landform (IWL) tailings storage facility (TSF), waste rock landforms (WRLs), low-grade stockpiles, explosive magazines and compounds, offices, workshops, laydowns, airstrip, workforce accommodation, surface water infrastructure, sealed and unsealed access and haulage roads, power and pipeline corridors, borrow pits, wastewater treatment plants (WWTP), landfills and other ancillary infrastructure.

The Proposed Action will commence with approximately a two-year period of dewatering, earthworks (including pre stripping), and construction activities, followed by operational pre-strip mining and processing. Dewatering activities will be ongoing for the life of mine to allow for safe operations.

The total indicative disturbance footprint for the Proposed Action is anticipated to be up to 5,830 ha within a Development Envelope of 22,194 ha. A summary of the Proposed Action elements is provided in Table 2-1 with the location of key infrastructure shown in Figure 2-1.

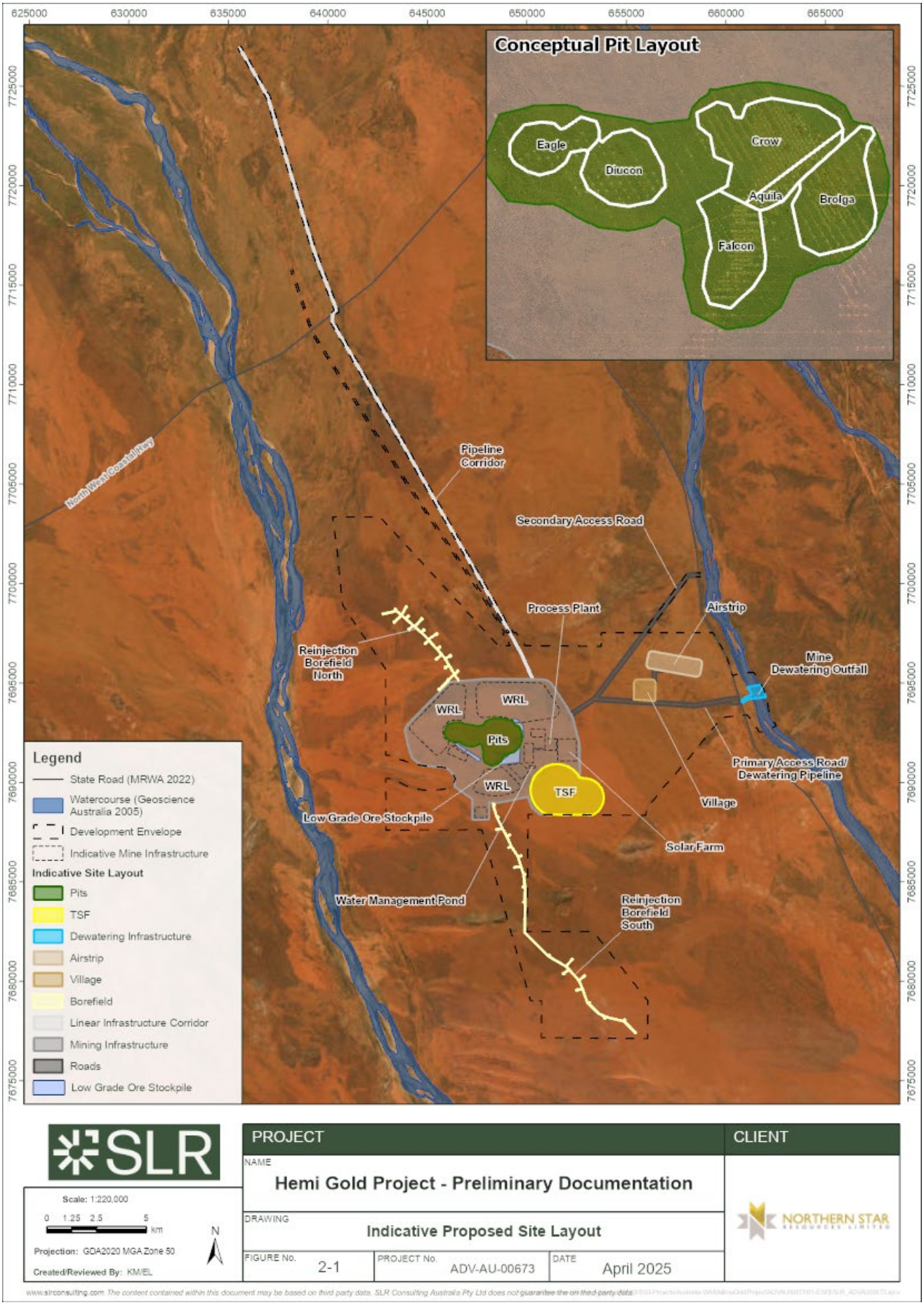
Table 2-1: Proposed Action Summary

Key Element	Details
Location	85 km south of Port Hedland in the Shire of the Town of Port Hedland
Main Activities	Hemi includes excavation of open pits (through traditional drill and blast mining method); mine dewatering; surplus water management including reinjection and controlled discharge; construction of waste rock landforms and low-grade stockpiles; construction and operation of onsite processing facilities; an Integrated Waste Landform Tailings Storage Facility and other supporting infrastructure.
Life of Mine (Approximately)	15 years, inclusive of a 2-year construction period
Proposed Disturbance Footprint	Up to 5,830 ha
Proposed Development Envelope	22,194 ha

Water	• Up to 30 GL/year of dewatering.
	• Up to 100% of water abstracted to be used for aquifer reinjection.
	• Surplus Water discharge:
	  ○ Up to 10 GL/year for the first three years.
	  ○ Up to 4 GL/year in years 4-6.
	  ○ Up to 2 GL/year thereafter.
	• Discharge of surplus water that is of acceptable quality into the Turner River, via water management ponds.

Key Element	Details	
Power	Power supply option to connect to the North West Interconnected System (NWIS), which supplies electrical power to the Pilbara region, with the potential for an on-site solar farm.	
Transport	Gold doré bar will be transported from the site to the Perth mint via airplane.	
Key Infrastructure	**Proposed Infrastructure**	**Indicative Proposed Area**
	Airstrip	Up to 5,830 ha disturbance footprint within a 22,194 ha Development Envelope.
	Borefield	
	Dewatering Infrastructure	
	Mining infrastructure	
	Linear Infrastructure Corridor	
	Open Pits	
	Roads	
	IWL TSF	
	Workforce Accommodation	

Figure 2-1: Indicative Proposed Site Layout



2.1.1 Open Pits

Open cut mining of gold bearing ore from six pits collectively known as the Hemi deposits (Aquila, Brolga, Crow, Diucon, Eagle, and Falcon). These will start as individual pit shells, however, as mining progresses will merge to form two large voids. The mine plan will be based on:

- Detailed geotechnical studies in accordance with regulatory and industry standards to develop safe and stable pits through appropriate wall and bench configurations.
- Optimisation of net present value – the sequence of mining ore and waste from the various open pits initially targets those deposits that provide the most financially advantageous outcome.

2.1.2 Processing

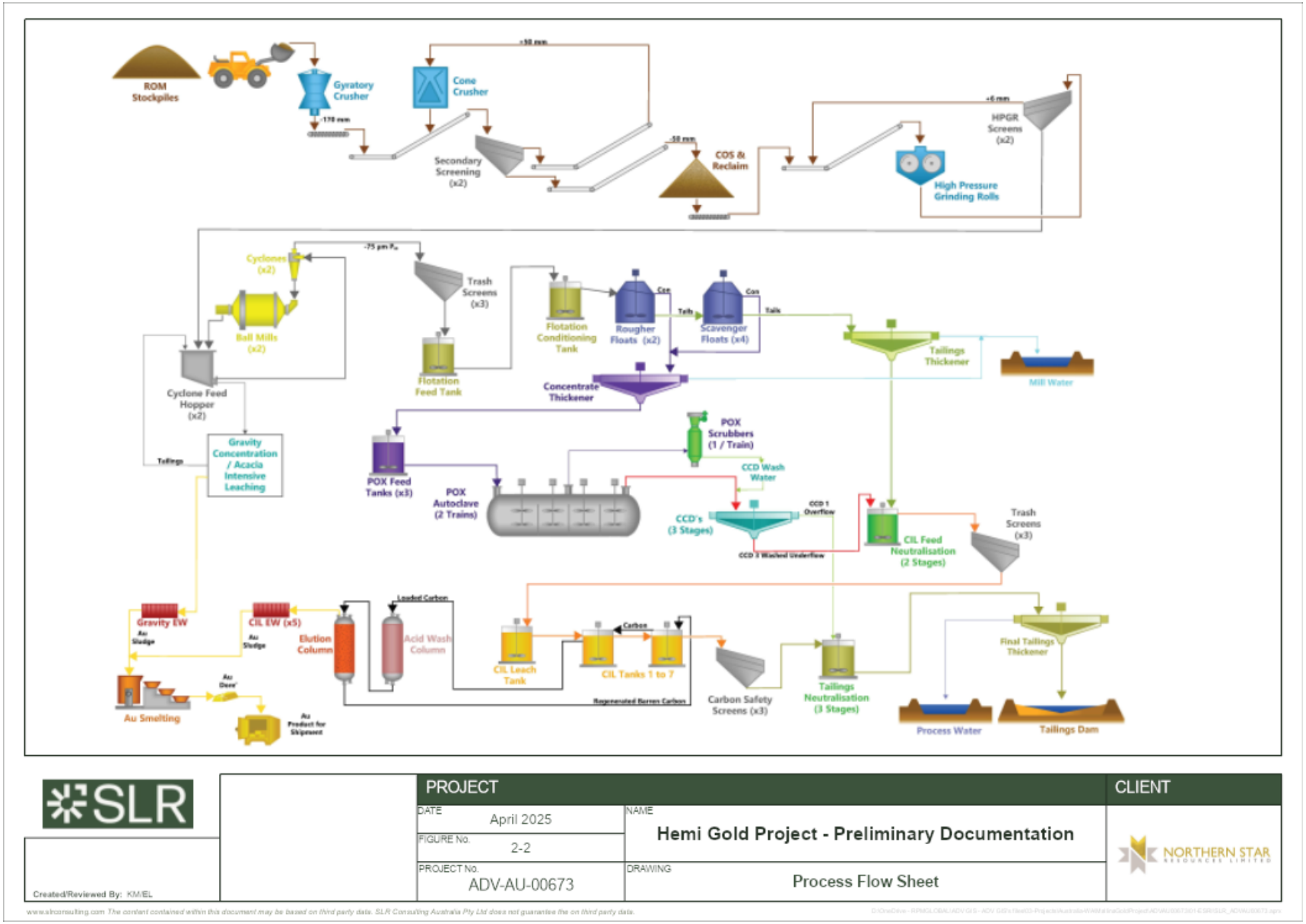
An onsite processing plant, with a ~10 million tonne per annum (Mtpa) throughput, will be constructed to produce gold doré from gold-bearing ore. The process, as shown in Figure 2-2, will consist of:

- A two-stage crushing circuit, followed by high pressure grinding rolls and grinding in a ball mill to reduce ore particle size.
- A gravity gold leaching circuit.
- A flotation circuit that separates out sulfide-bearing material into flotation concentrate.
- A pressure oxidation (POx) circuit that oxidises the sulfides in the flotation concentrate and converts ore into a form amenable to carbon-in-leach processing.
- A carbon-in-leach circuit that treats concentrate from the POx circuit as well as flotation tailings.
- An electrowinning circuit, refining and smelting on-site to produce gold doré.

Tailings will be passed through a thickener to recover process water and then pumped as a slurry to the IWL TSF.

Northern Star may construct a secondary crushing station as mining progresses and haulage distances increase. Provision for this has been allowed for in the indicative disturbance footprint. Crushed ore will most likely be transported by conveyor to the processing plant. This arrangement is likely to reduce diesel consumption associated with haulage in the later stages of the Proposed Action.

Figure 2-2: Process Flow Sheet



2.1.3 Mine Dewatering

Mining at Hemi will be conducted below the water table and mine dewatering is required for safe operations. Abstraction and reinjection activities will commence approximately 24 months prior to the operation of the processing plant and approximately 12 – 15 months prior to mining to lower the alluvial aquifers in the vicinity of the Hemi Deposits. Mine dewatering will continue for the duration of the Proposed Action. The detailed hydrogeological modelling assessment includes a conceptual water balance for the model's domain, which estimates that it has a long-term average inflow and outflow rate of 8.65 GL/year. Chart 2-1 shows the expected groundwater abstraction yearly over the Proposed Actions life of mine.

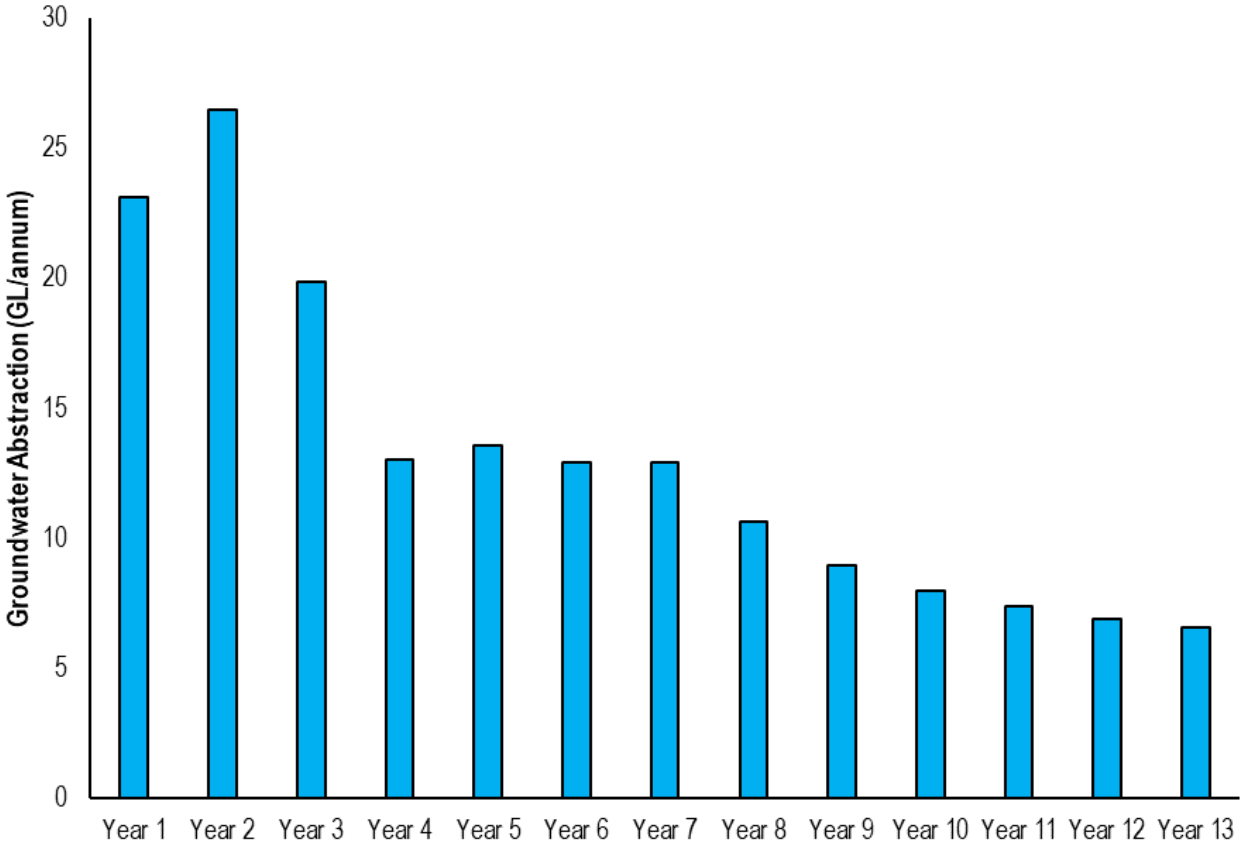


Chart 2-1: Expected Annual Groundwater Abstraction

Northern Star's approach to the management of mine dewater has been developed in accordance with the Western Australia Department of Water and Environmental Regulation's (DWER) policy on the use of mine dewatering surplus (DWER, 2020). The following hierarchy has been adopted:

- Mitigation of environmental impacts – used for dust suppression.
- Support fit-for-purpose on-site activities – used mainly in the ore processing plant when this becomes operational in year three of the Proposed Action, but also for construction activities, potable water, camp and other low-volume activities.
- Transfer of water to local third parties – negotiations are underway with interested parties.
- Reinjection into the upper and lower/paleochannel alluvial aquifers – reinjection borefields will be located north and south of mining infrastructure.
- Controlled release into designated watercourse - surplus water that is of an acceptable quality to be released into the Turner River.

Modelled abstraction rates are up to 30 GL/year for the first three years of dewatering. Northern Star proposes to reinject approximately 50% of the abstracted water during this period back into the aquifer upstream and downstream of the pits. After three years dewatering abstraction rates decline to approximately 13 GL/year and anticipated to be less than 10 GL/year from year 9. Reinjection volumes decline as abstraction declines.

2.1.3.1 Dewatering, Discharge and Reinjection

The groundwater system at Hemi is considered amenable to dewatering by a borefield system, with some groundwater abstraction occurring from in-pit floor sumps. The dewatering system has been designed to manage large volumes of dewatering required from the alluvial aquifers (upper and lower/paleochannel alluvium) and to manage water quality challenges posed by the existing naturally occurring elevated arsenic levels that interact with the orebody.

The Proposed Action distinguishes two dewatering discharge stream types, primarily related to concentrations of arsenic and other trace metals. This is further explained in Section 6.3.2.

2.1.3.2 Production Bores

Groundwater will be abstracted from a network of approximately 122 production bores primarily ex-pit bores targeting the alluvial aquifers adjacent to proposed pits, with some bores located in-pit. The borefield has been designed with pairs of deep and shallow abstraction bores in locations to manage different quality water encountered in deep aquifers down gradient of the ore. This arrangement will allow better separation of groundwater based on quality content at these locations in the proposed pits.

Individual bore yields and water quality characteristics will be confirmed as bores are drilled, developed, and pump tested and sampled for water quality.

2.1.3.3 Reinjection Bores

Two reinjection borefields are proposed – Reinjection Borefield North (RBN) and Reinjection Borefield South (RBS) (Figure 2-3). Reinjection bores will target the thickest and most permeable sections of the upper and lower alluvium/paleochannel aquifers, focusing on locations that will also minimise drawdown extension towards identified environmental values.

Particle tracking analysis of the RBS completed for 200 years, together with modelling of dewatering drawdown, has identified that reinjected water from some of the injection bores within the RBS is expected to recirculate through the aquifer and return to the pits within the life of the Project. However, the southernmost bores within the RBS may take a longer period to return water to the pits due to the distance and flow velocities. The reinjected water to the RBN is expected to follow natural paths away from the pits, though some bores, located in the southernmost portion of the RBN, may recirculate back to the pits. Up to 100% of water abstracted may be reinjected.

2.1.3.4 Surplus Water Discharge to the Turner River

The proposed location of the Turner River outfall is shown in Figure 2-3. The outfall will be designed to ensure impacts to the Turner River are as low as reasonably practicable. The design is being undertaken in consultation with the Traditional Owners. Discharge will be managed in accordance with the water quality requirements as per the CSSMP (Appendix 2).

The Proposed Action is estimated to discharge up to 10 GL/year of surplus water into the Turner River for the first three years of dewatering. Once the processing plant is commissioned and ramped up to nameplate capacity, the utilisation of abstracted groundwater in the processing will reduce discharge into the Turner River (initially up to 60%, gradually increasing to 80 - 100% until the end of the Proposed Action). Intermittent discharge of up to 4 GL/year may occur in years 4 to 6, and up to 2 GL/year is expected from year 7 until the end of the Proposed Action. Predicted discharge volumes are shown in Chart 2-2. These may vary depending on unscheduled shutdowns and significant rainfall events.

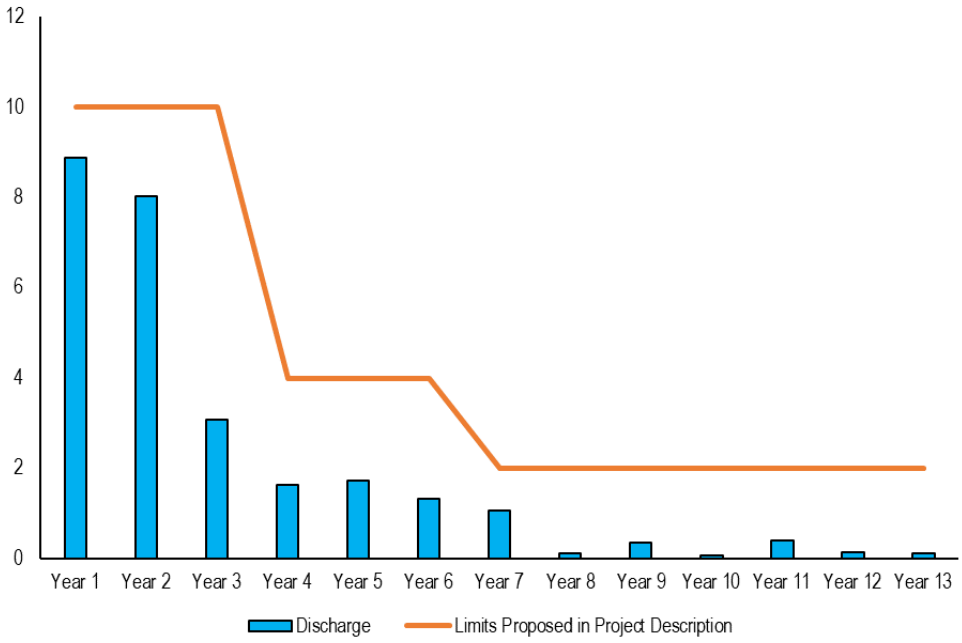
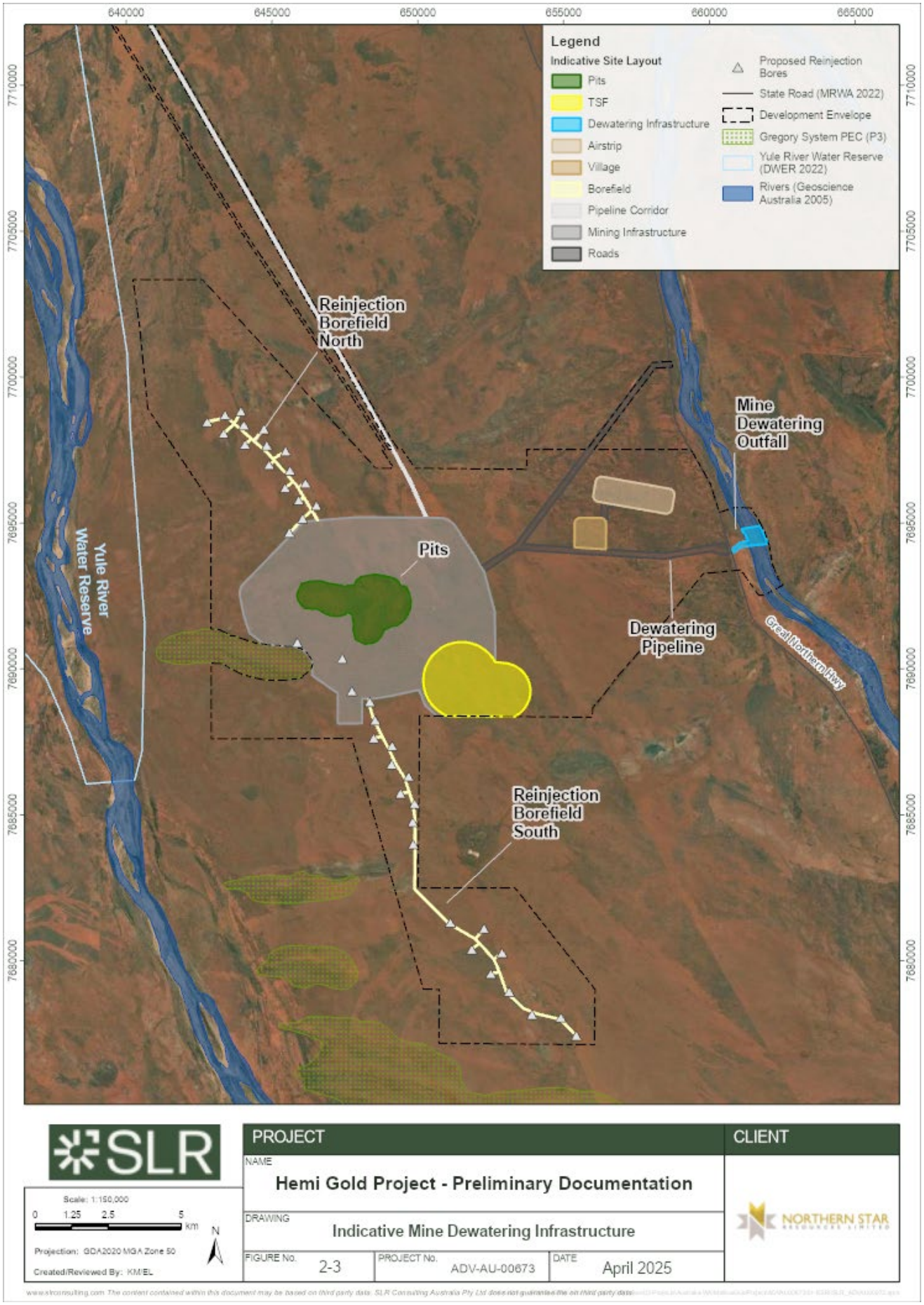


Chart 2-2: Base Case Dewatering and Water Balance Rates

Northern Star is also exploring opportunities to export surplus water to third parties for pastoral, commercial or mining uses. Any commitment to a third-party offtake arrangement will be determined according to their requirements. Before any water is supplied, Northern Star will monitor the aquifer's response to the dewatering against the hydrological modelling estimate to ensure that any contracted offtake quantities can be supplied for the period of the contract.

The hydrogeology of the Proposed Action is described in Section 6.3 together with additional detail on the proposed dewatering strategy.

Figure 2-3: Indicative Mine Dewatering Infrastructure



2.1.4 Tailings Storage

Tailings at Hemi will be stored in an Integrated Waste Landform Tailings Storage Facility (IWL TSF), hereafter referred to as the TSF designed by CMW Geosciences (2025) (Appendix 3). The TSF has been designed in accordance with Code of Practice: Tailings Storage Facilities in Western Australia (DMP, 2013), Guide to the Preparation of a Design Report for Tailings Storage Facilities (DMP, 2015) and Guidelines on Tailings Dams Planning, Design, Construction, Operation, and Closure (ANCOLD, 2019). The TSF design report is provided as Appendix 3

The TSF is designed to have a maximum storage capacity of 136.2 Mt over the life of mine. It will initially be constructed in two cells for the first stage, followed by six additional stages of one complete cell, until the maximum capacity is reached. The TSF will be operated in accordance with an approved TSF Operating Strategy, with regular inspections undertaken by a certified tailings engineer.

The construction of the TSF will include:

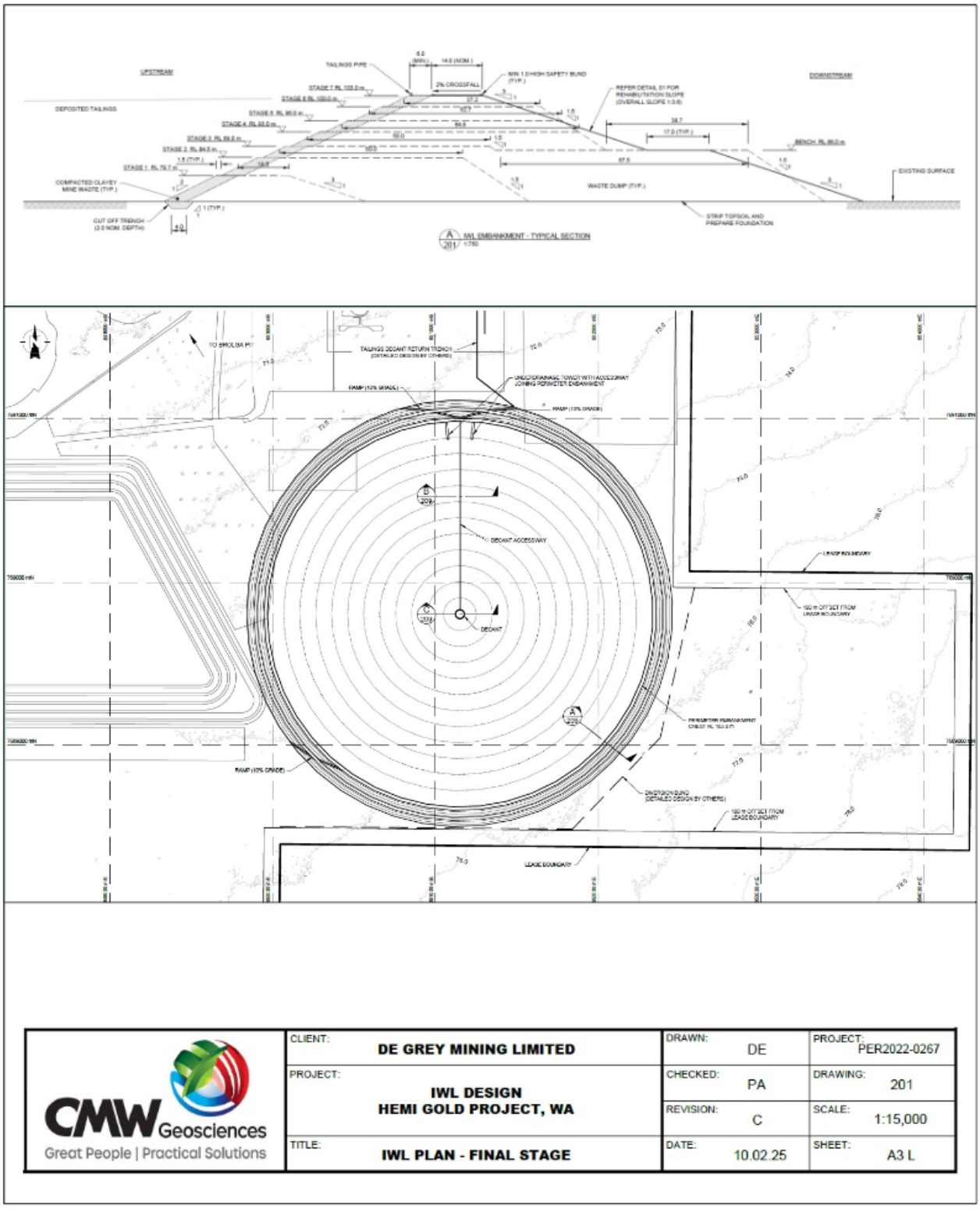
- Removal of 200 mm of topsoil from the TSF footprint.
- Installation of an underdrainage system.
- Compaction of the entire TSF basin foundation to a depth of 0.3 mbgl.
- Inclusion of a 2-metre cut-off trench under the perimeter embankment.
- Compaction of 500 mm clay liner (400 m radius) in the centre of the TSF footprint.
- Construction of the working platform as the base of the rock ring decant.

The embankments of the TSF will be zoned with a 6 m wide upstream zone of low permeability roller compacted clayey mine waste and a minimum of 14 m wide downstream zone of general, traffic compacted mine waste. Low-permeability clay materials (upstream) will be sourced from the oxide zone and clayey overburden within the Project area. Mine waste (downstream zone) will form the bulk of the embankment and will be sourced from mining operations. The downstream zone will buttress the low-permeability upstream embankment zone. To reduce seepage losses, the embankment will also incorporate a 2 m deep cut-off trench backfilled with compacted, low-permeability clay materials.

A cut-off trench will be incorporated in the upstream section of the Stage 1 embankment on the underlying Ferricate zone to reduce seepage losses. Tailings will be deposited sub-aerially via spigots and beached towards central decants. The final design plan and typical perimeter embankment cross-section is provided in Figure 2-4.

Tailings characterisation has been undertaken by SRK (2022) (Appendix 4). Tailings are non-acid forming and decant water quality is expected to be alkaline (pH 9) and brackish (Electrical Conductivity ca. 3,700 µS/cm). Analysis of cyanide, metals and metalloids present in tailings leachate and supernatant has been undertaken as part of materials characterisation studies. De Grey proposes to treat the return decant water with Caros Acid to remove cyanide, preventing interference with the flotation process. This will effectively limit the concentration of cyanide in recycled return water within the processing circuit and within the tailings slurry deposited in the TSF.

Figure 2-4: Final Design Plan and Perimeter Embankment Cross Section



2.1.5 Waste Rock Landforms

Benign mine waste will be used as construction material for TSF embankments, base of the Run of Mine (ROM) pad, hardstands, road base and to line drains where required. Surplus mine waste will be stored in WRLs located in close proximity to the open pits to minimise haulage distances and associated greenhouse gases, whilst being outside the zone of instability of the pits.

Waste characterisation studies completed by SRK Consulting (Australasia) Pty Ltd (SRK) (Appendix 4) show that approximately 95% of the waste at Hemi does not pose a risk of acid and metalliferous drainage (AMD) and only a small proportion (~5%) of samples were potentially acid forming. Approximately 20% of the non-acid forming (NAF) samples had a sufficient sulfide content to pose a potential neutral or saline mine drainage risk. Additional leach test results are provided in Appendix 5.

Northern Star will manage the risk of AMD, neutral metalliferous drainage (NMD), saline mine drainage and wastes with poor physical properties by encapsulating them within the WRL, ensuring that they are away from the edges of landforms so as to:

- Limit exposure to water and oxygen, thus preventing the oxidation of sulfides from occurring.
- Limit the potential for poor quality leachate entering the environment.
- Prevent erosion of the landform and promote long-term stability.

A Tier 1 ecological risk assessment on potential AMD from the WRLs on MNES was completed by SLR Consulting (Australia) Pty Ltd and provided as Appendix 6. The assessment analysed the hazards, exposure and potential risk pathways to MNES. The assessment concluded that pit lakes present a very low likelihood of adverse impacts to MNES species when assessing the combination of engineering controls, natural climatic conditions and species ecology.

In addition, SRK assessed the potential for radioactivity in waste materials. SRK analysed the concentrations of uranium and thorium in the waste rock and ore samples to determine if they were radioactive. Radioactivity is considered a very low risk based on the samples' low uranium and thorium contents and no further radioactivity assessments were required (SRK, 2022).

2.1.6 Low-Grade Ore Stockpiles

Lowgrade ore, that is less economical to process during the initial years of operation, will be placed into separate low-grade stockpiles (LG stockpiles). The disturbance footprint allows for 93 ha of LG stockpiles which could accommodate a maximum volume of 17.5 million tonnes at a height of 15 m high. These LG stockpiles will be added to and depleted as they are processed during the life of mine. The total live volumes are also subject to mine schedule changes during the life of the Project. The LG stockpiles are scheduled to be processed after high-grade stocks are exhausted or when excess plant capacity allows processing.

LG stockpiles which have the potential to result in AMD, NMD or saline mine drainage will be constructed with a compacted in situ soil base, a compacted NAF layer to nominal 0.5 m thickness and toe drains that capture all drainage and direct it to a sump/s. In the unlikely event the LG stockpiles are not processed, the final Mine Closure Plan (MCP) to be regulated under the Western Australian *Mining Act 1972* by the Department of Mines, Petroleum and Exploration (DMPE) will detail how each of the stockpiles is to be rehabilitated, likely in a similar manner to the WRLs.

2.1.7 Airstrip

The Proposed Action will be a fly-in, fly-out operation comprised of both fly-in, fly-out and residential workers. The majority of personnel will be transported to site by plane. A sealed airstrip, with capacity for jet aircraft having approximately 100-seats, will be constructed in accordance with Civil Aviation Safety Authority (CASA) standards.

The airstrip will be constructed approximately 1 km to the north of the village. The airstrip will be constructed and classified as a Code 3C or Code 4C non precision approach runway with a 30 m width and a nominal length of 2,500 m along a 10/28 orientation and will be designed to facilitate the take-off and landing of Code 3C jet aircraft (typical - Fokker F100, BAe146 and Embraer E190).

The airstrip will provide for the transport of personnel to and from site in accordance with their allocated roster. In addition to this, the airstrip will allow for 24 hr access by the Royal Flying Doctor Service ("RFDS") should emergency medical assistance be required either at, or within the vicinity of the Proposed Action.

Hours of operation will ultimately depend on flight slots in and out of Perth Airport however expected flight frequency would be 4 – 5 flights per week during construction, reducing to 3 – 4 flights during operations.

2.1.8 Power and Fuel Infrastructure

Operation of the processing plant and support infrastructure requires electrical power. Power is likely to be purchased from the North West Interconnected System (NWIS).

Supplementary supply from a solar farm is also being considered and provision for this has been allowed for in the indicative disturbance footprint. The inclusion of a solar farm would assist in reducing the Proposed Actions Scope 2 greenhouse gas (GHG) emissions; however, this may not be required if proposed renewable energy projects on the NWIS proceed.

The mine fleet will initially operate on diesel which will be trucked to site and stored in tanks in accordance with Australian Standards. Mobile diesel generators will also be used to power some electrical equipment where construction of powerlines is not practicable.

2.1.9 Workforce Accommodation

Accommodation with capacity to meet workforce requirements will be constructed within the proposed disturbance footprint. This will be designed to contemporary standards and relevant health and safety requirements. The accommodation will include rooms, messing facilities, recreational and social facilities. The accommodation has been located away from the mining operation and processing facilities to ensure personnel are not exposed to industrial noise at night.

2.1.10 Ancillary Infrastructure

Other infrastructure required to support the mining operation includes, but is not limited to:

- Workshops.
- Administration buildings.
- Washdown facilities.
- Bioremediation facilities.
- Communication facilities.
- Borrow Pits.
- Laydown Areas.
- Landfill and waste management facilities.
- Monitoring bores.
- Haul and access roads.
- Pipeline and powerline corridors.
- Water storage ponds.
- Topsoil stockpiles.
- Explosives magazine and ammonium nitrate emulsion (ANE) compound.
- Gatehouse and security.

2.2 Timing and Schedule for Proposed Action

An overview of the timing of all phases of the proposed action including construction, operation, and decommissioning/rehabilitation is provided in Table 2-2. The anticipated timing and duration of each component, as well as potential associated impacts, have also been included.

Table 2-2: Summary and Timing of all phases of the Proposed Action

Phase	Activity Description	Estimated Start Date	Estimated Completion Date	Estimated Duration	Potential Environmental Impacts
Construction	Clearing of impact area	Year 1	Year 2	~ 2 years	• Fauna habitat reduction • Vehicle strike
	Construction of processing facility and TSF	Year 1	Year 15	~ 15 years	• Noise • Dust
	Construction of ancillary infrastructure	Year 1	Year 2	~ 2 years	• Noise • Dust
	Compaction & construction of roads	Year 1	Year 2	~ 2 years	• Noise • Dust • Vehicle strike
	Construction of surface water diversion bunds and drains	Year 1	Year 2	~ 2 years	• Changes in surface water flows
	Water abstraction, reinjection and controlled discharge to Turner River	Year 1	Year 2	~ 2 years	• Change of Turner River flow
	General maintenance during construction period	Year 1	Year 2	~ 2 years	• Noise • Dust • Vehicle strike
Operations	Clearing of impact area	Year 2	Year 15	~ 15 years	• Fauna habitat reduction • Vehicle strike
	Mining of ore	Year 2	Year 15	~ 15 years	• Noise • Dust • Vehicle strike
	Deposition of waste (tailings and waste rock)	Year 2	Year 15	~ 15 years	• Noise • Dust
	Implementation of monitoring programs	Year 1	Year 15	~ 15 years	• Dust • Vehicle strike
	Road maintenance including dust suppression and surface grading	Year 1	Year 15	~ 15 years	• Noise • Dust • Vehicle strike

Phase	Activity Description	Estimated Start Date	Estimated Completion Date	Estimated Duration	Potential Environmental Impacts
	Water abstraction, reinjection and controlled discharge to Turner River	Year 1	Year 15	~ 15 years	• Change of Turner River flow
	General maintenance during operational period	Year 1	Year 15	~ 15 years	• Noise • Dust • Vehicle strike
Decommissioning and Rehabilitation	Decommissioning and removal of infrastructure	Year 15	Year 16	~ 2 years	• Noise • Dust • Vehicle strike
	Prepare waste facilities for closure i.e. reshaping and batter slopes of WRLs, cap surface of TSF	Year 12	Year 17	~ 6 years	• Noise • Dust • Vehicle strike
	Rehabilitation activities	Year 16	Year 17	~ 2 years	• Noise • Dust • Vehicle strike
	Rehabilitation monitoring	Year 17	TBD	TBD	• Vehicle strike

2.3 Rehabilitation and Closure Activities

Infrastructure and mine areas will be closed and rehabilitated in accordance with a MCP that is approved by the Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) under the WA *Mining Act 1978* (Mining Act). Mining activities are rehabilitated and closed in a manner to make them physically safe to humans and animals, geo-technically stable, geo-chemically non-polluting/non-contaminating, capable of sustaining an agreed post-mining land use, and without unacceptable liability to the State.

Stakeholder consultation over mine closure and acceptable post-mining land uses will be ongoing during operations. At the cessation of mining and processing, infrastructure will be decommissioned and removed (unless otherwise agreed with relevant stakeholders), closure earthworks completed, and native vegetation re-established. Abandonment bunds will be constructed to restrict access to post-closure pit lakes where required as part of the post mining land use.

As a minimum, the standard outcomes for rehabilitation and closure, in accordance with the DEMIRS closure objectives, include:

- The site has safe, stable, and non-polluting landforms.
- The final closed landscape considers visual amenity, heritage values and is suitable for the post closure land use.
- The closed landscape has the appropriate surface water features to reduce erosion and promote successful rehabilitation across the site.
- The established ecosystem is resilient and consists of self-sustaining vegetation comprised of local provenance species adapted to local conditions.
- The site is reaching agreed targets for vegetation recovery and suitable habitats for local fauna species.

A conceptual MCP is provided for context in Appendix 7.

3 Stakeholder Engagement

Since 2016, De Grey has engaged with the pastoral leaseholders and Kariyarra People. In 2020, broader engagement commenced with community groups and the Port Hedland community in general as well as with local, state, and federal government stakeholders as part of an ongoing stakeholder engagement process.

A Social Baseline and Impact Assessment (SBIA) (Umwelt, 2022b) was commissioned in 2021 to support the development of the Proposed Action. Through stakeholder identification and subsequent engagement, the SBIA has established the social factors that may potentially be impacted (both positively and negatively) by the Proposed Action. The stakeholder identification process considered groups or individuals that:

- Live, work, or recreate near Hemi.
- Have an interest in the Proposed Action or change.
- Use or value a resource associated with the Proposed Action.
- Are affected by the Proposed Action.

The SBIA also leveraged the extensive engagement with key stakeholders that the Community Relations team has been undertaking since 2021 by using the stakeholder engagement register and Community and Social Performance Plan 2021-2025.

The purpose of the stakeholder engagement strategy is to ensure that relevant stakeholders are kept informed and have the opportunity to provide input into aspects of the Proposed Action.

3.1 Key Stakeholders

Northern Star has identified the following key stakeholder groups with an interest in Hemi:

- **Commonwealth Government**: DCCEEW, Department of Industry Science and Resources (DISR).
- **State Government**: Environmental Protection Authority (EPA), DMPE, Department of Water and Environmental Regulation (DWER), Department of Planning, Lands and Heritage (DPLH), Main Roads WA (MRWA), Water Corporation and Department of Biodiversity, Conservation and Attractions (DBCA).
- **Local Government**: Town of Port Hedland.
- **Local Community/Land Users**: Kariyarra People, Indee Pastoral Leaseholder, Mundabullangana Pastoral Leaseholder, Town of Port Hedland community and local businesses.
- **Northern Star**: Shareholders, funders, employees and their families, Corporate/Senior management, and consultants/contractors.

The stakeholder engagement strategy for key stakeholders of the Proposed Action is provided in Table 3-1 with additional details of engagement with the Kariyarra People provided in Section 3.2.

Table 3-1: Stakeholder Engagement Strategy

Stakeholder Groups	Key Stakeholders	Engagement Type	Key Topics
Government Agencies	• DCCEEW • DISR • DMPE • DWER • DPLH • DBCA	• Regular meetings and workshops • Compliance reporting • Site visits • Approval submissions	• Regulator requirements. • Project approval. • Monitoring and environmental impacts. • Final land use and rehabilitation.
Native Title Community	• Kariyarra People	• Cultural heritage surveys • Formal meetings • Implementation Committee Meetings • Native Title Mining Agreement	• Identify archaeological and ethnographical sites of importance. • Identify and agree on mitigation measures to avoid or reduce potential impacts on heritage and cultural values. • Identify opportunities for participation in environmental surveys and monitoring, employment and partnership opportunities. • Final land use and rehabilitation.
Pastoralists	• Indee Pastoral Leaseholder • Mundabullangana Pastoral Leaseholder	• Access agreements (Signed agreement with Indee PL, continued consultation for Mundabullangana PL) • Regular correspondence and meetings	• Management of access. • Feral and weed management control. • Final land use and rehabilitation. • Planning to minimise disturbance to pastoral operations.
Community Groups and Surrounding Land users	• Town of Port Hedland • Surrounding community • Local businesses	• Regular town hall meetings • Website updates • Monthly community newsletter • Attendance at Port Hedland community and business events • Local supplier business register	• Opportunity for community infrastructure upgrades. • Employment and enhanced environmental management, environmental research and community support. • Project updates • Business and supply opportunities.

Northern Star has incorporated feedback from stakeholders into its planning to ensure implementation of the Proposed Action does not materially compromise the values of the area or the interests of the key stakeholders. The Stakeholder Consultation register is provided as Appendix 8. Consultation and engagement with stakeholders will be ongoing throughout the Proposed Action.

3.2 First Nations Engagement

The Proposed Action is on the lands of the Kariyarra People, and in the Kariyarra Native Title determination (National Native Title Tribunal Number WCD2018/015). Native Title matters are managed by the Prescribed Body Corporate, the Kariyarra Aboriginal Corporation (KAC), based in Port and South Hedland. Northern Star's Native Title and Heritage team manages all consultation and cultural heritage surveys with the Kariyarra People.

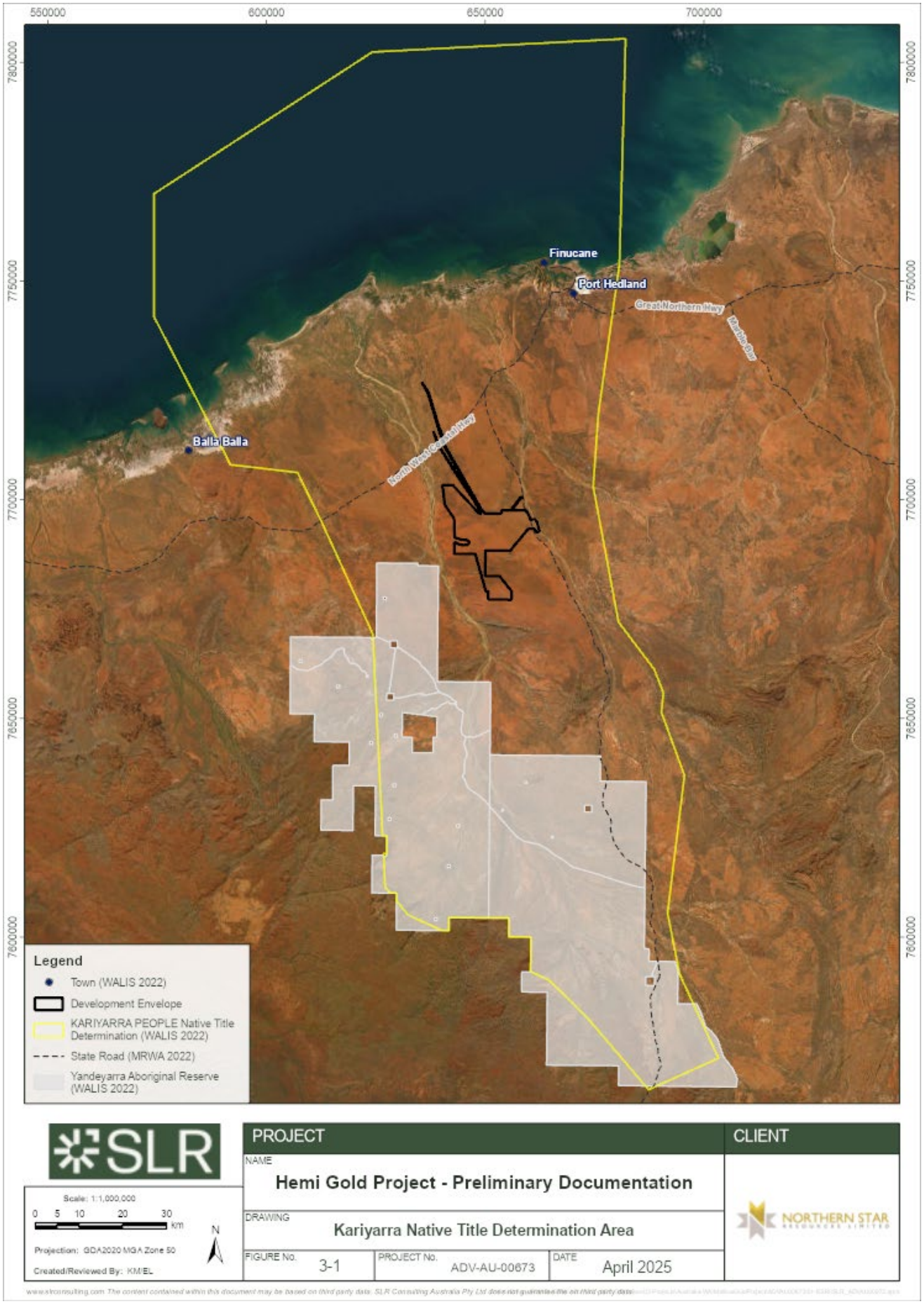
3.2.1 Kariyarra Aboriginal Corporation

The traditional lands of the Kariyarra People are around the town of Port Hedland, west to the Sherlock River and surrounding the Yule River. Kariyarra Country is surrounded by Ngarla Country to the northeast, Nyamal Country to the east and Ngarluma Country to the west.

Native title was determined in December 2018 and cover approximately 17,354 km² of traditional Kariyarra country, encompassing Port Hedland, the Aboriginal community of Yandeyarra, several pastoral leases, and mining operations.

The landmark determination of Native Title for the Kariyarra People was achieved 22 years after the first Kariyarra Native Title determination application was made in 1996. The Determination Area, shown in Figure 3-1, is home to places of special significance to the Kariyarra People, including ceremonial sites, song lines, permanent pools, and natural resources.

Figure 3-1: Kariyarra Native Title Determination Area



3.2.2 Negotiation Protocol

In January 2021, formal consultation and negotiations commenced between De Grey and KAC to progress the development of a Native Title Mining Agreement (the De Grey / Kariyarra Mining Agreement).

The negotiation process was formalised through execution of a Negotiation Protocol on 13 July 2021. This sets out details of how the negotiation would be carried out between the parties to reach the end point of a mutually beneficial Native Title Mining Agreement. The Negotiation Protocol (Table 3-2) clearly defined matters to be discussed.

Table 3-2: Negotiation Protocol

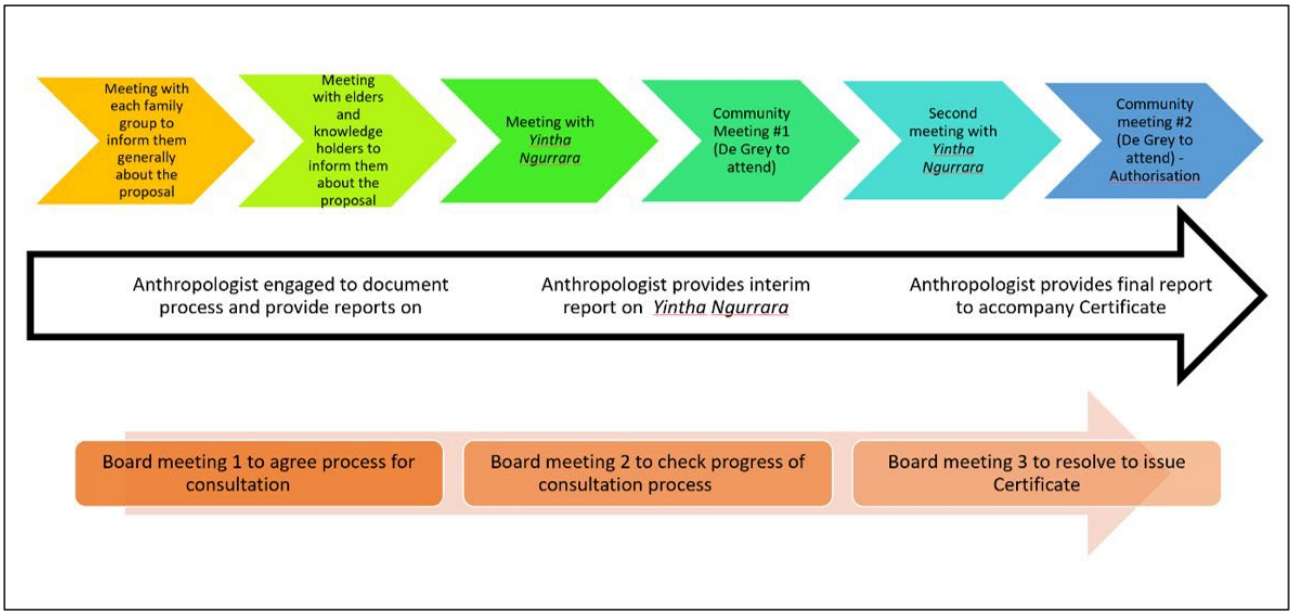
Protocol Aspect	Items Covered
Culture, country and community	• Heritage protection and avoiding damage to sites. • Facilitating 'caring for country' obligations. • Support for law and country. • Environmental assurances. • Processes for involving traditional owners in environmental matters.
Relationship between KAC and De Grey	• Development of long-term relationship between KAC, the Native Title Holders and De Grey. • The process for ongoing consultation between the parties. • How KAC will support De Grey to create a safe, productive and culturally aware workplace.
Access and consent	• Access by De Grey and its employees / contractors on relevant parts of the Determination Area. • Access by Native Title Holders to Hemi over the life of mine.
Community development	• Business and employment opportunities for Native Title Holders. • Training opportunities for Native Title Holders. • Economic development opportunities for Native Title Holders. • Providing a legacy for Native Title Holders.
Compensation	• Nature and quantum of compensation. • KAC, and any other entities advised by KAC to hold compensation and other community benefits.
People's lives	• Minimising any adverse impacts of the Proposed Action on Native Title Holders. • Minimising any adverse impacts of the Proposed Action on Native Title rights and interests. • Maximising education, training and mentoring opportunities.
Mining agreement	• Structure and content of Mining Agreement. • Strong processes for implementation of the Mining Agreement.
Commercial matters	• Providing commercial and contracting opportunities during the entire mine life to Native Title Holders and Native Title entities.

De Grey presented to the KAC board eight times throughout the negotiation in South Hedland or West Perth about the Project. In addition, De Grey also conducted numerous separate meetings with the negotiation group and lead a formal community meeting in late 2022 with all 11 family representatives. The parties have built a positive relationship over the period. Given the terms of the agreement, Northern Star believes the Proposed Action will present positive benefits upon KAC and the broader community.

3.2.3 Community Consultation

The boards of KAC and De Grey agreed the main terms of the Agreement (financial and non-financial) in December 2021. A formal consultation process then commenced between De Grey and Native Title holders which included extensive consultation (Figure 3-2).

Figure 3-2: Consultation Details



3.2.4 Apical Family Group Meetings

The Kariyarra Native Title Determination comprises eleven Apical Ancestor family groups who are legal representatives of the Kariyarra Native Title. Each separate family group has been extensively engaged with and consulted throughout this Native Title Mining Agreement-making process. Upon commencement of community consultation, De Grey engaged two consultants to complete separate pieces of work, aligned with objectives of the Agreement.

A consultant from Circle Advisory, James Kernaghan, took each Apical ancestor family group through a Social Impact Assessment process where impacts, risks and benefits of the Proposed Action were captured through ten full-day workshops (one of the family groups, whose focus is coastal areas, chose not to participate). Information provided by the family groups was collated and used for the purposes of developing a Social Impact Assessment for KAC, independent to the Social Impact Assessment completed by Umwelt for De Grey in January 2022.

A consultant from Human Terrain Anthropology, Roina Williams, attended all family group meetings where information was captured to produce a comprehensive set of [confidential] Cultural Heritage Management Plan documents, specific to the Hemi Gold Project Native Title Mining Agreement.

Senior representatives from De Grey attended each family group meeting, to present comprehensive information on elements of the Agreement, the Proposed Action, proposed mining areas, environmental considerations, and to answer any questions of the groups.

Out of the 11 apical ancestor family groups, 10 of them spent a full day at the South Hedland KAC office learning about the Proposed Action and what meaning it has to them. The remaining group was invited, however chose not to attend as the Proposed Action is out of their area of focus as they are the coastal family group. De Grey has presented extensive summaries to the family's nominated board member ensuring they are aware of the details of the Proposed Action.

3.2.5 Yintha Ngurrara Meetings

The Kariyarra People use the term Yintha Ngurrara to refer to their Elders and Knowledge Holders.

On 1 September 2022, De Grey hosted a full-day on-country Yintha Ngurrara meeting at the proposed Hemi mine and infrastructure site and exploration camp. The meeting was attended by senior leaders of De Grey, including the Managing Director, Technical Director, General Manager Community Relations and other senior exploration and Project development representatives from the company.

Buses took approximately 30 elders and Knowledge Holders and De Grey participants to specific locations relevant to the group. The entire delegation spent time on Country learning more about the Proposed Action and discussing boundaries, proposed location of infrastructure, heritage and matters of importance to the group.

After the meeting, the parties agreed to move the boundary of the mining area to ensure the Proposed Action did not impact areas that are important to the group including the sand dune area that has been excised from the Development Envelope. An Aboriginal cultural heritage management plan (ACHMP) is being developed with the group allowing the salvage of two sites within the proposed disturbance footprint. A letter of no objection has been received from KAC, with the Section 18 application awaiting determination for the salvage of the two sites.

On 29 September 2022, De Grey attended the second Yintha Ngurrara meeting in South Hedland and gave the group of around 50 attendees a further development update and answered questions to do with environmental concerns and water.

On 28 November 2022, a Native Title Community meeting was held with approximately 100 attendees including representatives from each of the 11 apical family groups. This included a majority vote to enter into the Agreement with De Grey. The Agreement was executed on 16 December 2022[1].

All levels of personnel (including senior management) from De Grey attend KAC board meetings regularly; present to family groups on request; walk on archaeological heritage surveys to better understand any issues and/or concerns directly from Traditional Owners on-country; and ensure De Grey's senior team members are familiar with the group and matters important to them, specifically related to heritage and culture.

3.2.6 Implementation Committee Meetings

Northern Star holds regular implementation committee meetings with KAC. The functions of the implementation committee include:

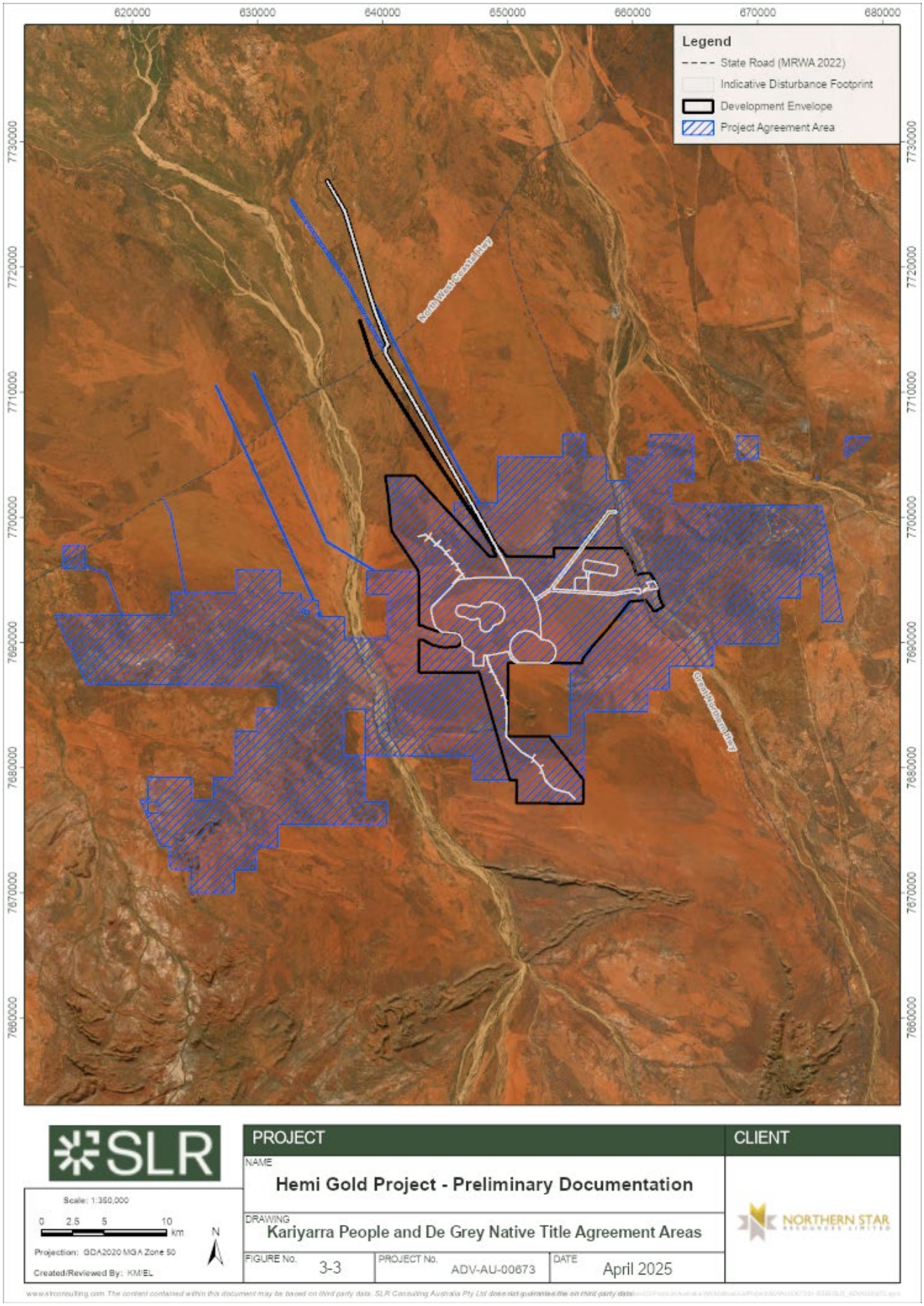
- Fostering a strong and constructive relationship between the Parties.
- Monitoring of the implementation of the operational aspects of the Agreement.
- Monitoring the implementation of the Strategies (employment and contracting).
- Monitoring the implementation of the Social Impact Management Plan.
- Monitoring the outcomes achieved through the Indigenous Engagement Strategy.
- Monitoring the implementation of the heritage protocol and any agreed Aboriginal cultural heritage management plans.
- Agree to and oversee a code for ensuring maximum access of the Kariyarra people to the Agreement Area.
- Provide non-binding recommendations to the Parties in relation to the manner in which the operational aspects of the Agreement may be implemented.

3.2.7 Native Title Mining Agreement Boundaries and Provisions

Through extensive consultation and engagement with the Kariyarra People, the area shown in Figure 3-3 was defined as the Project Agreement Area as agreed by KAC and its members, and De Grey. The Project Agreement area extends beyond Hemi and includes Northern Star's wider mineral exploration activities and will be reviewed when required.

1 De Grey released an announcement to the ASX on 16 December 2022. To view the announcement please click here.

Figure 3-3: Native Title Agreement Areas



3.2.8 Aboriginal Heritage Surveys

Northern Star takes its obligations with respect to the assessment and management of Aboriginal cultural heritage seriously, with surveys extending across the Project Agreement Area and other relevant areas of the Kariyarra determination area.

Since 2018, De Grey has completed a comprehensive series of archaeological and ethnographic heritage surveys, engaging external consultants. In January 2022, Scarp Archaeology, one of these external consultants, conducted a full review of all previous heritage surveys, ensuring De Grey employees are working with comprehensive, credible and reliable heritage information on an accurate and detailed Geographical Information System (GIS) dataset.

Heritage clearances over the past two years have consisted of 14 surveys in Kariyarra Country and included archaeological (A) and/or ethnographic (E) surveys (Table 3-3) and shown in Figure 3-4.

The survey work has been completed on a regular schedule in collaboration with KAC. A specific focus has been placed on ensuring the correct apical family groups, who have cultural knowledge of the Development Envelope, have approved all heritage work.

Table 3-3: Heritage surveys completed on and around Hemi

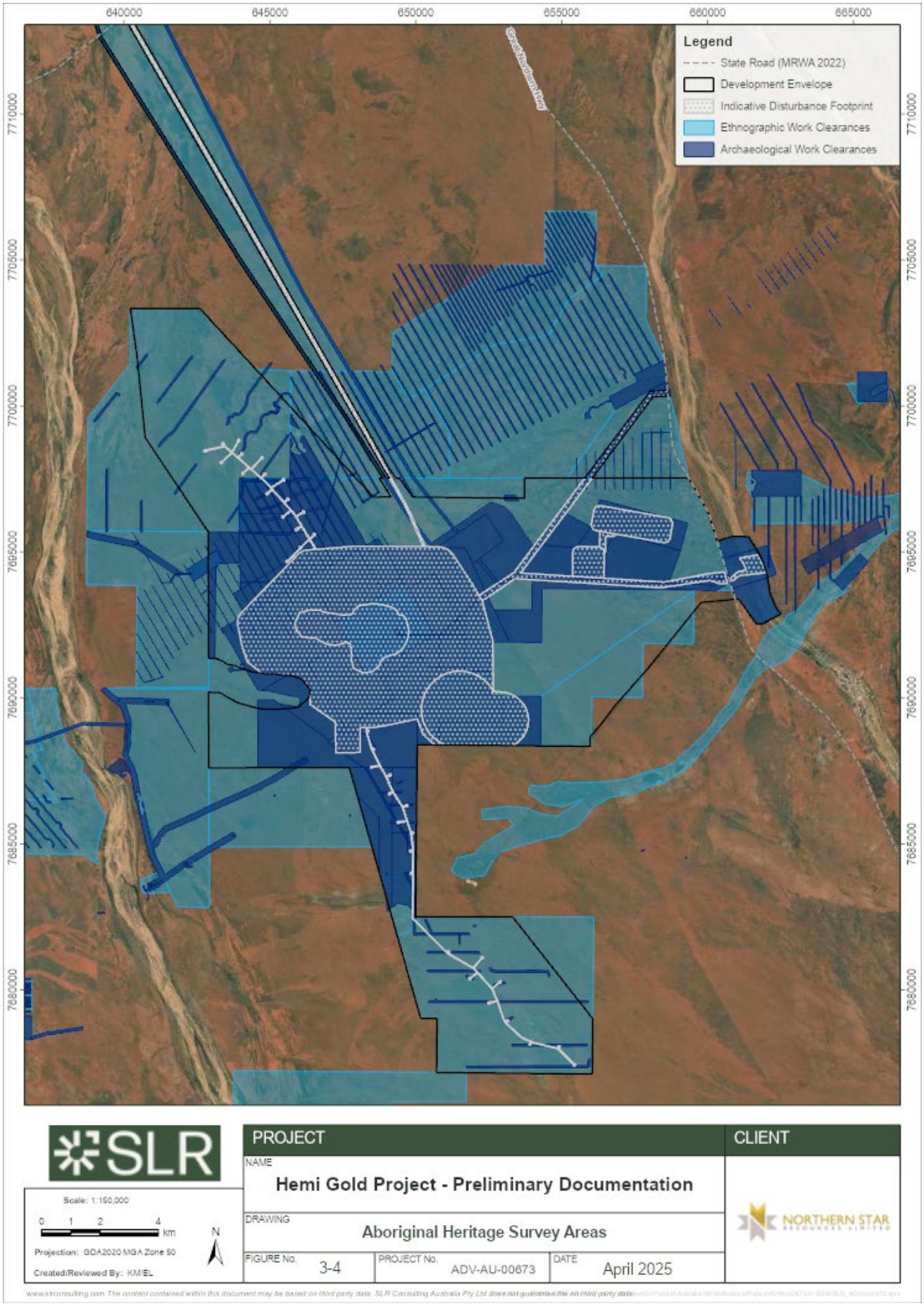
#	Consultant Group	Author/s	NT Group	Year	Type	Level
1	Terra Rosa	Monks and Morison 2018	Kariyarra	2018	A, E	Work program clearance
2	Gavin Jackson	Ryan et al 2019	Kariyarra	2018	A, E	Work program clearance
3	Gavin Jackson	Ryan et al 2021	Kariyarra	2019	A, E	Work program clearance
4	Scarp Archaeology	Slack 2022a (hemi)	Kariyarra	2021	A	Site identification
5	Scarp Archaeology	Slack 2022b	Kariyarra	2021	A	Site avoidance
6	Human Terrains	Williams 2021 (hemi)	Kariyarra	2021	E	Site identification
7	Human Terrains	Williams 2022	Kariyarra	2021	E	Site avoidance
8	Scarp Archaeology	Slack 2022 (hemi)	Kariyarra	2022	A	Site identification and Site avoidance
9	Scarp Archaeology	Slack 2022 (hemi)	Kariyarra	2022	A	Site identification and Site avoidance
10	Scarp Archaeology	Slack 2022 (hemi)	Kariyarra	2022	A	Site identification and Site avoidance
11	Scarp Archaeology	Slack 2022 (hemi)	Kariyarra	2022	A	Site identification and Site avoidance
12	Scarp Archaeology	Slack 2023	Kariyarra	2023	A	Site avoidance
13	Human Terrains	Williams 2023	Kariyarra	2023	E	Site identification and site avoidance
14	Scarp Archaeology	Slack 2023	Kariyarra	2023	A	Site avoidance
15	Scarp Archaeology	Burnett 2023	Kariyarra	2023	A	Site avoidance
16	Scarp Archaeology	Goranitis 2023c	Kariyarra	2023	A	Site identification and site avoidance

#	Consultant Group	Author/s	NT Group	Year	Type	Level
17	Heritage WA	Czerwinski 2024	Kariyarra	2024	E	Site avoidance
18	Scarp Archaeology	Slack 2024	Kariyarra	2024	A	Site avoidance
19	Scarp Archaeology	Burnett 2023	Kariyarra	2023	A	Site avoidance

A = Archaeological; E = Ethnographic

Approximately 10,059 ha of archaeological heritage surveys and approximately 18,147 ha of ethnographic surveys have been completed within the Development Envelope to date. The methods used ensured every part of the area has been surveyed in detail, on foot, by Kariyarra Traditional Owners, with specialist archaeologists and/or anthropologists in attendance each time. Additional heritage surveys are scheduled to complete coverage of the Development Envelope on a priority basis. Northern Star will ensure disturbance activities will not be undertaken in any unsurveyed areas through a robust ground disturbance permit procedure and program.

Figure 3-4: Aboriginal Heritage Survey Areas



3.2.9 Aboriginal Heritage Sites

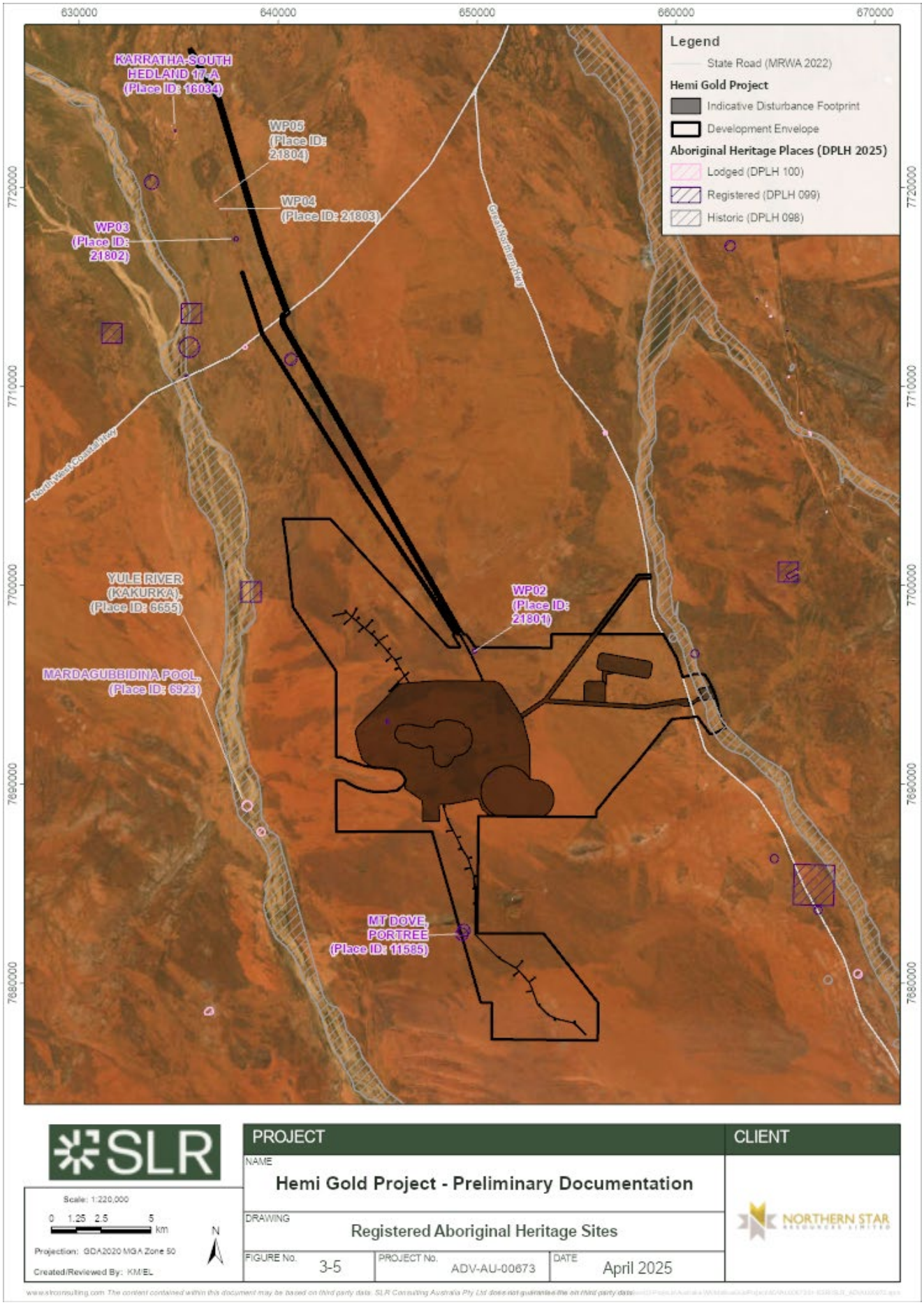
Details of registered Aboriginal heritage sites are provided in Table 3-4 and shown in Figure 3-5. The KAC has requested that the details and locations of other heritage sites identified during surveys for the Proposed Action are kept confidential.

Table 3-4: Registered Aboriginal Heritage Sites

Tenement	Type	Place ID	Name	Description	Restrictions
L47/962	Registered	16034	Karratha – South Hedland 17	Artefacts/Scatter	No
	Registered	21801	WP02	Artefacts/Scatter	No
	Registered	21802	WP03	Artefacts/Scatter	No
	Stored Data/Not a Site	21803	WP04	Artefacts/Scatter	No
	Stored Data/Not a Site	21804	WP05	Artefacts/Scatter	No
L47/963	Registered	21801	WP02	Artefacts/Scatter	No
L47/965	Stored Data/Not a Site	6655	Yule River (Kakurka)	Named Place	No
L47/975	Stored Data/Not a Site	6655	Yule River (Kakurka)	Named Place	No
	Lodged	6923	Mardagubbidina Pool	Water Source	No
L47/1048	Registered	11585	Mt Dove, Portree	Engraving	No
	Registered	11638	Mt Dove, Upper Yule	Artefacts/Scatter, Ceremonial, Engraving, Man-Made Structure	No

Working with KAC and partner heritage specialists, Northern Star has identified and assessed a number of heritage sites that require protection and management. If required, these sites will be subject to a Section 18 process under the *Aboriginal Heritage Act 1972* (WA) (AH Act) as well as provisions in the ACHMP as to be agreed with KAC.

Figure 3-5: Registered Aboriginal Heritage Sites



4 Ecologically Sustainable Development

Five principles of Ecologically Sustainable Development are included in Section 3A of the EPBC Act. Northern Star has designed the Proposed Action in accordance with these principles as detailed in Table 4-1. Additional information in relation to the economic and social impacts associated with the Proposed Action are detailed in Appendix 9.

Table 4-1: Principles of Ecologically Sustainable Development (Section 3A of EPBC Act)

Principle	Action Considerations
Decision making processes should effectively integrate both long term and short term economic, environmental, social, and equitable considerations.	Development of the Proposed Action will bring substantial socio-economic benefits to the Port Hedland community, Pilbara Region and to Western Australia. Wages and payments to suppliers will provide direct and indirect income for Australians and tax revenue for local, state and federal government. Part of this income stream will fund public and private investment for the benefit of the local community. At the same time, Northern Star has considered the environment in all stages of Project design including construction, operation and closure of the Proposed Action. Measures to avoid significant environmental and cultural values have been implemented including the avoidance of the Yule River and the Gregory Land System. At closure, the site will be rehabilitated to a safe, stable, and non-polluting state, suitable for post mining activities.
If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.	Supporting studies to inform environmental impact assessment have been undertaken by respected subject matter experts. Independent peer reviews of flora and hydrogeological studies have been undertaken to ensure the robustness of the findings. In addition, all studies were reviewed by the WA EPA, DCCEEW, and RPM Global to confirm that relevant guidelines and policies were adhered to. The study areas for scientific studies were typically four to six times larger than the proposed disturbance footprint. This ensures the baseline environment is well characterised and facilitates the environmental siting of some infrastructure to avoid sensitive areas. Mitigation measures and predicted environmental outcomes have been developed via careful consideration of the potential impacts of the Proposed Action and by risk assessment. A lack of certainty has not been used to postpone environmental management measures; rather the environmental management measures implemented post approval will be used to calibrate models and demonstrate that potential impacts are within predicted levels. Where environmental monitoring detects unpredicted impacts, control measures to halt or reverse the impact will be implemented.
The principle of inter-generational equity–that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.	The Proposed Action will create direct and indirect employment and training opportunities; support to local businesses; and increased economic activity in the community. Northern Star has studied the environmental values and designed the action to minimise potential impacts. For example, impacts to the Yule River have been avoided through Project design to ensure ecosystem health and cultural values are maintained for future generations. Northern Star has entered into a Native Title Mining Agreement with the Kariyarra People to identify and protect the traditional values of the land, open opportunities for engagement, business partnerships and employment and training opportunities. Where a residual significant impact to the environment is unavoidable, environmental offsets through contributions to the Pilbara Environmental Offsets Fund (PEOF) will

Principle	Action Considerations
	be made. The contributions will fund important research and management projects throughout the Pilbara to ensure the health, diversity and productivity of the region is maintained. Mine closure is a fundamental aspect of inter-generational equity. At the cessation of mining, the Proposed Action area will be rehabilitated to a safe, stable and non-polluting state suitable for traditional land uses, pastoralism or other post mining land uses identified by stakeholders. The costs of mine closure will be reviewed, as required and adequate provision made in the financial statements.
The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision making.	Northern Star has designed the Proposed Action to conserve the biological diversity and ecological integrity of the region wherever possible. These include avoidance of: • Gregory Land System Priority Ecological Community (PEC). • Critical Rocky Outcrop habitat. • Yule River. Additionally, Northern Star proposes to minimise disturbance of other critical habitats to the smallest extent possible to achieve a safe and economical Project. Within the Development Envelope, Northern Star proposes to: • Avoid, or otherwise minimise direct and indirect impact from the Proposed Action upon the Greater Bilby and Northern Quoll critical habitat. • Avoid, where possible, large hollow forming trees suitable for Northern Quoll within the Major River habitat. • Clear no more than 5,830 ha, with applied upper clearing limits of 5,759 ha for sandplain habitats (Spinifex Sandplain and Sandplain Drainage) and 10 ha of Major River habitat. Environmental management plans have been developed to minimise the impacts to flora and fauna, including monitoring the potential impacts of surplus water discharge into the Turner River.
Improved valuation, pricing and incentive mechanisms should be promoted.	The financial model for the Proposed Action included the costs of scientific studies to support environmental approvals and accounted for the time associated with obtaining approvals. Northern Star has also included the ongoing costs of environmental management, including staff, contractors, infrastructure, and equipment into the financial model. Mining companies in Western Australia must pay an annual fee based on disturbance areas and disturbance type to the Mine Rehabilitation Fund (MRF). The MRF is used to cover the costs of mine closure if there is a bankruptcy event and liability is vested with the WA government. Lower fees are charged for areas under rehabilitation and no fees are charged once DEMIRS accepts an area as rehabilitated. These costs incentivise the minimisation of environmental harm and continuous improvement. Where possible, Northern Star will reduce these costs by: • Minimising disturbance and clearing. • Maximising progressive rehabilitation. • Reducing the amount of waste generated on site. • Recycling wastes. • Efficient use of processing chemicals. • Recovery and reuse of water as groundwater inflows into the pits decrease.

5 Other Permits and Conditions

5.1 Environmental Approvals and Legislation

In addition to approval from DCCEEW, Northern Star must obtain other environmental approvals from various state government agencies or the local government. A summary of permitting requirements, approvals and anticipated conditions under these laws is provided in Table 5-1.

Table 5-1: Key Regulatory Approvals

Relevant Legislation	Regulator Agency	Purpose	Anticipated Conditions
Part IV *Environmental Protection Act 1986* (EP Act) (WA)	EPA	EPA will consider the potential impacts of the Proposed Action against the objectives and principles of the EP Act and objectives for key environmental factors (flora and vegetation, terrestrial fauna, subterranean fauna, inland waters, air quality, greenhouse gas emissions, and social surroundings).	The Project is currently under assessment (APP-0000394). Under the EP Act, the Minister for Environment has the power to issue a Ministerial Statement for the Project that may include, but are not limited to: • The disturbance extent of the Project. • Annual environmental and compliance reporting requirements. • Maximum annual GHG emissions. • Management measures defined within approved management plans.
Part V EP Act (WA) – Division 2 (Native Vegetation Clearing Permits)	DEMIRS	DEMIRS will assess clearing permit applications against the 10 clearing principles in the EP Act.	A Native Vegetation Clearing Permit (NVCP) will not be required where approval is granted under Part IV of the EP Act (described above).
Part V EP Act (WA) – Division 3 (Emissions and discharges)	DWER	A Works Approval and Environmental Licence are required for the construction and operation of infrastructure that may result in emissions or discharges to the environment. A Works Approval and Environmental Licence is required for: • Processing Plant and associated TSF. • Dewatering discharge and reinjection. • Wastewater treatment plant. • Crushing and screening activities. • Landfill and other waste disposal (e.g. tyres).	Standard Works approval conditions will require: • Construction in accordance with the Works Approval. • Submission of a construction compliance report. • Submission of a commissioning report. • Discharge limits and monitoring during construction. • Discharge limits and monitoring during commissioning and time limited operations. DWER will apply standard licence conditions requiring: • Annual environmental and compliance reporting. • Compliance recording and reporting. • Record-keeping. • Incident reporting
Mining Act (WA)	DEMIRS	Mine activities undertaken on mining tenure require approval	Additional conditions will be applied to the relevant tenements granted under the Mining Act that will require

Relevant Legislation	Regulator Agency	Purpose	Anticipated Conditions
		through a Mining Proposal (MP) and Mine Closure Plan (MCP).	implementation of the Proposed Action in accordance with outcomes and performance criteria outlined in the MP and MCP. Additional tenement conditions will require an annual environmental report, review of the MCP every three years and specific operating and inspection requirements for the TSF. Additional non-standard tenement conditions may be applied for specific environmental management measures.
Rights in Water and Irrigation Act 1914 (RIWI Act) (WA)	DWER	Each water bore requires a 26D Licence to construct; and operation of the abstraction borefield requires a 5C licence to abstract groundwater.	Groundwater Licences specify the volume of water that may be abstracted; and the purpose; aquifers and tenements from which abstraction is authorised. Standard conditions will require: • The use of abstraction meters. • Monthly and annual reporting of abstraction volume. • The implementation of a groundwater operating strategy (GWOS). • The submission of an annual groundwater monitoring report.
AH Act (WA)	DPLH	Section 18 approval required for disturbance to Aboriginal heritage sites.	Section 18 permits provide conditions for the removal or destruction of Aboriginal cultural heritage. The conditions may prescribe further surveys with qualified archaeologists, how the removal/destruction is to occur and management measures to protect other Aboriginal cultural heritage sites.

5.2 Agreements

Northern Star has signed agreements with other users of the area of the Proposed Action, including the Kariyarra People (via the KAC) and the pastoral leaseholders. The Proposed Action is predominantly located on the Indee Station Pastoral Lease with a small portion of the northern miscellaneous licences intersecting the Mundabullangana Station Pastoral Lease. An access agreement for exploration and mining activities has been signed with the Indee Pastoral Lease holder.

These agreements are legally binding and contain measures relevant to managing access for other users, compensation for damage, compensation for loss of pasture or livestock, protocols for managing Aboriginal heritage, and consultation with traditional owners. Additional information on the Native Title Mining Agreement is provided in Section 3.2.

6 Baseline Environmental Data

This section will address the results of baseline environmental studies within the Proposed Action area. Listed MNES will be addressed in greater detail in Section 6.7.

6.1 Regional Context

The Proposed Action is located predominantly within the Chichester subregion (PIL1) with northern infrastructure corridors within the Roebourne subregion (PIL4) of the Pilbara region, as described by the Interim Biogeographic Regionalisation for Australia (IBRA) Version 7 (DoEE, 2012). The Chichester subregion is situated on the northern end of the Pilbara Craton.

The Chichester subregion has large basaltic ranges amongst undulating Archean granite and basalt plains. These plains support a shrub steppe characterised by *Acacia inaequilatera* over hummock grasslands, with *Eucalyptus leucophloia* tree steppes occurring on the ranges. Drainage of the subregion occurs through many rivers running north, including the De Grey, Oakover, Nullagine, Shaw, Yule, Turner, and Sherlock Rivers (Kendrick & McKenzie, 2001).

The Roebourne subregion has quaternary alluvial and older colluvial coastal and sub-coastal plains. These plains support grass savannah of mixed bunch and hummock grasses and dwarf shrub steppe of *Acacia stellaticeps* or *Acacia pyrifolia* and *Acacia inaequilatera*. Uplands are dominated by *Triodia* hummock grasslands. Resistant linear ranges of basalts occur across the coastal plains, with minor exposures of granite (Kendrick P & Stanley F, 2001).

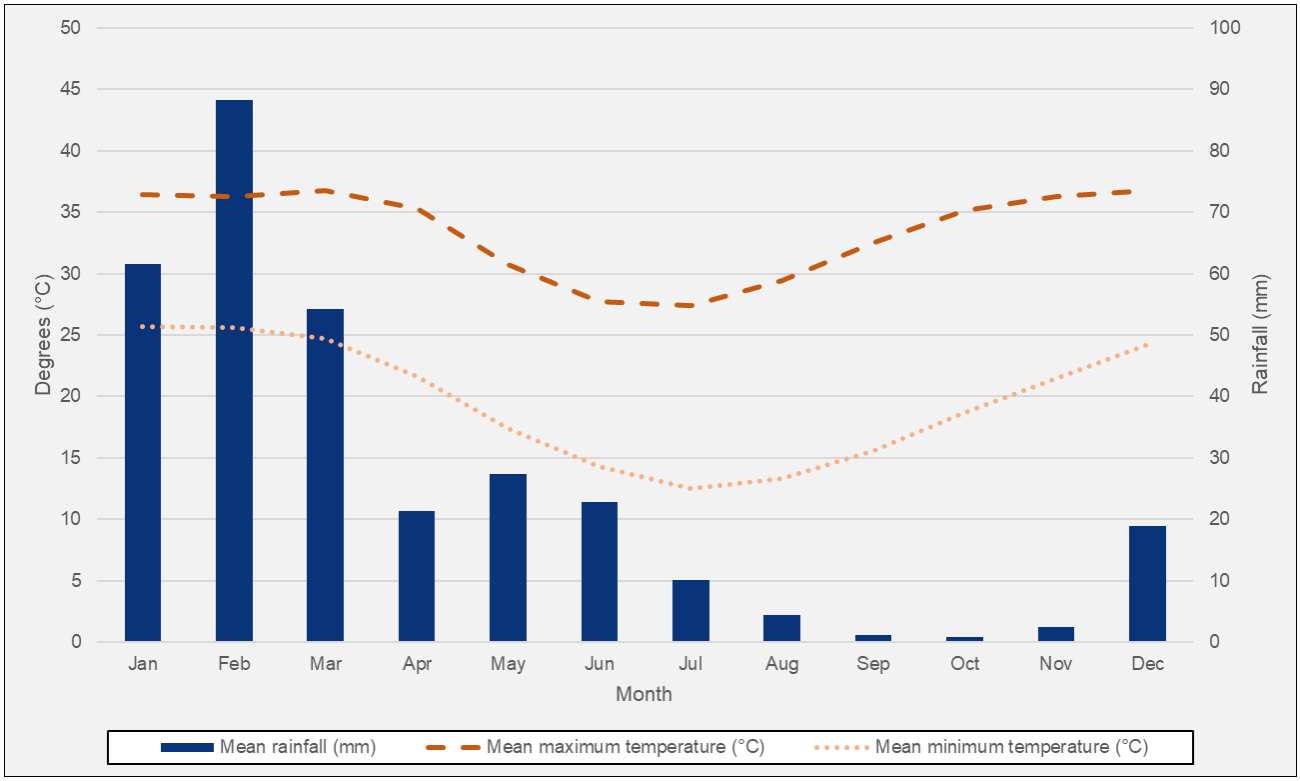
6.2 Climate

The nearest weather station to the Proposed Action is Port Hedland Airport (site number 004032). The climate is characterised as semi-arid to tropical due to occasional severe weather from tropical cyclones and rain-bearing depressions (ex-tropical cyclones). Climate data from the Bureau of Meteorology is displayed in Chart 6-1.

The annual average rainfall of 314.1 mm predominantly occurs between December and June with the mean number of days of rain being 20.1 days annually. The mean daily evaporation rate is 9.0 mm per annum with the highest rate in November at 11.5 mm. The lowest daily evaporation rates of 6.5 mm occur in June (BOM, 2024).

Mean maximum temperatures range from 36.8°C in March and December to 27.4°C in July, with mean minimum temperatures ranging from 25.7°C in January to 12.5°C in July. The mean 9 AM wind speed ranges from easterly at 20.8 km/h in June and July to southeasterly at 14.4 km/hr in February. The mean 3 PM wind speed ranges from northerly at 17.9 km/hr in June to north-westerly at 26.8 km/hr in December (BOM, 2024).

Chart 6-1: Port Hedland Climate Data (BOM, 2024)



6.3 Hydrogeology

6.3.1 Overview

A definitive feasibility level hydrogeological assessment of the Proposed Action was completed by Geowater in 2024 (Appendix 10), with additional information from Northern Star studies provided in Appendix 11. Due to the high permeability and extent of the alluvium and surrounding the Hemi deposits a large model domain of 1,520 km^2 was considered, inclusive of the Yule and Turner Rivers.

A peer review of the groundwater model has been completed by Jurassic Groundwater (2023) and is provided as Appendix 12.

Figure 6-1 presents the hydrostratigraphy of the Hemi Deposit, highlighting placement of the following different aquifer zones:

- Upper Alluvium – laterally extensive surficial aquifer system with low to moderate, but significant permeability and saturated thickness; the saturated extent includes the Yule, but not the Turner River.
- Lower Alluvium (Palaeochannel) – basal palaeochannel sands and gravels with high permeability and storage values. This Palaeochannel is generally 1 km to 2 km wide and drains northwards towards the coast. Note that in the Geowater report the terms 'lower alluvium' and 'basal alluvium' are used interchangeably when referring to this hydrogeological unit.
- Saprolite Zone – uppermost sections of weathered bedrock with limited permeability.
- Saprock Zone – lower section of weathered profile consisting of moderately to slightly weathered rock. Moderate fractured rock permeability in the igneous intrusive.
- Fresh bedrock – unweathered rock with limited permeability, particularly at depth.

Considering the hydrogeological cross-section presented in

Figure 6-2, the following key aspects of Hemi's groundwater system are interpreted:

- Saprolite and saprock generally do not hold significant amounts of groundwater. This layer acts as a weak barrier to water flow (aquitard) and is unlikely to be a major water source during mining activities.
- Groundwater at Hemi is more likely to be found in fractured zones within igneous rock intrusions and near the contact zones between different rock types. These fractures provide pathways for water movement but have limited storage capacity. These fractures also become tighter and less permeable with depth.
- Bedrock permeability is very limited, likely becoming impermeable with no storage of water below approximately 150 m.
- Limited, although significant, rain replenishes groundwater at Hemi (1 - 3 % on average). This rate is even lower near the exposed rock. Salinity levels increase eastward.

Depth to groundwater is typically 6 m – 12 m below the ground surface and hydraulic gradients and flow directions are relatively uniform. Regional groundwater flow is to the north-northwest.

Figure 6-1: Project Aquifer Mapping

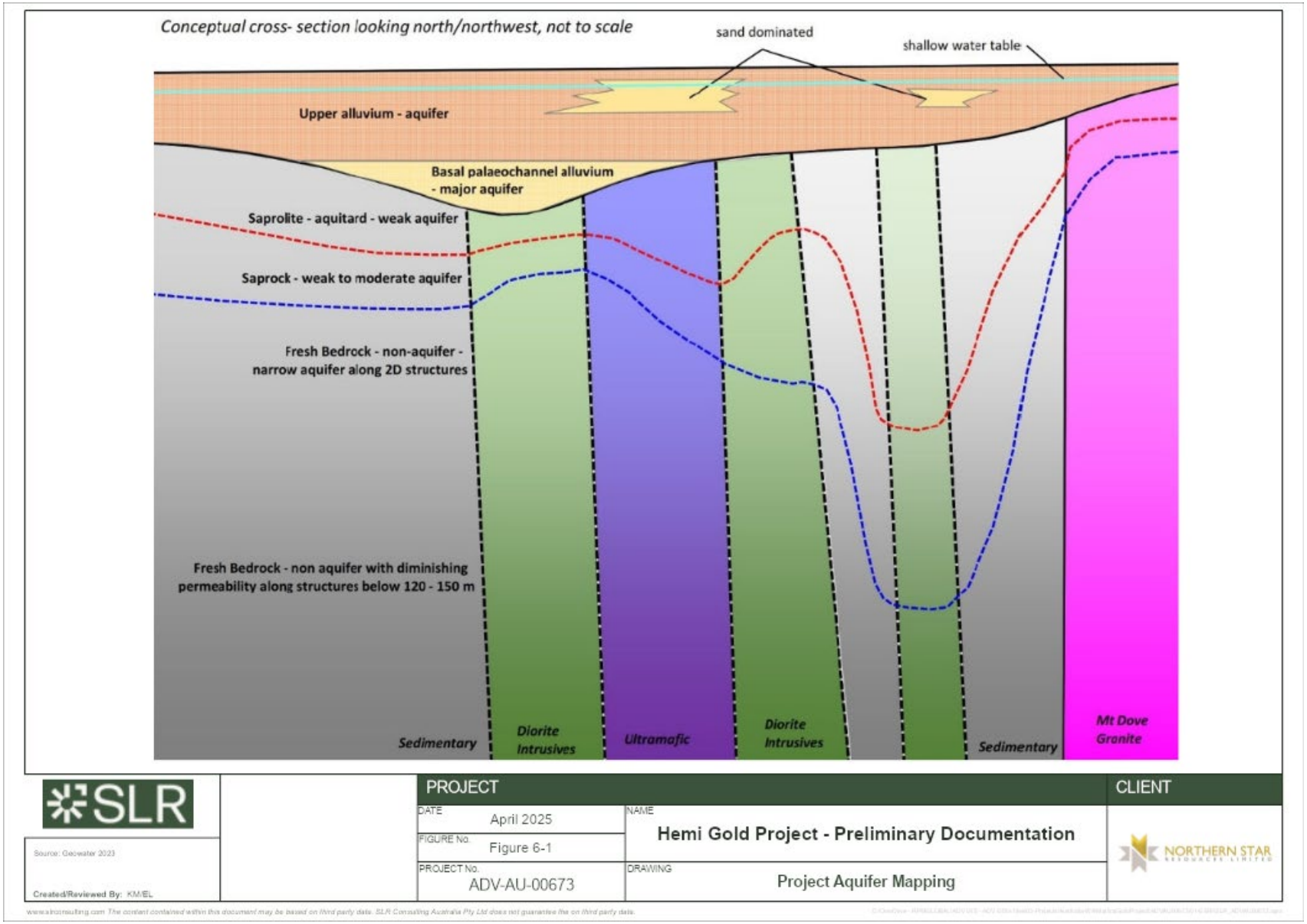
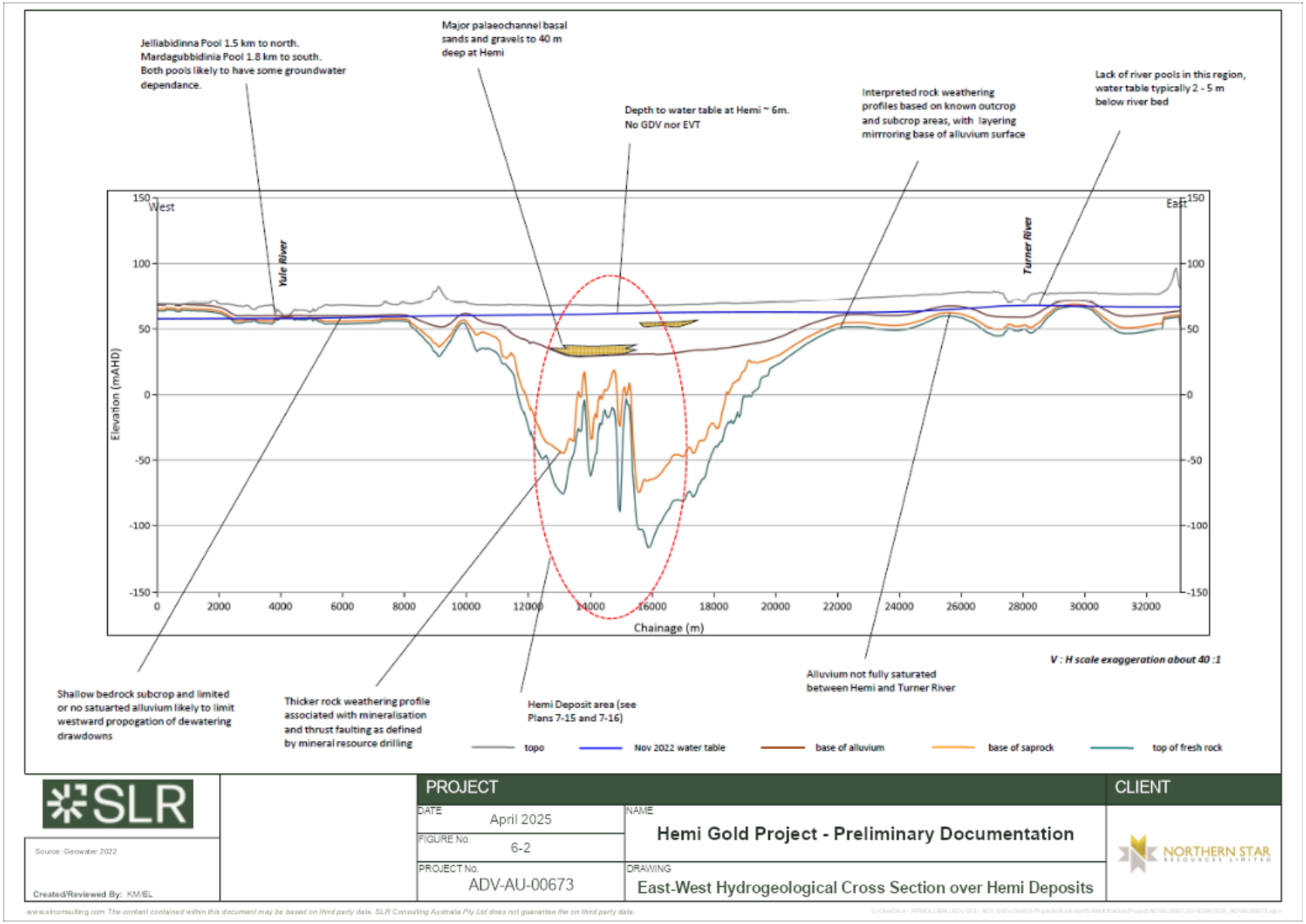


Figure 6-2: East-West Hydrogeological Cross Section over Hemi Deposits (Geowater, 2023a)



6.3.2 Groundwater Quality

Detailed hydrochemical analysis and modelling of groundwater at Hemi has been undertaken for the alluvial and paleochannel aquifers. Results show that groundwater quality in both the alluvium and paleochannel aquifers is generally fresh to brackish (800 – 1,100 mg/L Total Dissolved Solids), circum-neutral to alkaline (pH 7.5 – 8.5), with elevated hardness (average 270 mg/L as $CaCO_3$) and highly oxygenated. Groundwater in alluvium and saprock have similar salinities and is suitable for existing pastoral and mining purposes.

Groundwater quality along the Turner River is more variable than at Hemi. Zones of higher salinity (1,000 – 1,350 mg/L) near southern monitoring bores (4 km upstream of the proposed dewatering outfall) indicate limited recharge during flood events in bedrock-dominated reaches of the river. Lower salinities (350 – 500 mg/L) further north indicate potential recharge zones from river flooding events.

The Hemi gold deposits are associated with naturally elevated levels of pyrite and arsenopyrite. Trace metal analysis of groundwater in some bores that intersect the Hemi deposits shows higher levels of naturally occurring arsenic, chromium, uranium and vanadium than in other bores within the Development Envelope of the Proposed Action and along the Turner River.

Studies on the groundwater quality across Hemi conclude:

- Arsenic levels vary significantly, ranging from 0.6 µg/L to 797 µg/L, where the occurrences of high concentrations occur in deep bores (drilled into basement rocks). Groundwater associated with the ore body with arsenic levels higher than 24 µg/L will be reinjected into the borefield upgradient of the open pits.
- Chromium concentrations are higher up-gradient of known ore zones than down-gradient. This suggests that the gold deposit is not the contributing source of chromium.
- Groundwater near the Turner River typically has lower arsenic, chromium and uranium levels relative to groundwater in the region of the Hemi deposits.
- Uranium and vanadium levels are spatially consistent across bedrock zones and up-gradient and down-gradient alluvium suggesting that the distribution of these metals is not specifically related to the gold deposit. The presence of these metals may be due to Hemi being down-gradient of a large granodiorite dome located to the south-east.

Additional details on groundwater quality are provided in Section 3.1 of the hydrogeology report (Appendix 10).

The project water management strategy distinguishes two dewatering discharge stream types, primarily related to concentrations of arsenic and other trace metals:

- Type I contains <24 µg/L of dissolved arsenic (As).
- Type II contains >24 µg/ L of dissolved arsenic (As).

The Project has characterised Type I and Type II water streams based on analysis of over 350 water quality samples collected to date. The threshold of 24 µg/L of dissolved arsenic was defined based on the Australian and New Zealand Fresh and Marine Water Quality (ANZG) (201800) guidelines, which safeguard 95% of aquatic species.

The management of abstracted groundwater will follow these priorities:

- Groundwater with naturally elevated concentrations of dissolved Arsenic (Type II) will be reinjected into the RBS and become available for re-abstraction after two to ten years, at which time it will be directed for use in the processing plant.
- Groundwater with naturally lower concentration of dissolved Arsenic (Type I) will be suitable for discharge to the Turner River, aquifer reinjection at both Reinjection Borefield North (RBN) and Reinjection Borefield South (RBS) and for camp and potable water supplies (once treated).

Dewatering and reinjection will occur between the same aquifers and within a closed piping system (i.e. no exposure to air) with dewatered water from the pits transferred directly to the RBS or RBN. The direct transfer between the same aquifer, with no exposure to air will mean that there will be no change to groundwater chemistry.

The water quality of dewatering discharge would be similar to the native water quality of the alluvial aquifer in the proposed aquifer reinjection areas. Table 6-1 provides a summary comparison of salinity, pH and several trace metal levels between the project area and proposed aquifer reinjection areas based on groundwater samples collected between 2021 and 2023. The table indicates that dissolved arsenic levels at Hemi are higher than in the alluvial aquifer in reinjection areas. However, the tabled values do not represent the likely averaged metal levels of actual dewatering discharge, as the summary does not incorporate the 'flow weighting' effects of combining high permeability alluvial aquifer water (with typically low arsenic levels) with low permeability bedrock water (with higher arsenic content in some areas) that will occur as a result of dewatering, i.e., the mean and median values in the table are biased (to higher levels) by bedrock samples collected near ore zones.

Table 6-1: Comparison of the Proposed Action's Groundwater Quality and Ambient Groundwater Quality in the Reinjection Borefield Areas

Analyte	Reinjection Borefield Areas				Proposed Action's Groundwater			
	Minimum	Maximum	Mean	Median	Minimum	Maximum	Mean	Median
Arsenic (µg/L)	2.7	11.8	6.8	6.7	3.4	818.0	70.0	12.3
Uranium (µg/L)	6.4	34.9	23.5	24.9	7.0	114.0	33.2	32.5
Vanadium (µg/L)	0.8	39.7	26.5	28.5	0.3	45.6	27.3	28.8
Boron (mg/L)	0.29	0.62	0.49	0.50	0.29	0.80	0.52	0.52
Strontium (mg/L)	0.32	1.94	0.60	0.58	0.17	0.85	0.61	0.60
pH	7.9	8.5	8.1	8.1	7.7	9.1	8.1	8.1
TDS (mg/L)	840	993	909	916	667	1,741	1,029	1,049

Notwithstanding the expected low average trace metal content of dewatering discharge proposed for aquifer reinjection, any individual dewatering bores that abstract exceptionally high levels of dissolved arsenic would be designated and managed as 'Type II' water for reinjection into the RBS. Once the ore processing and TSF circuit is commissioned, any Type II water would be preferentially directed to the ore processing water stream. To evaluate the behaviour of any reinjected Type II water, the groundwater model applied particle tracking to the alluvial aquifer model layers, with particles 'released' in reinjection bores at day 1 and 730 and tracked for the life of mine (15 years) for the RBN and long-term (200 years) for the RBS. Figure 6-3 shows the particle tracking paths from each reinjection bore and confirms that all injected water from the RBS will ultimately discharge into the pit void post-closure, reinforcing the role of the pit lakes as long-term hydraulic sinks.

The reinjection borefields have been designed to minimise the risk of groundwater mounding affecting shallow-rooted vegetation, with bore spacing less than 400 m to maintain groundwater depths greater than 2 m below surface.

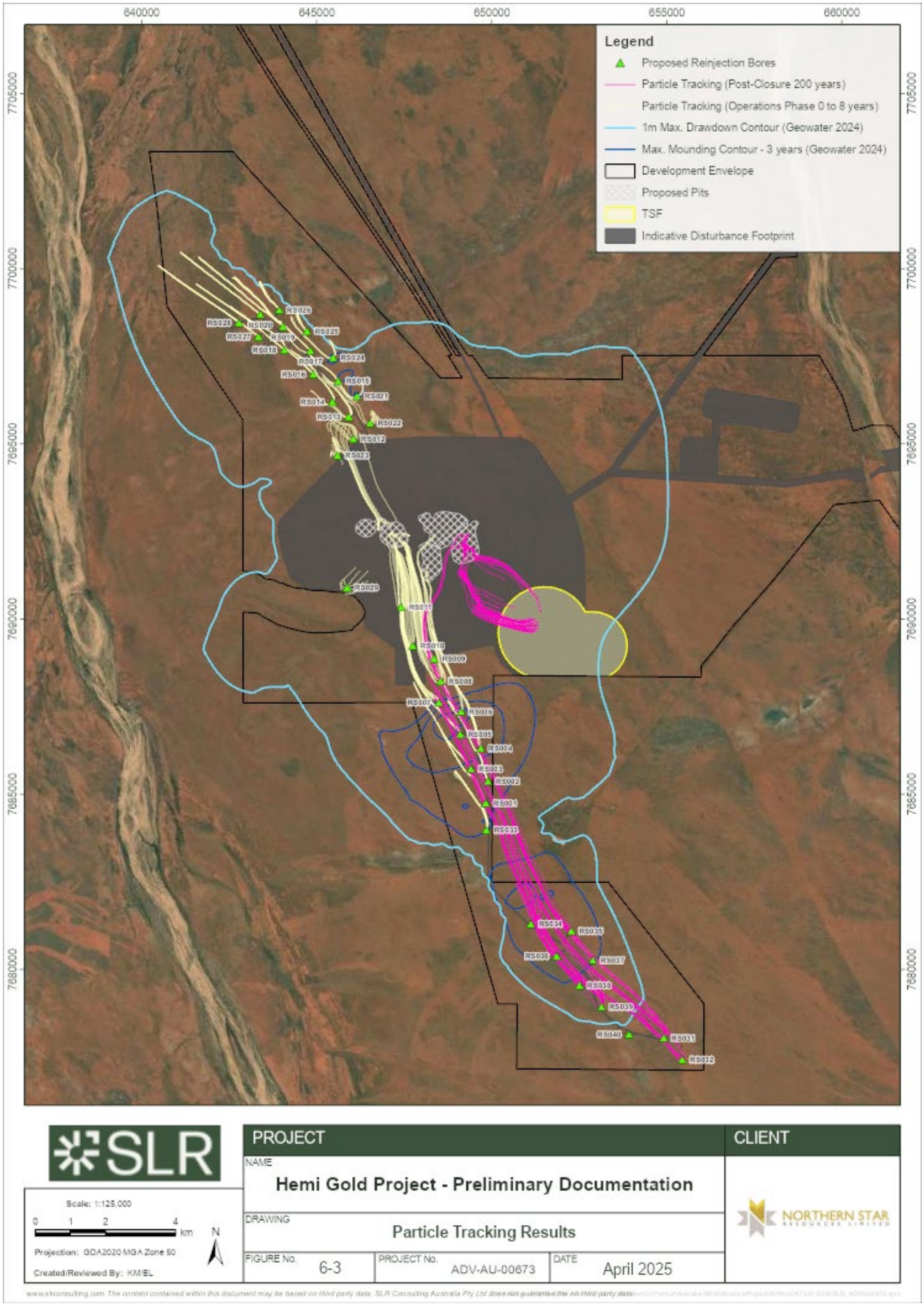
As boreholes are drilled, developed, and pump tested, water quality sampling will be conducted to determine whether the water falls under Type I or Type II classification.

6.3.3 Existing Groundwater Use

Existing groundwater users within the surrounding area include mining (Mt Dove Iron Ore Mine Borefield), pastoralism (Indee Station) and mineral exploration.

In addition to the above, the Water Corporation operates the Yule River Borefield for public drinking water supply for the town of Port Hedland. The supply bores are located near the eastern banks of the Yule River between 32 – 45 km northwest of the Proposed Action. This area is protected by the Yule Public Drinking Water Supply area which extends southwards along the Yule River to within approximately 6 km from the Proposed Action.

Figure 6-3: Particle Tracking Results



6.3.4 Dewatering Drawdown

The modelled extent of groundwater drawdown (defined as the area where drawdown is expected to be no more than 0.5, 1 and 2 m, noting that there is an observed natural variation in groundwater levels of 2 m in the region) is shown in Figure 6-4, along with an indicative area of mounding at reinjection borefields in year 3, which will later also be dewatered. Drawdown and reinjection are not predicted to impact either the Yule or Turner Rivers, and the Yule River borefield on Reserve 33015. By year 15, the model shows that the 0.5 m drawdown while proximate, will not impact, the Yule River channel and/or any potential GDVs, whilst the drawdown will be approximately 5 km from the Turner River channel.

Considering the 2 m drawdown contour, which accounts for the observed natural variation in groundwater levels, drawdown is expected to remain at 1.5 km from the Yule River and 6.2 km from the Turner River, ensuring that no riparian vegetation or GDVs within these water systems will be impacted. Therefore, no impacts are expected on riparian vegetation, GDVs or on riverine pools.

The drawdown area is predicted to reach a small portion of the Yule River Water Reserve (YRWR), between years 9 and 15. This Public Drinking Water Source Area (PDWSA), classified as a P1 protection zone, aims to prevent any degradation to the quality of groundwater. The PDWSA prioritises the protection of the Yule River channel, which is the primary source for aquifer recharge. Therefore, the extension of the water drawdown of less than 2 m towards the YRWR is not expected to impact the quality of water at the Yule River Borefield. The post closure drawdown for the Proposed Action is shown in Figure 6-5 with further information provided in Appendix 14.

As recharge rates are low, groundwater recovery is slow and long-term drawdowns are predicted to stabilise after 200 years. Long term drawdowns are expected due to the continued effect of evaporation from the pit lakes.

Geowater (Appendix 10) estimate that within the confines of the model domain, the alluvial aquifer has a total volume of 9,113 million m^3. At the conclusion of mining the alluvial aquifer will have a total volume of 8,486 million m^3 within the confines of the model area, which equates to an aquifer reduction of approximately 627 million m^3 (~ 7% of the pre-dewatering volume).

Due to the low permeability and/or storage capacity of the saprolite, saprock and bedrock Geowater did not consider these to be important aquifers which support cultural or environmental values, including Matters of National Environmental Significance, and as such volumetric calculations have not been provided for.

Figure 6-4: Groundwater Drawdown and Mounding

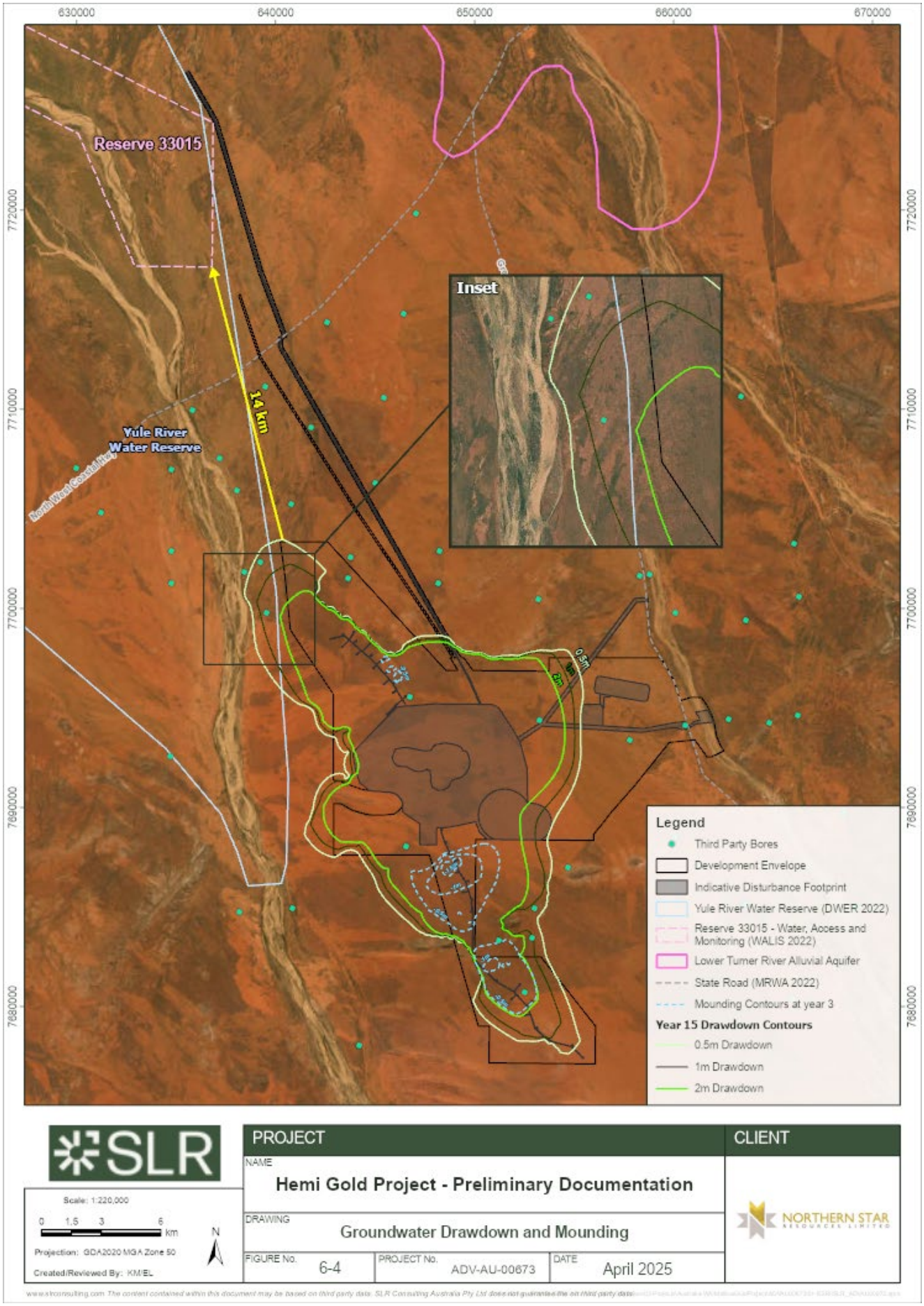
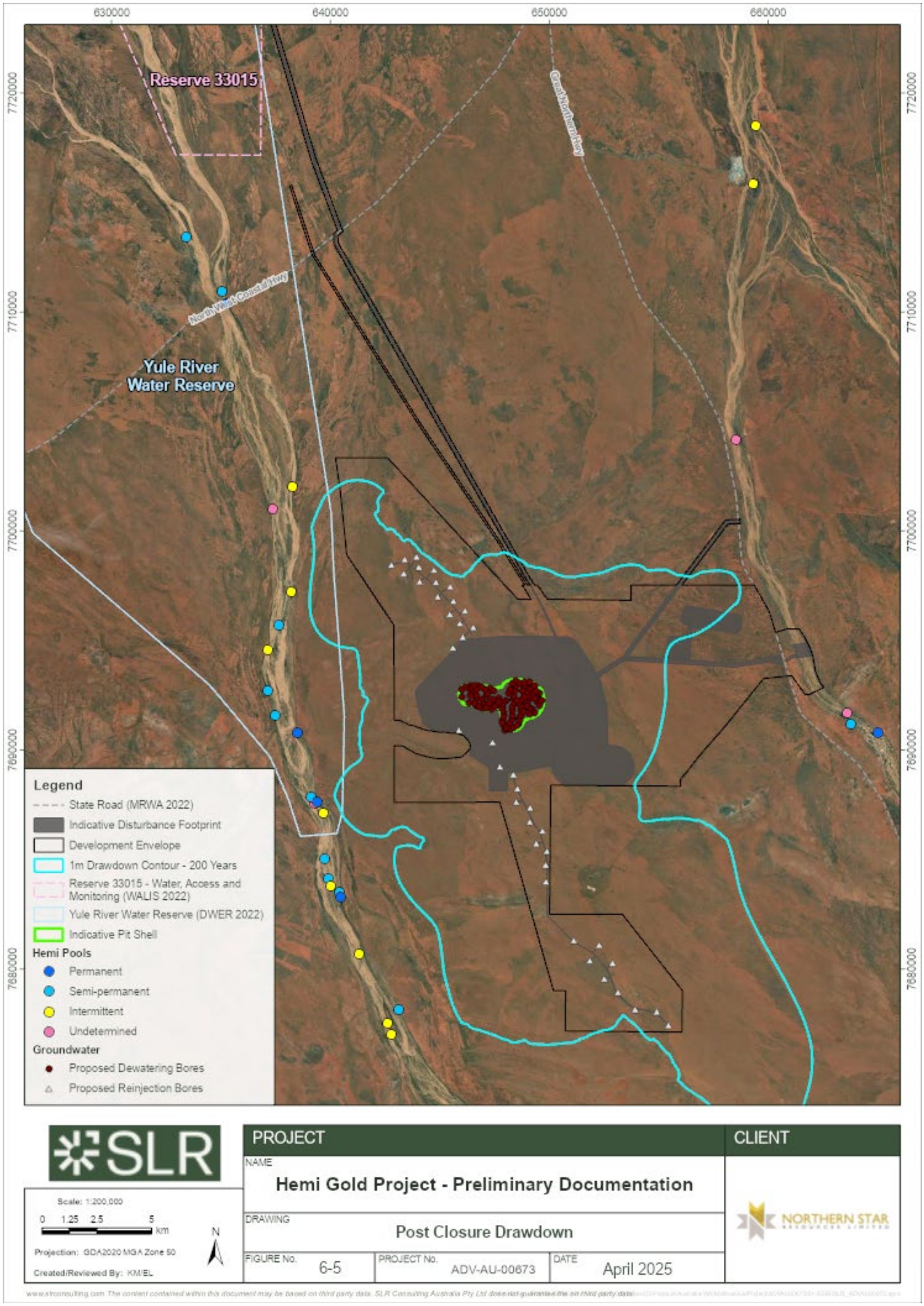


Figure 6-5: Post Closure Drawdown



6.3.5 Surplus Water Discharge to Turner River

For the first three years of dewatering, the Proposed Action is estimated to discharge up to 10 GL/year of surplus water into the Turner River. Once the processing plant is commissioned and ramped up to nameplate capacity, the utilisation of abstracted groundwater in the processing will reduce discharge into the Turner River. Intermittent discharge of up to 4 GL/year may occur in years 4 – 6 and 0 – 2 GL/year is expected from year seven until the end of the Proposed Action.

Modelling of no-natural-flow conditions indicates the wetting front will progress at approximately 5 km per month for a maximum of 50 km downstream of the outfall along the Turner River. This extent will be maintained for 14 months before discharge volumes decline, and the wetting front begins to recede.

The expected depth range of the area of surplus water discharge in the Turner River is provided in Table 6-2. The majority of the surplus water discharge area is expected to be shallow with 71% less than 20 cm deep and 91% less than 40 cm deep. The maximum expected depth is 130 cm however only 2% of the discharge area is expected to exceed 80 cm in depth. In comparison, a 10% AEP event spreads across more than 80% of the river at a depth of approximately 3.5 m.

Table 6-2: Modelled Depth Range of Surplus Water Discharge in the Turner River

Depth (cm)	Percentage of Surface Area	Cumulative Percentage
0.2 – 20	71%	71%
20 - 40	20%	91%
40 – 60	5%	96%
60 – 80	2%	98%
80 – 130	2%	100%

The discharge will not cover the entire riverbed (approximately 1.5 km), being principally contained within the river's low flow channel estimated to be 10% of the average width of the Turner River. The discharge area is significantly narrower than the riverbed and shallower than natural flood events and is not anticipated to have any long-term impacts to river morphology. The proposed surplus water discharge to the Turner River will cause a temporary shift from seasonal to continual flows within the low flow channel.

The modelled maximum extent of the wetting front is shown in Figure 6-6 and visually compared to photos of natural flow at the proposed discharge outfall (Figure 6-7) and the Indee Causeway (Figure 6-8) 2.1 km downstream of the outfall, which shows that natural flows are approximately 2.5 times greater than the proposed maximum discharge at the outfall and close to natural flow at Indee causeway.

The modelled maximum and minimum periods of continuous low flow are shown in Figure 6-9 and Figure 6-10, noting that after 3 years discharge decreases from 10 to 4 GL/year.

An analysis of the flow record (total GL/year, total number of flow days per year and number of flow days per year greater than 24 ML) for the Yule and Turner River between 2014 to 2024 is provided in Table 6-3. From this it can be seen that the Yule River experience flows ranging from 9 to 198 days per year. Similarly, the Turner River experiences flows ranging from 2 to 107 days per year. Of these total flow days, approximately half are greater than 24 ML per day for each river.

Despite the Yule River flow being approximately 10 times that of the Turner River (1,316.8 GL/year versus 181.1 GL/year) the total flowing days in the Yule River is lower than that of the Turner River (506 days versus 530 days).

As described in Geowater (2023), mounding beneath the Turner River in response to surplus water discharge is expected to be spatially limited and transient due to the high hydraulic conductivity of the alluvial sediments, which promotes rapid infiltration and dissipation of infiltrated water. The modelling assumed a conservative scenario, with continuous discharge during dry periods and flow rates of up to 24 ML/day. Even under this scenario, the mounding does not extend significantly into the wider alluvial aquifer or across the river floodplain.

From this it can be concluded that:

- There is not much alluvial sediment under Turner River (i.e. very little storage).
- Relatively small rainfall events creating flow in the Turner River.
- The extent of mounding beneath Turner River will be limited.

This is also confirmed by the more significant no-flow year numbers (7 years in the Yule River versus 4 years in the Turner River).

Table 6-3: Analysis of Yule and Turner River Flow

Year	Yule River			Turner River		
	Total Flow per Year (GL/year)	Total Number of Flow Days per Year	Total Number of Flow Days per Year Greater than 24 ML	Total Flow per Year (GL/year)	Total Number of Flow Days per Year	Total Number of Flow Days per Year Greater than 24 ML
2014	153.5	21	21	19.0	88	48
2015	51.1	40	27	0.0	2	0
2016	3.7	23	15	0.9	10	4
2017	255.7	198	171	20.4	107	71
2018	20.4	69	58	6.3	44	27
2019	588.8	26	15	82.9	49	21
2020	192.6	55	35	40.6	91	47
2021	38.1	37	24	2.9	65	24
2022	0.8	14	3	0.1	15	3
2023	0.3	9	3	1.7	30	16
2024	11.8	14	13	6.3	29	19
Total	1,316.8	506	385	181.1	530	280

Figure 6-6: Surplus Water Discharge Wetting Front Extent

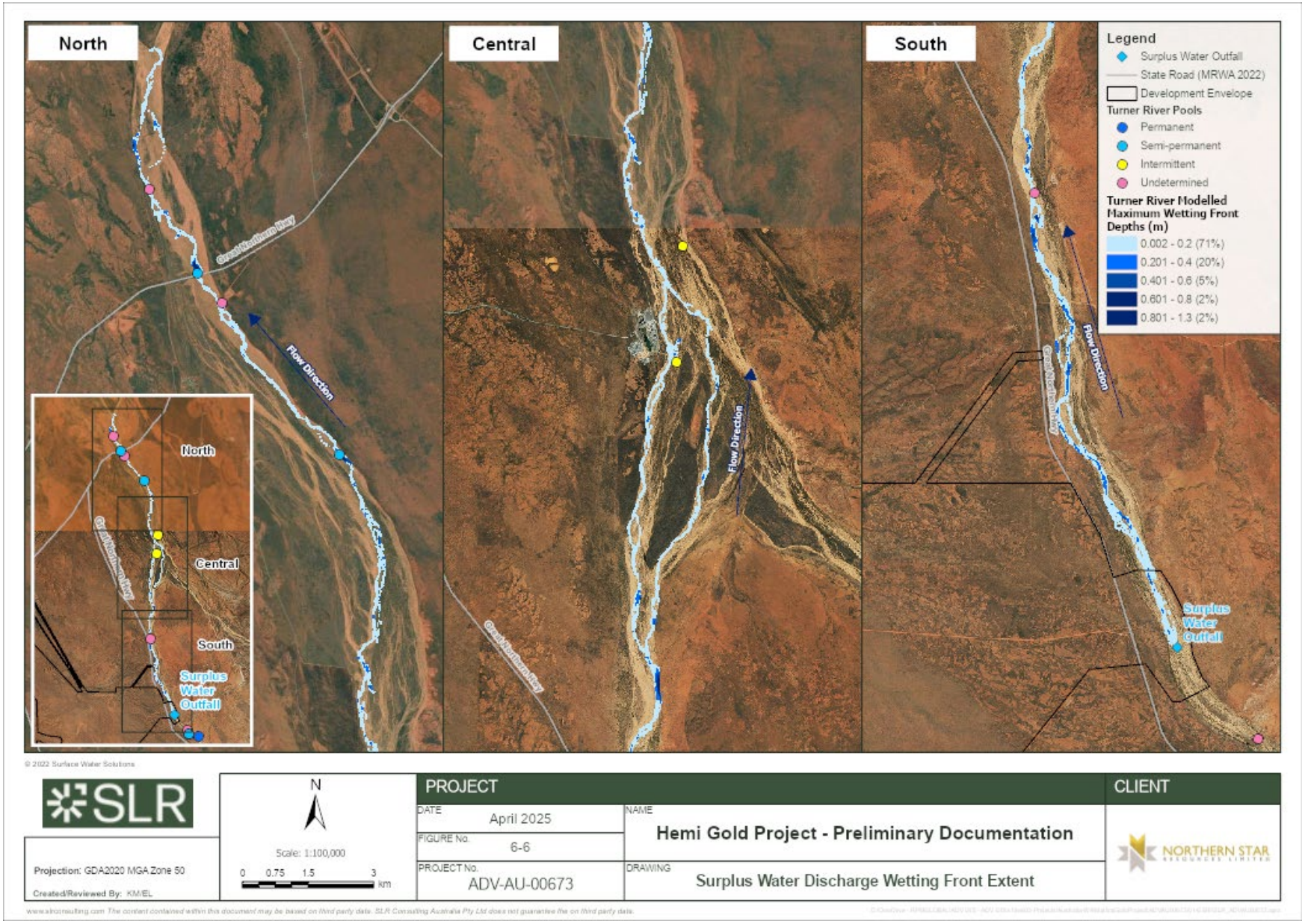


Figure 6-7: Wetting Front Modelling and Comparable River Flow Near Outfall

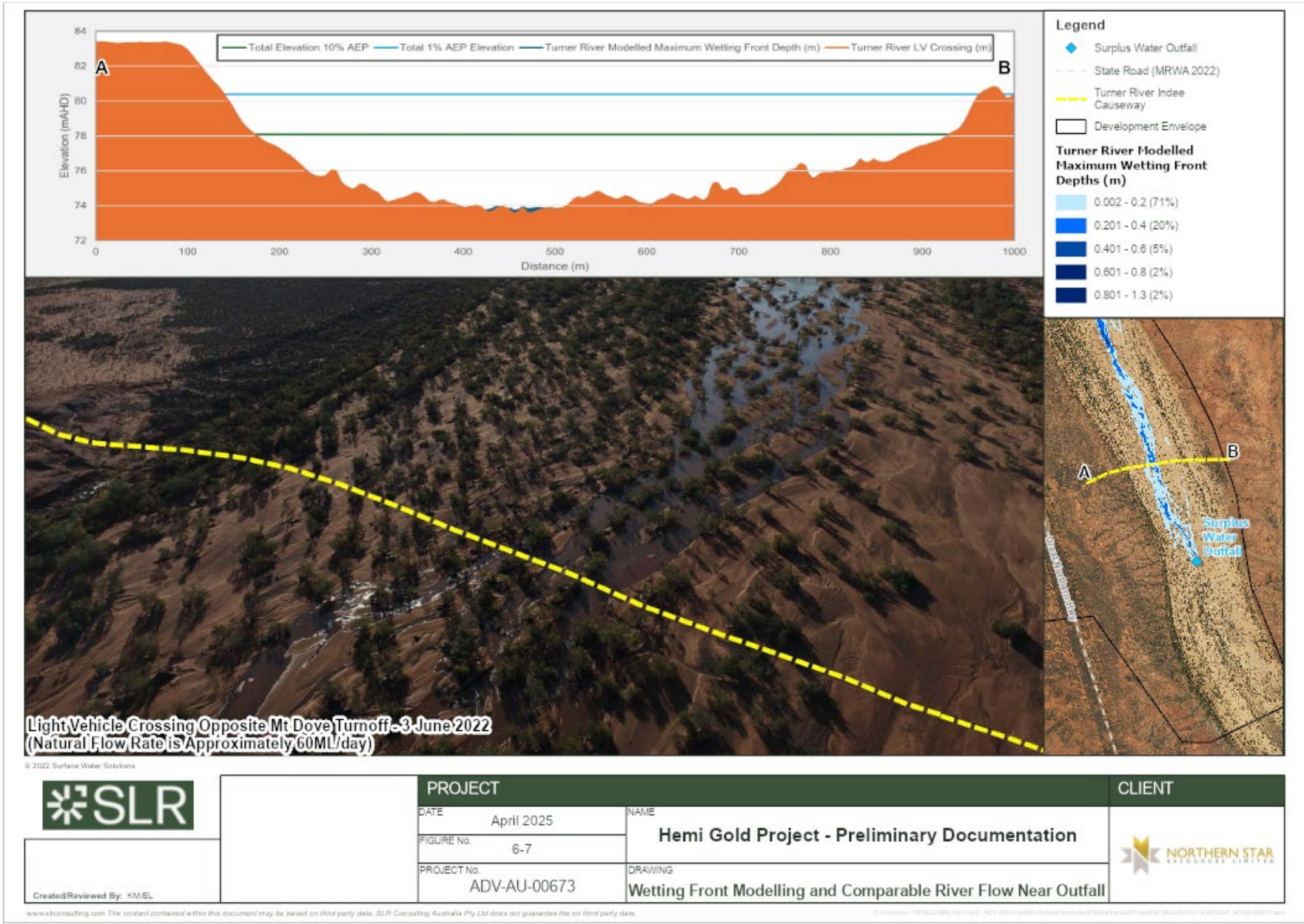


Figure 6-8: Wetting Front Modelling and Comparable River Flow at Indee Causeway (2.1 km Downstream of Outfall)

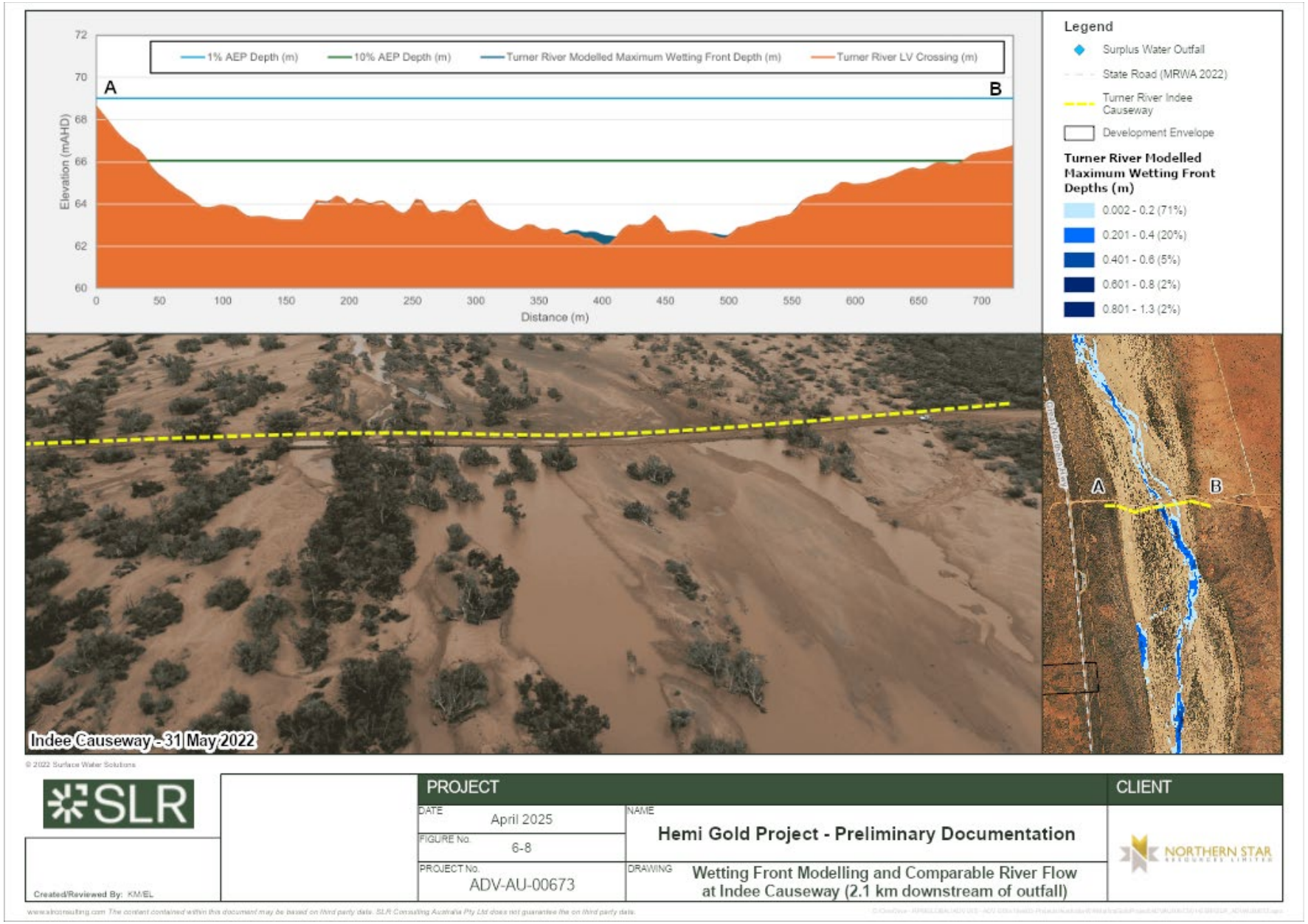


Figure 6-9: Maximum Continuous Flow within the Turner River

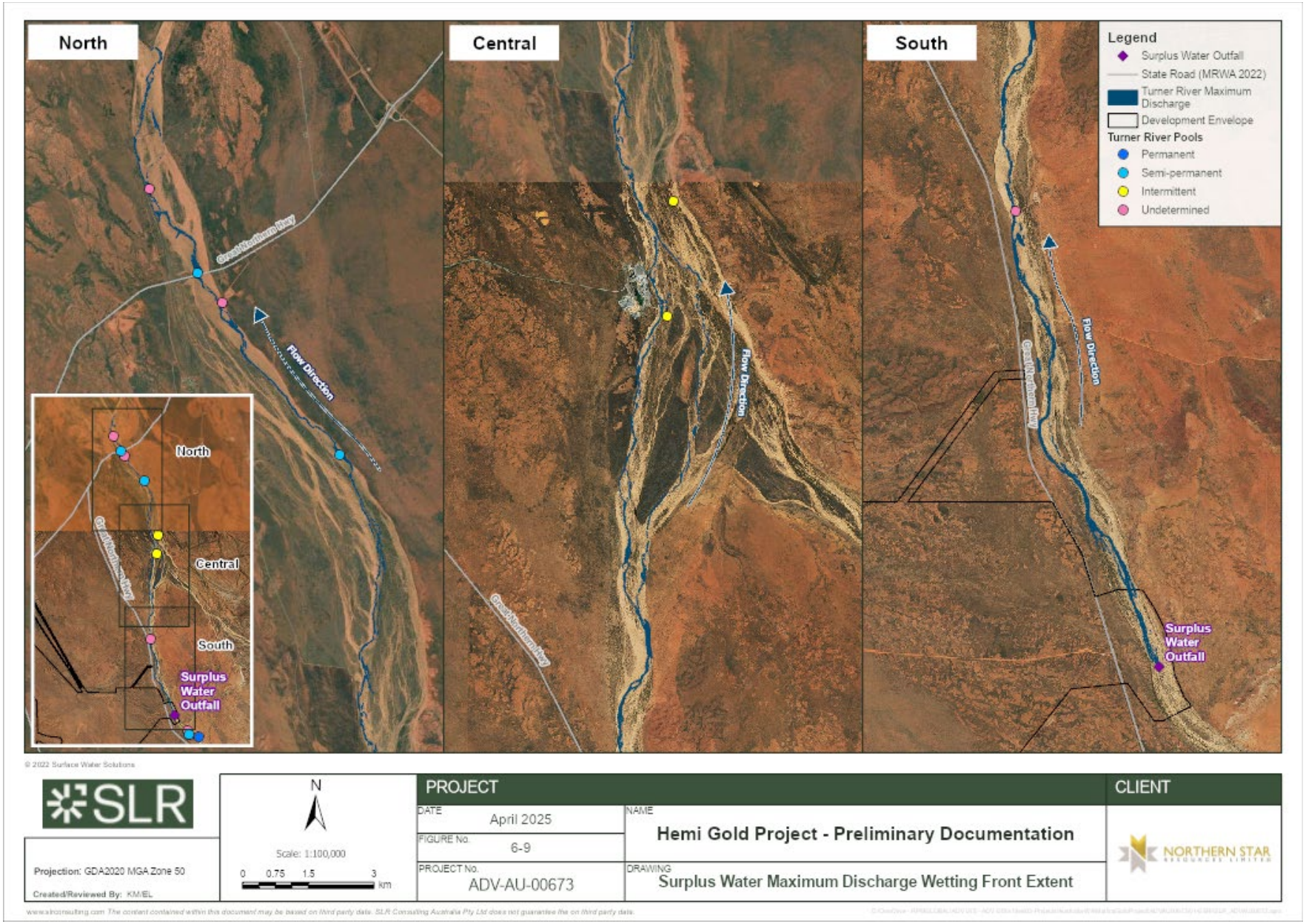
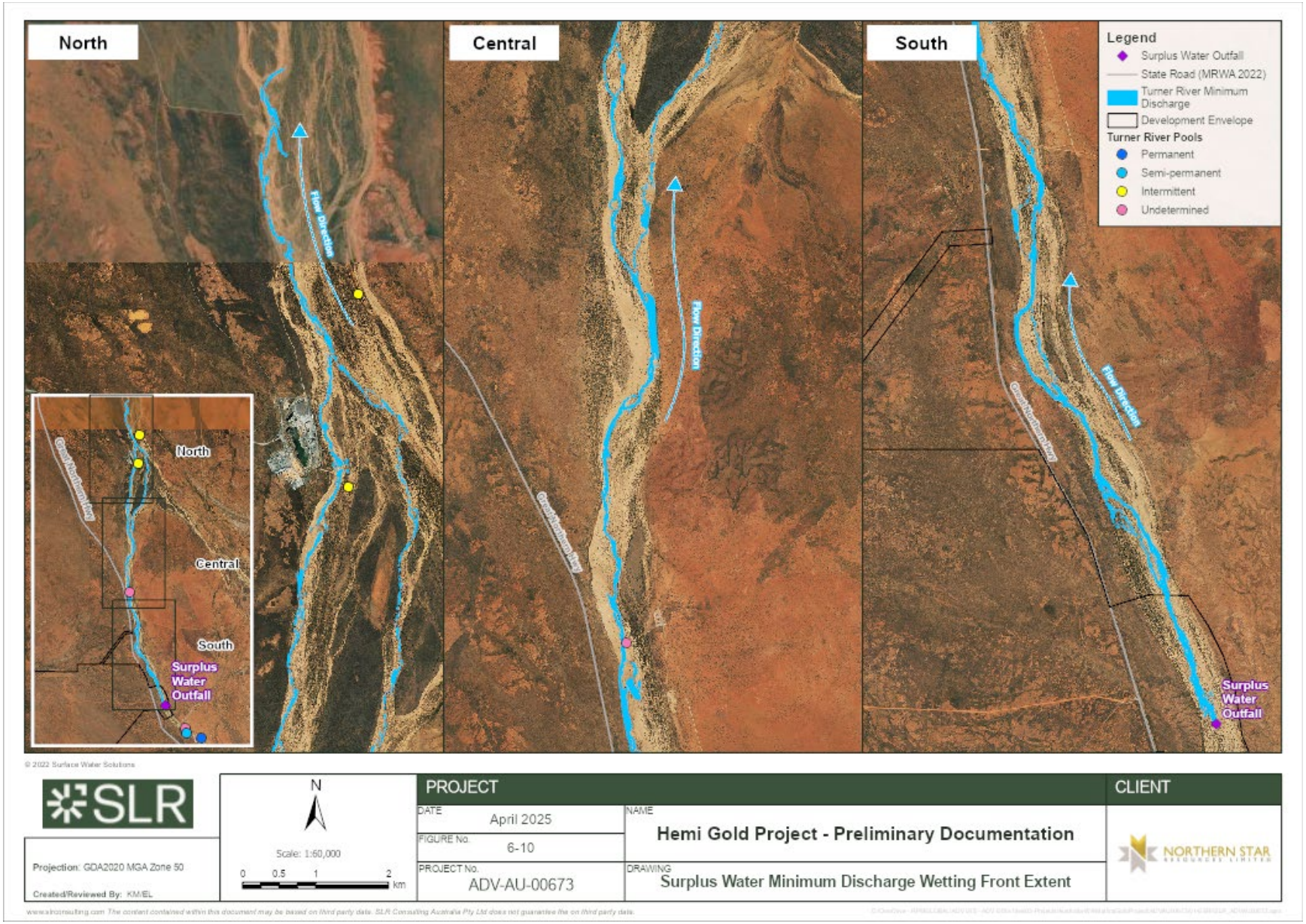


Figure 6-10: Minimum Continuous Flow within the Turner River



A Tier 2 Ecological Risk Assessment (ERA) was undertaken to evaluate the potential impacts on the Turner River ecosystem from the discharge of surplus water (MBS, 2024). This assessment, provided as Appendix 15, considered the existing surface water quality of the Turner River, potential ecological receptors and the quality of the groundwater that will be discharged. The key findings were as follows:

- Raw groundwater proposed to be discharged into the Turner River was found to contain naturally elevated dissolved concentrations of uranium (28–31 µg/L) and vanadium (28–30 µg/L).
- These concentrations were considerably higher than the ANZG (2018) low reliability freshwater species protection guidelines for uranium (0.5 µg/L) and vanadium (6 µg/L).
- Selected raw groundwater arsenic concentrations (6–36 µg/L) were also elevated with respect to ANZG (2018) freshwater species protection guidelines (13 µg/L).
- The Turner River is naturally enriched in uranium, with a mean concentration of 5.3 µg/L, far above the ANZG (2018) guideline value of 0.5 µg/L for species protection.
- Average vanadium concentrations of 4.1 µg/L in the Turner River are comparable to the ANZG (2018) low-reliability (limited toxicity data) freshwater species protection value of 6 µg/L.
- Given the low reliability of ANZG (2018) freshwater species protection guidelines for uranium and vanadium and the elevated concentrations of uranium and to a lesser extent vanadium and arsenic present in the Turner River, a series of site-specific trigger values were generated.
- Modelling and laboratory tests indicate that soil-based holding ponds (with a residency time of three hours) and/or iron oxide treatments effectively reduce vanadium and arsenic concentrations to below trigger levels, while uranium remains largely unaffected.

Based on these results, a Tier 3 ERA was undertaken on representative discharge water (direct toxicity assessment) to further understand the potential impacts of the proposed discharge on aquatic biota in the Turner River ecosystem (Appendix 16). The result of this assessment concluded that:

- Discharge of representative water treated via soil-based holding ponds showed no deleterious effects on a range of Pilbara based biota within the Turner River system, even at uranium concentrations of 33 µg/L. Tested species included freshwater cladoceran, rainbowfish, freshwater hydra, duckweed, and green algae, with results indicating that the planned discharge would not have significant adverse acute or chronic effects on these organisms. Therefore, the establishment of provisional trigger values for naturally occurring uranium, suggested prior to conducting this ecotoxicological test, is deemed unnecessary, as the planned discharge is not expected to have significant adverse effects on the biota of the Turner River.
- Radiological risks from untreated discharge water are minimal at the population level for organisms residing in or utilising the Turner River, even under conservative scenarios.
- The impact on Turner River sediments and hydrology due to surplus water discharge was considered low, with the 50-km wetting front predicted to inundate less than 6% of the river width, posing minimal ecological risk over the three-year discharge period.

A separate study focused on assessing potential impacts of the discharge water on MNES (Appendix 25). This assessment considered radiological exposure, bioaccumulation potential, and trophic transfer risks for species such as Northern Quoll, Pilbara Olive Python, and Grey Falcon. The key outcomes of this study are as follow:

- Radiological modelling (ERICA and RESRAD) demonstrated that dose rates for representative organisms (cattle, large birds, reptiles) were far below the 40 µGy/h screening threshold, even under conservative scenarios.
- Uranium shows low bioaccumulation and does not biomagnify in food webs. Higher trophic MNES species are unlikely to accumulate uranium due to limited dietary exposure and the absence of biological uptake mechanisms.

- Post-discharge concentrations of uranium, arsenic, and vanadium remain well below ANZECC livestock drinking water guidelines.

Based on these findings, the proposed discharge is not expected to result in significant adverse effects on MNES fauna or their habitats.

6.3.6 Post Closure Pit Lakes

With the cessation of dewatering at closure, groundwater flow into pit voids together with rainfall and surface water run-off, will accumulate to form pit lakes. Groundwater flow will occur due to the natural flow path becoming re-established and due to the presence of a hydraulic gradient associated with the groundwater drawdown depression created by the dewatering.

Forward particle tracking (200 years) confirms that all injected water from the southern bore field will ultimately discharge into the pit void post-closure, reinforcing the role of the pit lakes as a long-term hydraulic sink. This ensures that any remaining high-arsenic reinjectant water will be removed from the aquifer system between Hemi and Mt Dove.

Hydrogeological modelling indicates that due to low groundwater flow and high evaporation rates, the hydraulic gradient will remain post-closure. Thus, the pit lakes will act as a groundwater sink, continually drawing in groundwater as it evaporates from lake surfaces (Appendix 17).

Pit lake modelling predicts that water salinity will slowly climb in both voids due to evapo-concentration effects, reaching up to 2,000 – 15,000 mg/L after 866 years. Groundwater drawdown modelling indicates that the post-closure groundwater drawdown depression will not adversely affect the Yule River, or its permanent pools that are potentially groundwater-fed nor the Turner River or semi-permanent pools (Appendix 17).

The data available considerably influences the accuracy of hydrogeological modelling, with the intended use of the modelled results matched to the appropriate calibration standards set out in the Australian Modelling Guidelines (Barnett B et al., 2012). While Northern Star's model is appropriately calibrated, once dewatering and monitoring commence, the model's performance can be further enhanced through ongoing recalibration based on monitoring data. Continual improvement in knowledge and understanding of closure issues is a standard requirement of mine closure planning under the Mining Act. DEMIRS will be updated on the ongoing collection of data and the current status of pit lake modelling as part of the ongoing revisions of the MCP. Preliminary pit lake modelling is included in the Conceptual MCP, attached as Appendix 7. Kinetic leach column testing that is currently underway will be used to assign source terms to the pit walls as part of the ongoing refinement of the pit lake water quality modelling.

A Tier 1 ecological risk assessment of potential impacts from the pit lake on MNES was completed by SLR Consulting (Australia) Pty Ltd and is provided in Appendix 6. The assessment analysed the hazards, exposure pathways, and risks to MNES. It concluded that, considering the proposed engineering controls, local climatic conditions, and the ecology of relevant species, the likelihood of adverse impacts to MNES is very low.

6.4 Hydrology

6.4.1 Overview

A surface water assessment is included in the hydrogeology report (Geowater Consulting, 2023) for the Proposed Action, which is attached as Appendix 18. Hemi is on a relatively flat plain in an internal surface water catchment between the Yule River and Turner River Catchments (Figure 6-11). The nearest proposed mining infrastructure is located approximately six kilometres east of the Yule River Catchment and two kilometres west of the Turner River Catchment (excluding monitoring bores).

The highest elevation within the Development Envelope is 109 mAHD, situated at the southern portion, while 95% of the terrain is between 54 and 94 mAHD.

Despite an upstream catchment area of approximately 528 km^2, there are no clearly defined drainage lines within the Development Envelope, and the Great Northern Highway separates the central mining and

infrastructure area from the Turner River. Drainage lines, creeks and rivers in the Pilbara are typically ephemeral and flow for only a short duration following rainfall events.

Modelling predicts that prior to surface water management controls, stormwater flow will result in sheet flow over much of the internal catchment containing the Proposed Action, draining to the north/northwest and eventually forming a series of disorganised drainage lines. Drainage within the internal catchment does not flow to the Turner or Yule River systems. Surface water controls will be applied to manage stormwater runoff within the proposed disturbance footprint.

Surface Water Solutions (SWS, 2022) conducted a conservative flood modelling exercise for the Hemi area for 20% Annual Exceedance Probability (AEP) (1-in-5 years) and 1% AEP (1-in-100 years) events (Figure 6-12). Conservatively, the model assumed peak river flows in the Turner and Yule Rivers simultaneously and coincident in time with peak local rainfall events.

The 20% AEP event predicts minimal flooding limited to existing river channels with no significant impact on the immediate Hemi area. The 1% AEP event predicts overflow from the Turner River, potentially creating an eastern anabranch and widespread shallow flooding northwest of Hemi. However, large river flows are unlikely to cause flooding at Hemi. Heavy rainfall pooling and sheet flow will cause mostly localised flooding within the Development Envelope, with water draining northwest.

Figure 6-11: Catchments and Topography

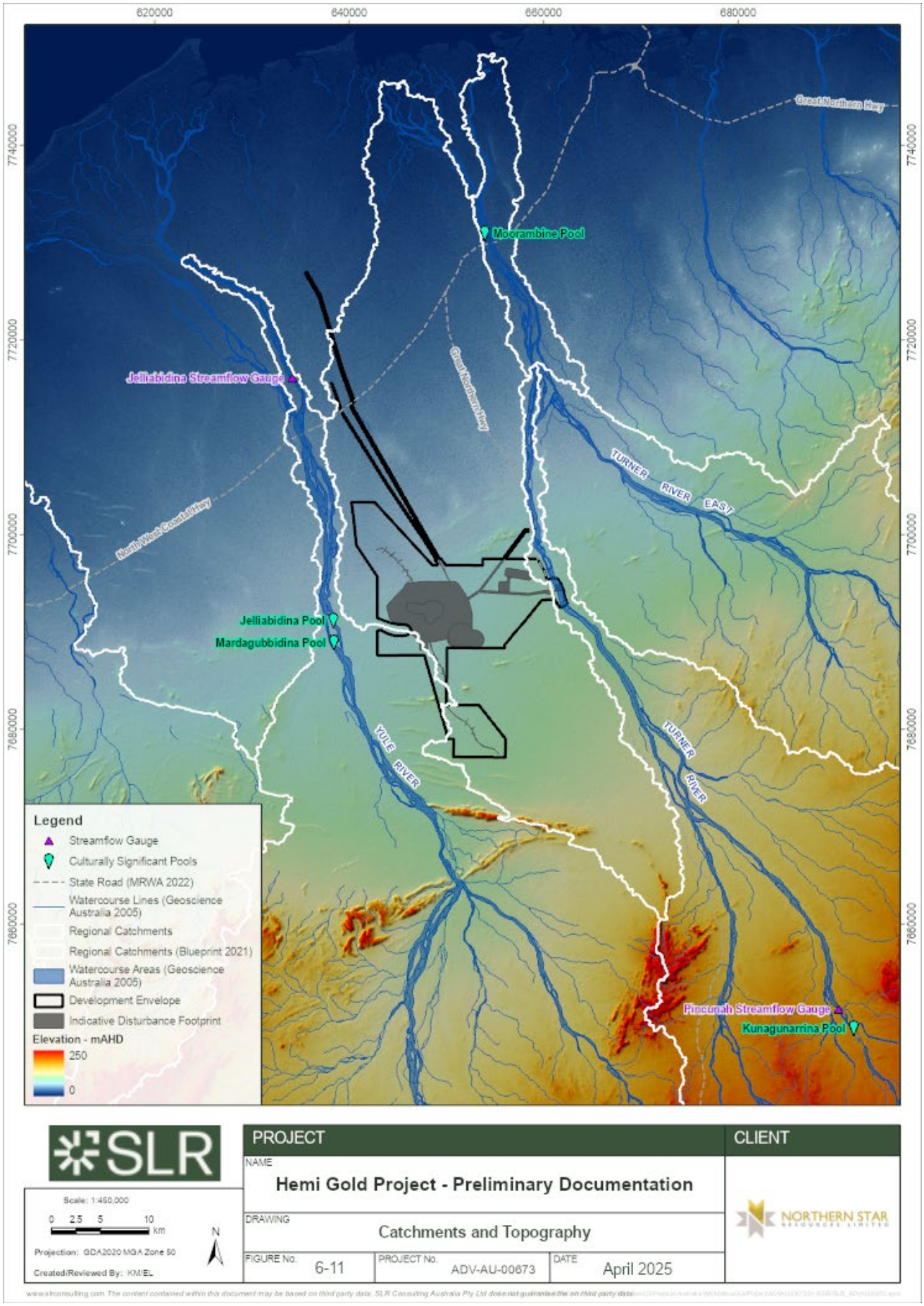
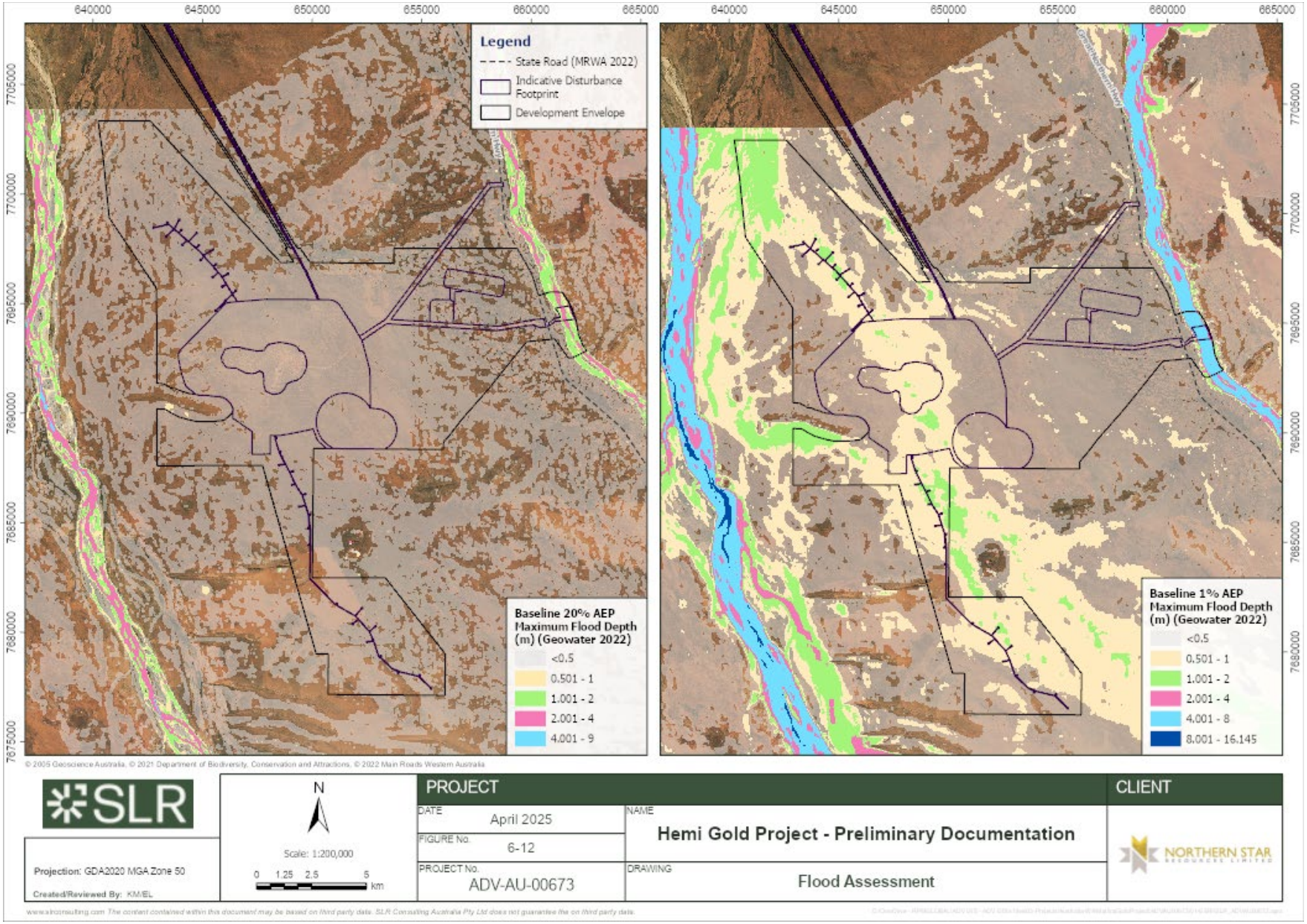


Figure 6-12: Flood Assessment



6.4.2 Riverine Pools

The Turner and Yule Rivers are ephemeral, flowing only after seasonal heavy rainfall. Despite this, both rivers contain permanent or semi-permanent pools (Figure 6-13), with the Yule River boasting larger and more persistent pools. To understand the aquatic ecology of these pools, Stantec Limited (Stantec, 2022, 2023) conducted a dual phase baseline aquatic ecology survey in the Yule and Turner Rivers in November 2021 (dry season) and May 2022 (wet season). A copy of Stantec's survey report is included in Appendix 19.

The 2022 Pilbara wet season was unusually dry, with typical wet season conditions not eventuating until later in the year. Stantec subsequently undertook an additional opportunistic survey in July 2022 to characterise the Yule and Turner Rivers after rainfall, providing characteristics of the wet season across the Pilbara region. The survey memo (Stantec, 2023) is attached as Appendix 20.

Unless otherwise referenced, the text in this section of the document is drawn from the Stantec report and memorandum. Detailed monitoring results can be found in the Stantec report (2022, 2023).

6.4.2.1 Yule River

The Yule River, which has been excluded from the Development Envelope, contains permanent pools and supports a riverine and groundwater dependant ecosystem. Based on satellite imagery and previous studies, Stantec (2022, 2023) narrowed down potential pools locations. From eight potential pools identified, seven contained waters in at least one monitoring campaign.

Based on water and biota presence, two pools (YRU1 and YRU2) were classified as semi-permanent and the other five pools as permanent (YRU1-A, YR1, YR2, YRD1 and YR3 (also called Jelliabidina Pool)) (Figure 6-13). Based on satellite imagery, DWER (2008) has identified several other pools along the Yule River. Most of them were classified as either semi-permanent or intermittent, with two permanent pools (Jelliabidina pool and unnamed) mapped.

Consultation with the Traditional Owners has identified two pools of cultural heritage significance in the Yule River, being Papawilyuwihi Pool and Mardagubbidina Pool. The river is used for stock water, and groundwater under the river is used as a source of drinking water for Port Hedland, with an established borefield north northwest of the Project, located within a Public Drinking Water Source Area.

Recognising the importance of these semi-permanent and permanent pools within the Yule River for maintaining ecological values and cultural significance, Northern Star will establish an outcome-based provision within the Conservation Significant Species Management Plan (CSSMP) to manage potential impacts. This provision will utilise a three-tiered approach with early warning bores, trigger bores, and threshold bores. Early warning bores will provide an initial indication of potential drawdown approaching. Trigger bores will signal the need for investigation and potential mitigation measures if drawdown reaches a predetermined level. Finally, threshold bores will indicate if intervention strategies are necessary to protect the ecological and cultural values of the pools.

This outcome-based approach ensures a proactive and measured response to safeguard the integrity of the Yule River pools and the potential GDV present in the river channel.

6.4.2.2 Turner River

Stantec (Stantec, 2022, 2023) mapped eight potential pools along the Turner River, of which five contained water during at least one sampling campaign. Stantec then classified them as permanent (TR1) and semi-permanent (TRE2, TRU1, TRU2 and TRD2). Additionally, based on aerials, DoW (2011) mapped additional pools along the Turner River and classified them as either semi-permanents or intermittent, apart from one undetermined. Based on aerials, DoW (2011) mapped additional pools along the Turner River and classified them as either semi-permanent or intermittent, with one classified as being undetermined. Northern Star has identified an additional pool, named Kunagunarinna Pool, situated 54 km upstream of the proposed dewatering outfall (currently undefined).

While some pools exist downstream of the proposed discharge outfall, as shown in Figure 6-13 they are all temporary and rely on seasonal rainfall to maintain their water levels. Among these, the semi-permanent Pool TRD2 was consistently sampled throughout the study, as it contained at least some water in the dry season (November 2021), wet season (May 2022) and post-flood (July 2022) surveys. This site is located approximately 40 km downstream of the proposed discharge of surplus water, and functions as a semi-permanent pool situated beneath the Great Northern Highway bridge.

Considering that Pool TRD2 was observed with water in both wet and dry seasons and is the only pool within the wetting front, Northern Star has reviewed aerial imagery to determine whether it had periods of complete dryness. This precautionary measure was taken to confirm that TRD2 is semi-permanent. Figure 6-14 presents aerial imagery captured on 1 January 2024, providing additional evidence that water availability in TRD2 varies over time and that the pool experiences periodic drying phases, supporting the classification as semi-permanent. In addition to TRD2, Figure 8 8 shows Moorambine pool which has previously been classified as undetermined by DoW. From this figure it can be seen that Moorambine pool also experiences periods of dry conditions, indicating that it cannot be considered a permanent pool.

As stated by Stantec, pools on the Turner River are seasonal and semi-permanent, and considered to be of low to moderate ecological value. Several pools were in a recessional phase or dry during the wet season survey. By comparison, pools on the Yule River were larger, more permanent, potentially groundwater-fed and considered to hold moderate to high ecological value. As discussed in Section 2.1.3, due to its higher ecological and heritage value, the Project has avoided any impacts on the Yule River; thus, it is not the primary focus of this assessment.

Figure 6-13: Riverine Pools

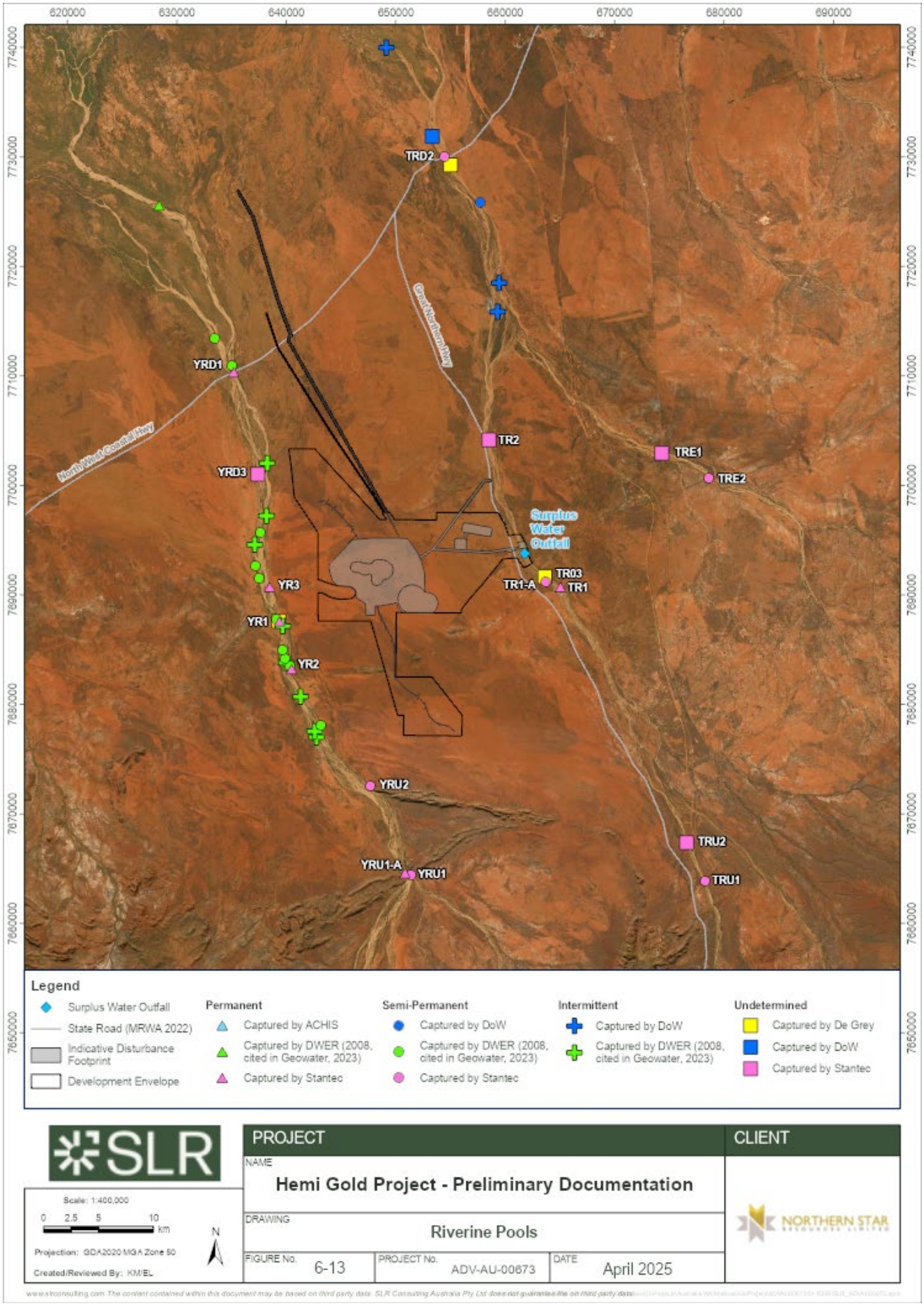
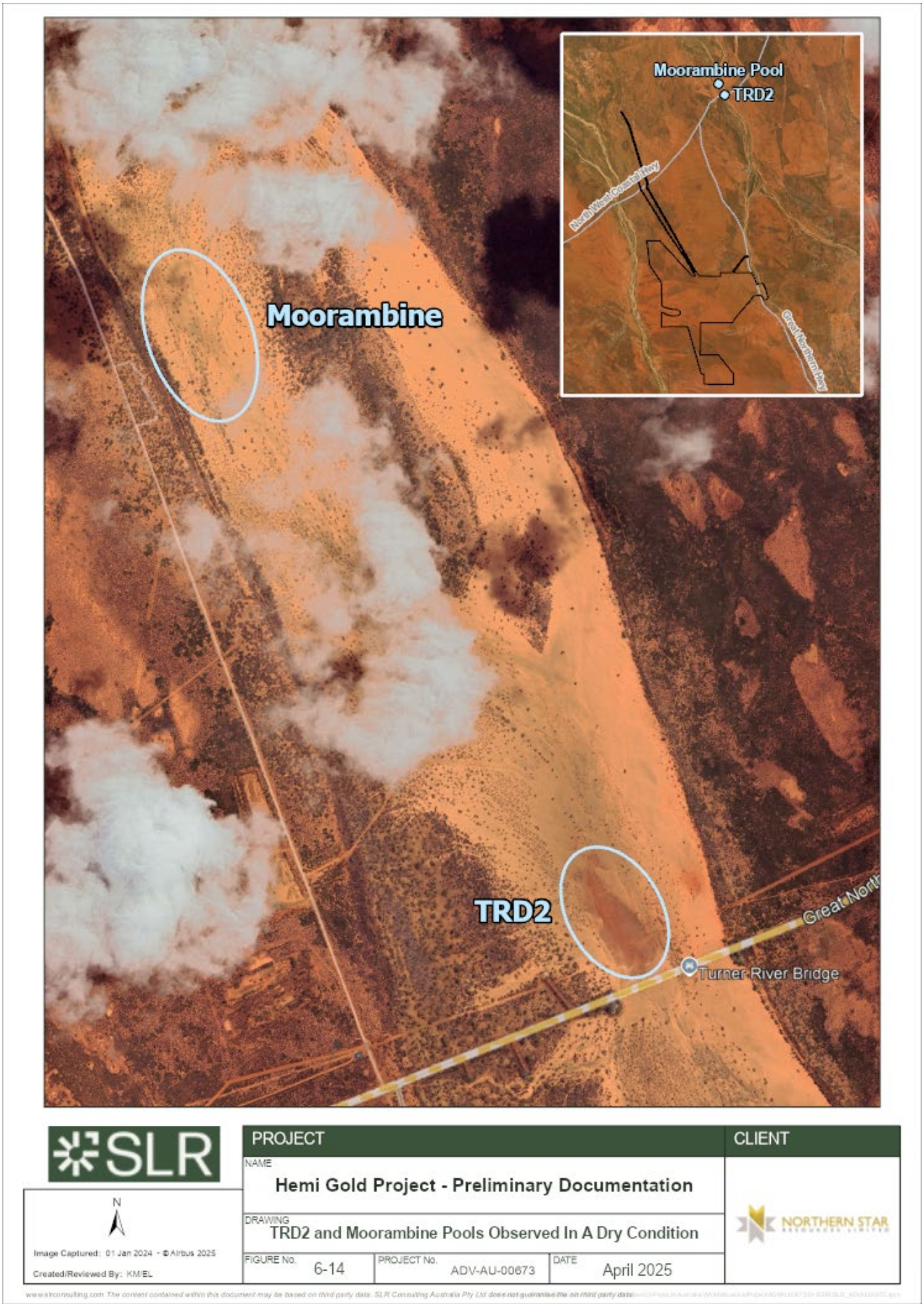


Figure 6-14: TRD2 and Moorambine Pools Observed in a Dry Condition



6.4.3 Turner River Water Quality

Baseline water quality was assessed by Stantec (2022, 2023), who sampled water in the Turner River from four pools in the dry season of 2021, five pools in the wet season of 2022 and four pools after a flood event in 2022. Northern Star also sampled the Turner River in 2022.

Water in the Turner River, when present, is circumneutral to alkaline and fresh to brackish depending on the amount of evapo-concentration in pools after a flow event. Nitrogen and phosphorus levels in excess of Australia and New Zealand Guidelines (ANZG) are attributed to enriched groundwaters and unrestricted livestock access. Naturally occurring aluminium, arsenic, boron, chromium, copper, nickel, uranium and zinc were also recorded in excess of the ANZG guidelines for sporadic samples.

The Turner River also supports an extensive riverine and groundwater dependant ecosystem and is used for various purposes, including pastoralism (stock), domestic use and limited mining/quarrying (Stantec, 2022).

6.5 Flora and Vegetation

6.5.1 Studies

Detailed flora and vegetation surveys were undertaken by Ecoscape in March 2021 (Ecoscape, 2021) and Umwelt in March to July 2022 (Umwelt, 2024). The flora survey area of 29,522 ha is approximately 25% larger than the 22,194 ha Development Envelope and approximately 80% larger than the 5,830 ha proposed indicative disturbance footprint.

The relevant studies and surveys for the Proposed Action are summarised in Table 6-4.

Table 6-4: Relevant Flora and Vegetation Surveys for the Proposed Action

Report Name	Survey Dates	Reference	Location
Mallina Gold Project Detailed Flora and Vegetation Assessment	March 2021	(Ecoscape, 2021)	Not applicable
Hemi Gold Deposit: Baseline Flora and Vegetation Assessment	March to July 2022	(Umwelt, 2024)	Appendix 21
RE: Status of *Seringia exastia* at Hemi	November 2022	(Umwelt, 2022a)	Appendix 22

6.5.2 Results

A total of 17 Vegetation Types (VTs) were defined and mapped based on the results of floristic classification analysis and subsequent examination of data collected from quadrats in the survey area described in Table 6-5 and displayed in Figure 6-15. The 17 VTs defined represent five broad groups of vegetation based on soils and topography:

- Group 1: Hummock grasslands on low-lying flood plains and flats on clay or sandy loams (VT 1).
- Group 2: Tussock grasslands in clay pans (VT 2).
- Group 3: Low woodlands and tall shrublands over low shrublands and hummock grasslands on plains, in minor drainage lines and low stony rises and hills on clay and sandy loams (VTs 3-15).
- Group 4: Mid to low woodlands and tall shrublands over low shrublands and hummock grasslands in river channels (VT 16).
- Group 5: Tall shrublands over low shrublands and tussock and hummock grasslands on red sand dunes (VT 17).

Table 6-5: Vegetation Types of the Survey Area

Code	Description	Representative Photo	Area Mapped (ha)	Area in Development Envelope (ha)	Area in Indicative Disturbance Footprint (ha)
1	Low isolated shrubs dominated by *Acacia stellaticeps* and *Pluchea tetranthera* over low hummock grassland dominated by *Triodia longiceps* and *Triodia epactia* over ephemeral low sparse sedgeland, tussock grassland and forbland of mixed taxa including *Fimbristylis dichotoma*, *Bulbostylis barBata*, *Calandrinia stagnensis*, *Streptoglossa decurrens* and *Eriachne aristidea* on red-brown clay loam, sandy clay loam or sandy clay on plains and flats.		1,198.1	817.9 (3.7%)	33.1 (0.6%)
2	Low tussock grassland to sparse tussock grassland dominated by a combination of *Eriachne glauca* var. *glauca*, *Eriachne benthamii* and *Eriachne flaccida* over low sparse hummock grassland of *Triodia epactia* and *Triodia longiceps* over ephemeral low sparse sedgeland and forbland of mixed species including *Cyperus iria*, *Fimbristylis dichotoma*, *Neptunia dimorphantha*, *Marsilea hirsuta* and *Calandrinia pumila* on orange, red-brown or brown clay in clay pans.		39.8	7.1 (0.03%)	0.5 (0.008%)

Code	Description	Representative Photo	Area Mapped (ha)	Area in Development Envelope (ha)	Area in Indicative Disturbance Footprint (ha)
3	Low woodland to open woodland dominated by *Corymbia candida* subsp. *candida* over tall shrubland to open shrubland dominated by *Acacia colei* and *Acacia tumida* var. *pilbarensis* over low open to sparse shrubland of mixed species including *Pluchea tetranthera*, *Afrohybanthus aurantiacus* and *Sida rohlenae* subsp. *rohlenae* over low open to sparse hummock grassland dominated by *Triodia epactia* over low sparse tussock grassland of mixed species including *Chrysopogon fallax*, *Aristida holathera* var. *holathera*, *Eragrostis eriopoda*, *Eriachne obtusa* and *Cenchrus ciliaris* on orange sandy or sandy clay loam on flats.		83.3	19.7 (0.9%)	2.2 (0.04%)
4	Tall sparse shrubland of mixed species including *Acacia ancistrocarpa*, *Acacia inaequilatera*, *Acacia colei* and *Melaleuca lasiandra* over low open to sparse shrubland dominated by *Acacia stellaticeps, Pluchea tetranthera, Sida arenicola* and *Corchorus elachocarpus* over low hummock grassland to open hummock grassland dominated by *Triodia epactia*, *Triodia lanigera* and *Triodia schinzii* on red or red-brown sandy loam on plains.		3,789.8	2,853.3 (12.9%)	88.1 (1.5%)

Code	Description	Representative Photo	Area Mapped (ha)	Area in Development Envelope (ha)	Area in Indicative Disturbance Footprint (ha)
5	Tall open to sparse shrubland dominated by *Acacia trudgeniana* and *Acacia colei* over low open to sparse shrubland dominated by *Acacia stellaticeps*, *Corchorus incanus* subsp. *incanus* and *Pimelea ammocharis* over low hummock grassland of *Triodia epactia* over low sparse tussock grassland of mixed species including *Aristida holathera* var. *holathera*, *Eragrostis eriopoda*, *Chrysopogon fallax* and *Eriachne obtusa* on red-brown clay or sandy loam on plains.		958.6	281.2 (1.3%)	67.8 (1.2%)
6	Tall sparse shrubland dominated by *Acacia trachycarpa* and *Acacia colei* over low sparse shrubland of mixed species including *Acacia stellaticeps* and *Corchorus incanus* subsp. *incanus* over low hummock grassland dominated by *Triodia lanigera* on red-brown sandy loam on low dunes within river channels.		1.8	0.1 (0%)	0.0 (0%)
7	Tall sparse shrubland dominated *by Acacia tumida* var. *pilbarensis* over low sparse shrubland dominated by *Corchorus incanus* subsp. *incanus* and *Tephrosia rosea* var. *clementii* over ephemeral low sparse forbland and grassland of mixed species including *Calocephalus beardii*, *Aristida contorta*, *Eragrostis cumingii*, *Indigofera colutea* and *Perotis rara* on brown sandy loam with granite outcropping and stones on and around low granite outcrops.		24.2	24.2 (0.1%)	0.0 (0%)

Code	Description	Representative Photo	Area Mapped (ha)	Area in Development Envelope (ha)	Area in Indicative Disturbance Footprint (ha)
8	Low open woodland to isolated trees dominated by *Corymbia hamersleyana* over tall open to sparse shrubland dominated by *Acacia bivenosa*, *Acacia inaequilatera*, *Grevillea wickhamii* subsp. *aprica* and *Hakea loreus* subsp. *loreus* over low sparse shrubland of mixed species dominated by *Acacia stellaticeps*, *Scaevola amblyanthera* var. *centralis* and *Corchorus elachocarpus* over low hummock grassland dominated by *Triodia epactia* on red or red brown clay or sandy loam with calcrete and silica stones, occasionally with calcrete or silica outcropping, on low rises or plains.		204.8	133.3 (0.6%)	13.0 (0.2%)
9	Tall sparse shrubland of mixed species including *Acacia inaequilatera* and *Grevillea wickhamii* subsp. *aprica* over low sparse shrubland of mixed species dominated by *Corchorus parviflorus* over low hummock grassland dominated by *Triodia wiseana* and *Triodia epactia* on red-brown clay loam with chert stones and often chert outcropping on hills and low rises.		66.1	66.1 (0.3%)	6.1 (0.1%)
10	Tall open to sparse shrubland dominated by *Acacia ancistrocarpa*, *Acacia inaequilatera*, *Acacia sericophylla*, *Acacia acradenia* and occasionally *Melaleuca lasiandra* over low shrubland to sparse shrubland dominated by *Acacia stellaticeps* and occasionally *Sida arenicola*, *Indigofera monophylla*, *Pluchea tetranthera* and *Corchorus parviflorus* over low hummock grassland to open hummock grassland dominated by *Triodia lanigera* and/or *Triodia schinzii* on red or red-brown sandy loam on plains.		17,319.5	14,170.3 (63.8%)	4,533.5 (77.8%)

Code	Description	Representative Photo	Area Mapped (ha)	Area in Development Envelope (ha)	Area in Indicative Disturbance Footprint (ha)
11	Low open woodland to isolated trees of *Corymbia hamersleyana* over tall open to sparse shrubland dominated by *Acacia orthocarpa*, *Acacia inaequilatera* and *Grevillea wickhamii* subsp. *aprica* over low sparse shrubland dominated by *Acacia stellaticeps* over low hummock grassland dominated by a combination of *Triodia lanigera*, *Triodia angusta*, *Triodia epactia* and *Triodia chichesterensis* on red or red brown sandy or clay loam with primarily quartz and calcrete stones, occasionally with calcrete or quartz outcropping, on low rises and undulating plains.		271.1	102.2 (0.5%)	14.8 (0.3%)
12	Isolated low trees dominated by *Corymbia hamersleyana* over low open to sparse shrubland of mixed species including *Acacia inaequilatera*, *Acacia acradenia*, *Acacia ancistrocarpa* and *Grevillea wickhamii* subsp. *aprica* over low sparse shrubland of mixed species dominated by *Goodenia stobbsiana* over low hummock grassland dominated by *Triodia epactia* and occasionally *Triodia wiseana* on red or red-brown clay loam with silica and chert stones and often silica and chert outcropping on low rises.		68.4	13.8 (0.06%)	6.4 (0.1%)
13	Low open woodland dominated by *Corymbia hamersleyensis* and/or *Corymbia candida* subsp. *candida* over tall open to sparse shrubland dominated by *Acacia ancistrocarpa*, *Acacia tumida* var. *pilbarensis*, *Acacia acradenia* and *Acacia colei* over low hummock grassland of *Triodia epactia* on red or red-brown clay or sandy loam on flats or plains.		118.1	36.9 (0.2%)	17.6 (0.3%)

Code	Description	Representative Photo	Area Mapped (ha)	Area in Development Envelope (ha)	Area in Indicative Disturbance Footprint (ha)
14	Tall open shrubland to isolated shrubs dominated by *Acacia ancistrocarpa*, *Acacia colei* and *Acacia inaequilatera* over low open shrubland to isolated shrubs dominated by *Acacia stellaticeps* and *Pluchea tetranthera* over low hummock grassland dominated by *Triodia epactia* on red or red brown sandy or clay loam on plains and flats.		4,020.9	2,876.0 (12.9%)	556.5 (9.5%)
15	Low open woodland of *Eucalyptus victrix* over tall sparse shrubland dominated by *Acacia colei* over low open hummock grassland of *Triodia epactia* over ephemeral low sparse herbland of mixed species including *Bergia perennis* subsp. *perennis, Marsilea hirsuta*, *Cyperus iria* and *Centipeda minima* subsp. *macrocephala* on pale brown sandy clay loam on the margins of clay pans.		3.4	3.4 (0.02%)	0.0 (0%)
16	Mid to low open woodland dominated by *Eucalyptus camaldulensis* subsp. *refulgens* and *Melaleuca argentea* over tall sparse shrubland dominated by *Melaleuca glomerata*, *Acacia coriacea* subsp. *pendens* and *Acacia trachycarpa* over mid to low sparse shrubland dominated by *Acacia pyrifolia* var. *pyrifolia, Crotalaria cunninghamii* and *Corchorus incanus* subsp. *incanus* over low sparse hummock grassland dominated by *Triodia epactia* over low sparse sedgeland dominated by *Cyperus vaginatus* on pale red or brown sand with patchy mixed stones in river channels.		554.8	180.8 (0.8%)	35.3 (0.6%)

Code	Description	Representative Photo	Area Mapped (ha)	Area in Development Envelope (ha)	Area in Indicative Disturbance Footprint (ha)
17	Gregory Land System: Tall open to sparse shrubland dominated by *Acacia sabulosa* over mid open to sparse shrubland of mixed species dominated by *Corchorus incanus* subsp. *incanus*, *Sida arenicola*, *Ptilotus arthrolasius*, *Gyrostemon tepperi* and *Triumfetta deserticola* over low open to sparse hummock grassland dominated by *Triodia lanigera* and *Triodia schinzii* over low sparse tussock grassland dominated by *Aristida holathera* var. *holathera* and *Eragrostis eriopoda* on red sand on dunes.		101.1	0.0 (0%)	0.0 (0%)
C	Disturbed Land (including land under rehabilitation)	Not available	698.4	607.1 (2.7%)	451.7 (7.7%)
Total*			**29,523**	**22,194**	**5,827**

*Rounded up to the nearest one.

A total of 334 discrete vascular taxa were identified within the survey area, as well as three formally named hybrids and three putative hybrids. The taxa and hybrids represent 53 families and 145 genera. The most well-represented families consist of Fabaceae (54 taxa), Poaceae (54 taxa), Malvaceae (36 taxa), Ameranthaceae (18 taxa) and Cyperaceae (16 taxa). 101 of the taxa are considered ephemeral taxa (30.2% of taxa) and 10 taxa were considered introduced (3.0% of taxa).

Based on surveys undertaken, no Threatened Ecological Communities (TECs) listed under the EPBC Act occur within the area of the Proposed Action.

6.5.3 Groundwater Dependent Vegetation (GDVs)

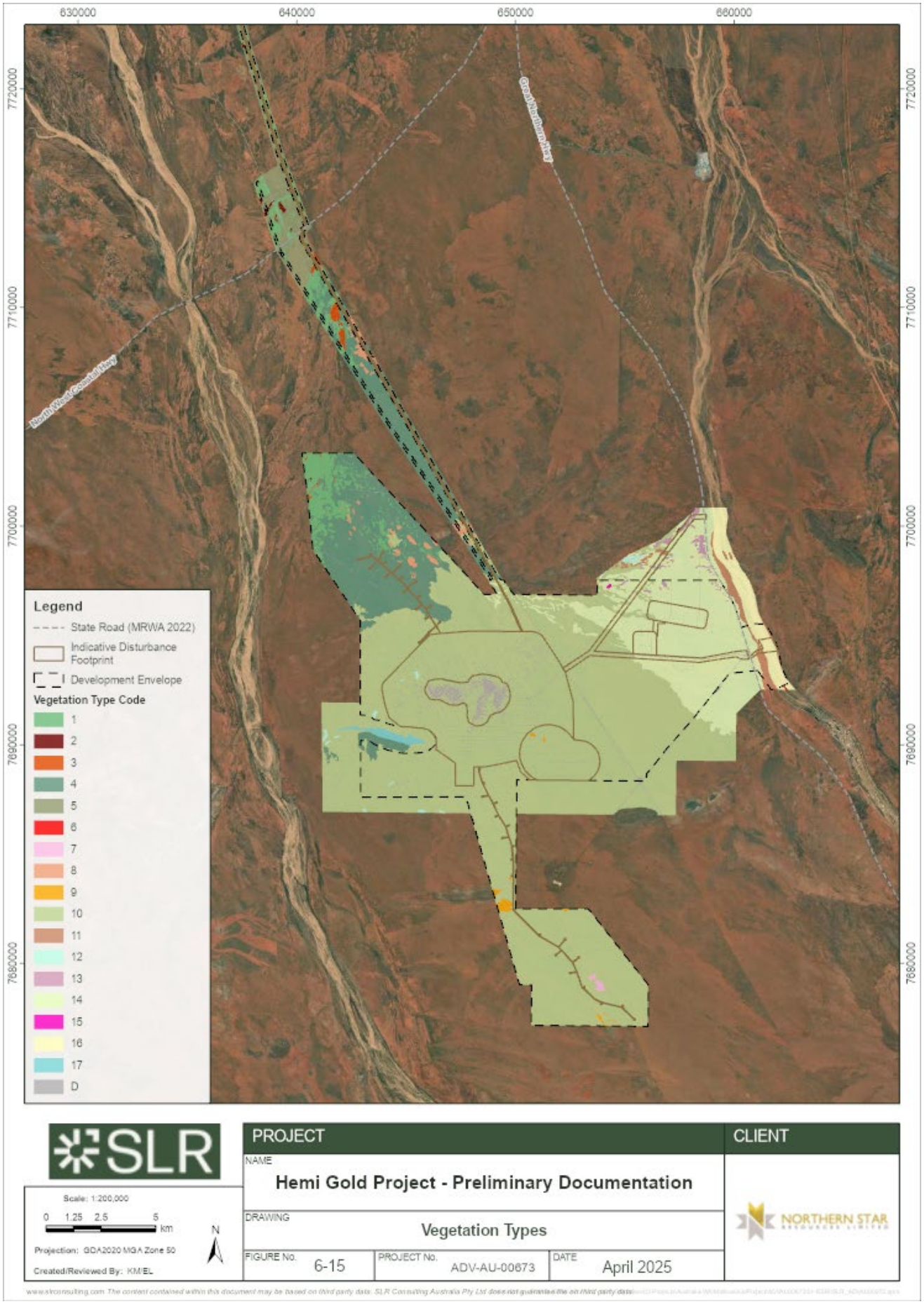
Umwelt undertook an assessment of GDVs as part of flora and vegetation studies for the Proposed Action (Umwelt, 2024). Vegetation along the Yule and the Turner Rivers contains obligate phreatophyte species[2] and is considered groundwater dependent. A copy of the survey report is attached as Appendix 21.

Vegetation along the Yule and Turner Rivers is situated beyond the 1 m dewatering drawdown contour and as a result it has been determined that the Proposed Action's dewatering program will not impact the rivers' GDVs.

Nevertheless, as noted in Section 6.4.1, the Turner River typically exists in a dry state with occasional flow events. The Proposed Action involves discharging water over an extended period, potentially transforming the river into a continuously flowing system for approximately 2.5 years. This change in the river's hydrology could impact plant and animal life adapted to the dry cycles, and the presence of permanent water could alter predator-prey relationships within the food web. However, these are deemed low risk (MBS, 2024). Details on measures to manage these potential impacts are detailed in the following sections.

[2] The species require continual access groundwater and can cope with having some or all roots permanently inundated.

Figure 6-15: Vegetation Types



Legend

Vegetation Type - Description (Umwelt 2023)

1 - Low isolated shrubs including Acacia stellaticeps and Pluchea tetranthera over low hummock grassland dominated by Triodia longiceps and Triodia epactia over ephemeral low sparse sedgeland, tussock grassland and forbland of mixed taxa including Fimbristylis dichotoma, Bulbostylis barbata, Calandrinia stagnensis, Streptoglossa decurrens and Eriachne aristidea on red-brown clay loam, sandy clay loam or sandy clay on plains and flats

2 - Low tussock grassland to sparse tussock grassland dominated by a combination of Eriachne glauca var. glauca, Eriachne benthamii and Eriachne flaccida over low sparse hummock grassland of Triodia epactia and Triodia longiceps over ephemeral low sparse sedgeland and forbland of mixed species including Cyperus iria, Fimbristylis dichotoma, Neptunia dimorphantha, Marsilea hirsuta and Calandrinia pumila on orange, red-brown or brown clay in clay pans

3 - Low woodland to open woodland dominated by Corymbia candida subsp. candida over tall shrubland to open shrubland dominated by Acacia colei and Acacia tumida var. pilbarensis over low open to sparse shrubland of mixed species including Pluchea tetranthera, Afrohybanthus aurantiacus and Sida rohlenae subsp. rohlenae over low open to sparse hummock grassland dominated by Triodia epactia over low sparse tussock grassland of mixed species including Chrysopogon fallax, Aristida holathera var. holathera, Eragrostis eriopoda, Eriachne obtusa and Cenchrus ciliaris on orange sandy or sandy clay loam on flats

4 - Tall sparse shrubland of mixed species including Acacia ancistrocarpa, Acacia inaequilatera, Acacia colei and Melaleuca lasiandra over low open to sparse shrubland dominated by Acacia stellaticeps, Pluchea tetranthera, Sida arenicola and Corchorus elachocarpus over low hummock grassland to open hummock grassland dominated by Triodia epactia, Triodia lanigera and Triodia schinzii on red or red-brown sandy loam on plains

5 - Tall open to sparse shrubland dominated by Acacia trudgeniana and Acacia colei over low open to sparse shrubland dominated by Acacia stellaticeps, Corchorus incanus subsp. incanus and Pimelea ammocharis over low hummock grassland of Triodia epactia over low sparse tussock grassland of mixed species including Aristida holathera var. holathera, Eragrostis eriopoda, Chrysopogon fallax and Eriachne obtusa on red-brown clay or sandy loam on plains

6 - Tall sparse shrubland dominated by Acacia trachycarpa and Acacia colei over low sparse shrubland of mixed species including Acacia stellaticeps and Corchorus incanus subsp. incanus over low hummock grassland dominated by Triodia lanigera on red-brown sandy loam on low dunes within river channels

7 - Tall sparse shrubland dominated by Acacia tumida var. pilbarensis over low sparse shrubland dominated by Corchorus incanus subsp. incanus and Tephrosia rosea var. clementii over ephemeral low sparse forbland and grassland of mixed species including Calocephalus beardii, Aristida contorta, Eragrostis cumingii, Indigofera colutea and Perotis rara on brown sandy loam with granite outcropping and stones on and around low granite outcrops

8 - Low open woodland to isolated trees dominated by Corymbia hamersleyana over tall open to sparse shrubland dominated by Acacia bivenosa, Acacia inaequilatera, Grevillea wickhamii subsp. aprica and Hakea loreus subsp. loreus over low sparse shrubland of mixed species dominated by Acacia stellaticeps, Scaevola amblyanthera var. centralis and Corchorus elachocarpus over low hummock grassland dominated by Triodia epactia on red or red brown clay or sandy loam with calcrete and silica stones, occasionally with calcrete or silica outcropping, on low rises or plains

9 - Tall sparse shrubland of mixed species including Acacia inaequilatera and Grevillea wickhamii subsp. aprica over low sparse shrubland of mixed species dominated by Corchorus parviflorus over low hummock grassland dominated by Triodia wiseana and Triodia epactia on red-brown clay loam with chert stones and often chert outcropping on hills and low rises

10 - Tall open to sparse shrubland dominated by Acacia ancistrocarpa, Acacia inaequilatera, Acacia sericophylla, Acacia acradenia and occasionally Melaleuca lasiandra over low shrubland to sparse shrubland dominated by Acacia stellaticeps and occasionally Sida arenicola, Indigofera monophylla, Pluchea tetranthera and Corchorus parviflorus over low hummock grassland to open hummock grassland dominated by Triodia lanigera and/or Triodia schinzii on red or red-brown sandy loam on plains

11 - Low open woodland to isolated trees of Corymbia hamersleyana over tall open to sparse shrubland dominated by Acacia orthocarpa, Acacia inaequilatera and Grevillea wickhamii subsp. aprica over low sparse shrubland dominated by Acacia stellaticeps over low hummock grassland dominated by a combination of Triodia lanigera, Triodia angusta, Triodia epactia and Triodia chichesterensis on red or red brown sandy or clay loam with primarily quartz and calcrete stones, occasionally with calcrete or quartz outcropping, on low rises and undulating plains

12 - Isolated low trees dominated by Corymbia hamersleyana over low open to sparse shrubland of mixed species including Acacia inaequilatera, Acacia acradenia, Acacia ancistrocarpa and Grevillea wickhamii subsp. aprica over low sparse shrubland of mixed species dominated by Goodenia stobbsiana over low hummock grassland dominated by Triodia epactia and occasionally Triodia wiseana on red or red-brown clay loam with silica and chert stones and often silica and chert outcropping on low rises

13 - Low open woodland dominated by Corymbia hamersleyensis and/or Corymbia candida subsp. candida over tall open to sparse shrubland dominated by Acacia ancistrocarpa, Acacia tumida var. pilbarensis, Acacia acradenia and Acacia colei over low hummock grassland of Triodia epactia on red or red-brown clay or sandy loam on flats or plains

14 - Tall open shrubland to isolated shrubs dominated by Acacia ancistrocarpa, Acacia colei and Acacia inaequilatera over low open shrubland to isolated shrubs dominated by Acacia stellaticeps and Pluchea tetranthera over low hummock grassland dominated by Triodia epactia on red or red brown sandy or clay loam on plains and flats

15 - Low open woodland of Eucalyptus victrix over tall sparse shrubland dominated by Acacia colei over low open hummock grassland of Triodia epactia over ephemeral low sparse herbland of mixed species including Bergia perennis subsp. perennis, Marsilea hirsuta, Cyperus iria and Centipeda minima subsp. macrocephala on pale brown sandy clay loam on the margins of clay pans

16 - Mid to low open woodland dominated by Eucalyptus camaldulensis subsp. refulgens and Melaleuca argentea over tall sparse shrubland dominated by Melaleuca glomerata, Acacia coriacea subsp. pendens and Acacia trachycarpa over mid to low sparse shrubland dominated by Acacia pyrifolia var. pyrifolia, Crotalaria cunninghamii and Corchorus incanus subsp. incanus over low sparse hummock grassland dominated by Triodia epactia over low sparse sedgeland dominated by Cyperus vaginatus on pale red or brown sand with patchy mixed stones in river channels

17 - Tall open to sparse shrubland dominated by Acacia sabulosa over mid open to sparse shrubland of mixed species dominated by Corchorus incanus subsp. incanus, Sida arenicola, Ptilotus arthrolasius, Gyrostemon tepperi and Triumfetta deserticola over low open to sparse hummock grassland dominated by Triodia lanigera and Triodia schinzii over low sparse tussock grassland dominated by Aristida holathera var. holathera and Eragrostis eriopoda on red sand on dunes

D - Disturbed Land

SLR

PROJECT			CLIENT
NAME: Hemi Gold Project - Preliminary Documentation			NORTHERN STAR RESOURCES LIMITED
DRAWING: Vegetation Types			
FIGURE No. 6-15	PROJECT No. ADV-AU-00673	DATE April 2025	

Created/Reviewed By: KM/EL

6.5.4 Vegetation Condition

The Hemi Development Envelope lies across two active pastoral leases and although cattle are known to impact native vegetation, the vegetation at the Proposed Action is mostly undisturbed and in excellent or very good condition. The exception is areas that have been disturbed by exploration activities and infrastructure corridors, as well as by cattle grazing and trampling. Vegetation condition mapping is presented in Figure 6-16.

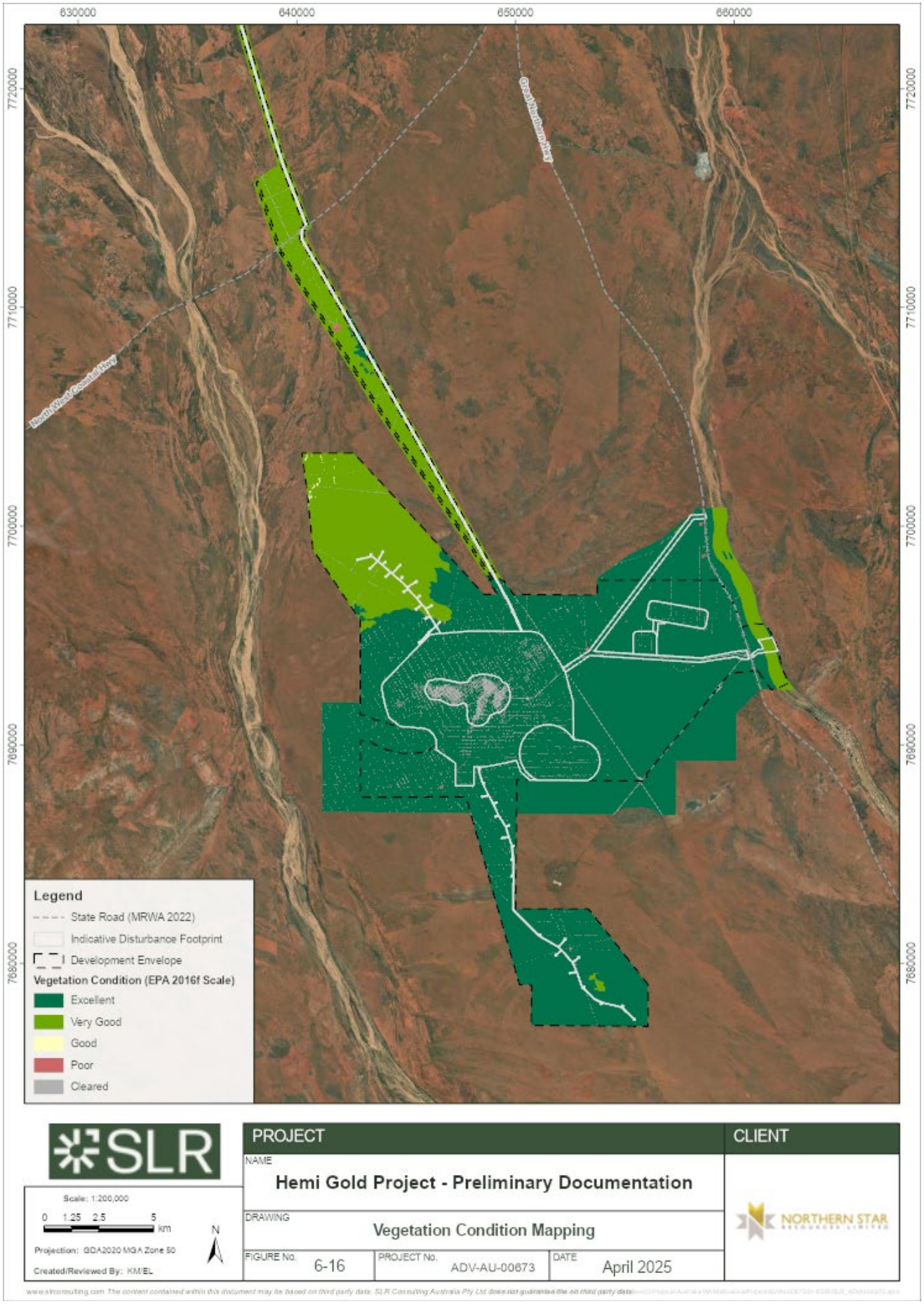
Large expanses of the survey area were mapped as 'Very Good', including the area generally along the Turner River, northwestern part of the proposed borefield area and most of the proposed infrastructure corridors. The vegetation condition declined with proximity to the Yule River, corresponding with the expansive plains, likely more appealing for grazing, with obvious evidence of cattle trampling in these areas.

Vegetation conditions across the survey area are shown in Table 6-6.

Table 6-6: Vegetation Condition

Rating Condition	Criteria	Survey Area Extent (ha)	Proportion (%)
Excellent	Vegetation structure intact with no obvious signs of disturbance or damage.	22,092.0	74.8
Very Good	Vegetation structure altered with minor signs of disturbance	6,700.0	22.7
Good	Obvious signs of disturbance, with vegetation notably altered.	10.0	0.03
Poor	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure caused by partial clearing, vehicle tracks, the presence of aggressive weeds at high density and signs of grazing.	17.0	0.06
Degraded	Cleared area. The structure of the vegetation is no longer intact, completely, or almost completely without native species.	0.0	0.0
Completely Degraded	Vegetation structure intact with no obvious signs of disturbance or damage.	0.0	0.0
Not assessed	Land with large occurrences of clearing	698.0	2.36
Total		**29,517.0**	**100**

Figure 6-16: Vegetation Condition Mapping



6.5.5 Introduced Flora

Hemi is located on an active pastoral lease, and 10 introduced flora species have been recorded, including one Weed of National Significance (WoNS) that is also a declared species:

- **Opuntia* sp. – Prickly Pear (WoNS and declared species)
- **Calotropis procera* – Calotrope (declared species)
- **Aerva javanica* – Kapok Bush
- **Cenchrus ciliaris* – Buffel Grass
- **Cenchrus setiger* – Birdwood Grass
- **Citrullus colocynthis* – Colocynth
- **Digitaria ciliaris* – Summer Grass
- **Echinochloa colona* – Awnless Barnyard Grass
- **Malvastrum americanum* – Spiked Malvastrum
- **Passiflora foetida* var. *hispida* – Stinking Passionflower

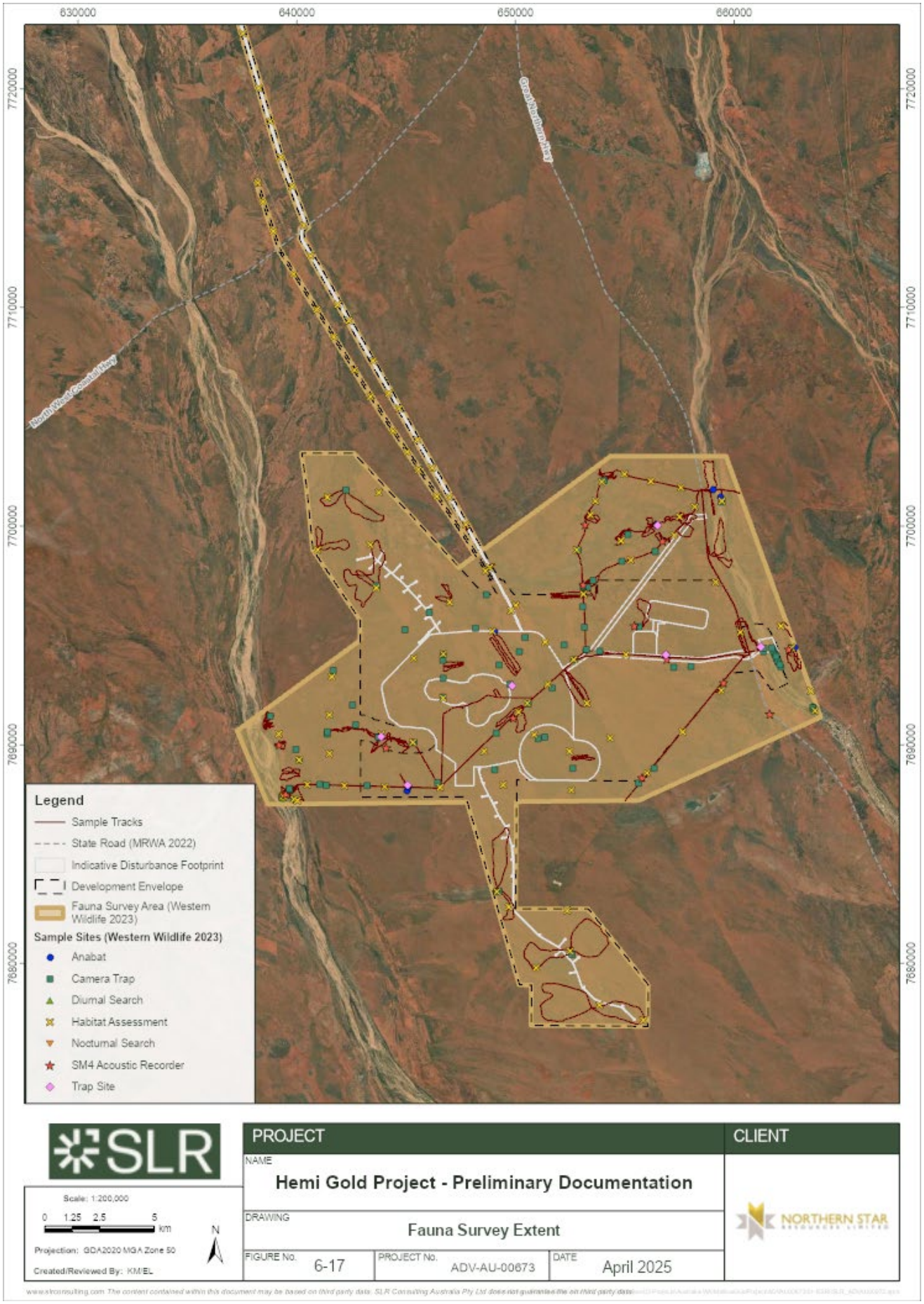
6.6 Terrestrial Vertebrate Fauna

6.6.1 Studies

Western Wildlife completed a detailed vertebrate fauna survey over two seasons in September 2021 and March 2022, with additional targeted surveys in August 2022 (Appendix 23). The survey area encompasses the Development Envelope and extends to the Yule and Turner Rivers, covering 34,688 ha (Figure 6-17) (Western Wildlife, 2023). The timing and adequacy of the Detailed Vertebrate Fauna Survey undertaken by Western Wildlife were consistent with the Technical Guidelines (EPA, 2020).

A dual-phase baseline aquatic ecology survey was undertaken in the Yule and Turner Rivers by Stantec Limited (Stantec, 2022) in November 2021 (dry season) and May 2022 (post-wet season). Aquatic ecology surveys undertaken by Stantec also identified terrestrial vertebrate species along the Yule and Turner Rivers and is provided as Appendix 19. The survey included eDNA analysis for Pilbara Olive Python (*Liasis olivaceus barroni*).

Figure 6-17: Fauna Survey Extent



6.6.2 Vertebrate Fauna Habitat

The fauna habitats were identified and mapped using the habitat assessments and observations made in the field during the fauna surveys, interpretation of vegetation mapping (Umwelt, 2024), aerial photography and land system mapping.

Six broad fauna habitats (excluding cleared areas) were identified and mapped within the survey area as described in Table 6-7 and Figure 6-18.

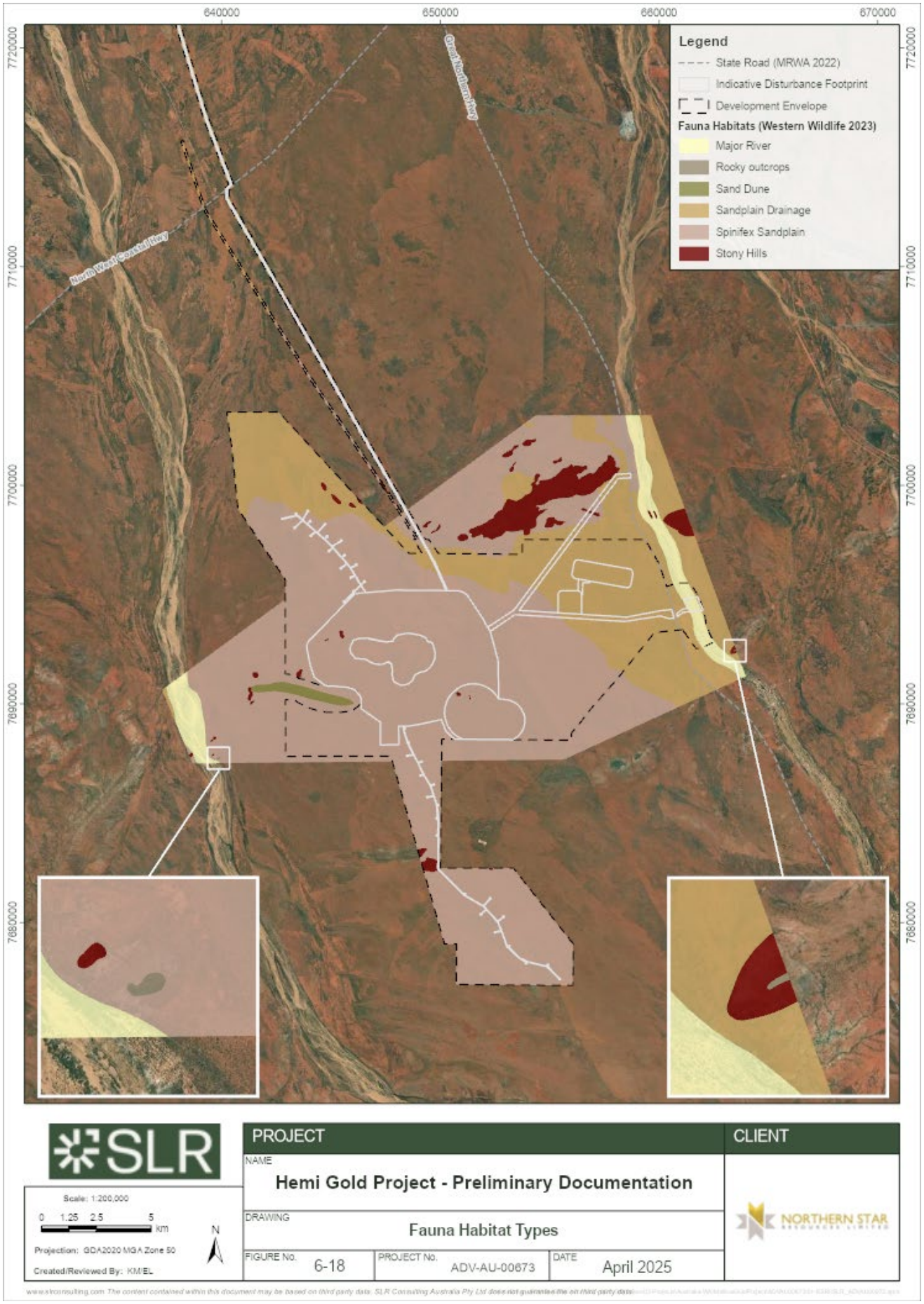
Table 6-7: Fauna Habitats within Proposed Action Area

Vegetation Type	Key Elements	Representative Photo	Area Mapped (ha)	Area inside Development Envelope (ha)	Area in Indicative Disturbance Footprint (ha)
Spinifex Sandplain	• Consolidated sands suitable for burrowing reptiles and mammals.		22,718.6	15,809.8 (71.2%)	5,037.1 (86.4%)
Sandplain Drainage	• Consolidated sands suitable for burrowing reptiles and mammals. • Claypans of various sizes that hold water and may be breeding. • Habitat for frogs. • Mature spinifex in some areas, where encouraged by water runoff and/or protection from fire.		9,349.5	6,029.4 (27.2%)	721.2 (12.4%)
Sand Dune	• Loose flowing sands provide habitat for fossorial reptiles.		190.1	0.0 (0.0%)	0.0 (0.0%)
Stony Hills	• Minor drainages lines (not mapped separately) provide dense habitat for birds. • Small stones suitable for Western Pebble-mound Mouse. • Minor rocky outcrops provide shelter for rock-dwelling reptiles.		1,196.4	172.9 (0.8%)	33.3 (0.57 %)

Vegetation Type	Key Elements	Representative Photo	Area Mapped (ha)	Area inside Development Envelope (ha)	Area in Indicative Disturbance Footprint (ha)
Major River	• Likely to function as a corridor for fauna movement. • Waterholes provide habitat for bathing and drinking and breeding habitat for frogs. • Tree hollows for arboreal reptiles, bats and hollow-nesting birds. • Leaf litter accumulations and woody debris in the creek bed. • Provides habitat for reptiles.	 	1,231.9	181.2 (0.8%)	34.9 (0.6%)
Rocky Outcrops	• Outcropping rocky areas, boulders, overhangs and rock crevices provide shelter for reptiles and mammals (no large caves present).		1.5	0.0 (0.0%)	0.0 (0.0%)
	Total*		**34,688.0**		**5,827***

*Rounded up to the nearest whole number.

Figure 6-18: Fauna Habitat Types



6.6.3 Vertebrate Fauna

A total of 173 vertebrate fauna species were recorded within the survey area during the Western Wildlife surveys, including six amphibians, 56 reptiles, 83 birds, 22 native mammals and six introduced mammals. Desktop assessments identified 21 conservation significant fauna listed under the EPBC Act that may occur in the study area including seven Threatened and 14 Migratory species. The conservation status of these 21 species and their assigned likelihood (as described in Table 6-8) of occurrence within the survey area are summarised in Table 6-9.

Table 6-8: Criteria for assessing likelihood of occurrence

Likelihood	Criteria
Unlikely	• The study area is outside the current known distribution of the species as presented in the literature. • No suitable habitat was identified as being present during the field survey. • For some species, individuals may occur occasionally as vagrants, especially if suitable habitat is located nearby, but the study area itself would not support the species. • May include species generally accepted as being locally extinct.
Possible	• The study area is within or just outside the current known distribution of the species, as presented in the literature. • Any habitat present is either limited in extent or of marginal quality at best. • No recent or nearby records of the species on databases. • The species is generally known to be less common in the vicinity of the study area (e.g., for inland sites, where the species usually occurs on the coast).
Potential	• The study area is within the current known distribution of the species, as presented in the literature. • Habitat of reasonable quality was identified as being present during the field survey. • There are some recent and/or nearby records of the species of databases.
Likely	• The study area is well within the current known distribution of the species, as presented in the literature. • Habitat of good quality was identified as being present during the field survey. • Many recent and nearby records of the species on databases
Known to Occur	• The species was positively identified in the study area during this field survey or recorded as occurring in the study area on previous recent field surveys. • Note that for a species 'known to occur', the habitat may still be marginal and therefore the population may be small, or the species may visit the site irregularly.

Table 6-9: Conservation Significant Fauna Species

Species	Conservation Status*				Likelihood of Occurrence	Recorded in Development Envelope	Notes
	EPBC Act	BC Act	DBCA Priority	Locally Significant			
Threatened Species							
Pezoporus occidentalis **Night Parrot**	En	Cr			Possible	Not Recorded	This species has been recorded at only a few locations across Australia. The limited patches of mature spinifex habitats in the study area are technically suitable habitats.
Dasyurus hallucatus **Northern Quoll**	En	En			Known to occur	Recorded in Development Envelope	Recorded in the study area in September 2021 and March 2022. Likely to be a resident of the Rocky Outcrops (excluded from the Development Envelope) and Major River habitats, dispersing and foraging in adjacent habitats.
Macrotis lagotis **Greater Bilby**	Vu	Vu			Known to occur	Secondary signs recorded	Secondary signs, mostly of old burrows (inactive but active in the past year) recorded (outside of the indicative disturbance footprint)
Rhinonicteris aurantia **Pilbara Leaf-nosed Bat**	Vu	Vu			Known to occur	Recorded	Recorded in the study area in September 2021 and March 2022. Likely to be a regular foraging visitor to all habitats, particularly the Rocky Outcrops and Major River habitats. No diurnal roosting habitat present.
Macroderma gigas **Ghost Bat**	Vu	Vu			Likely	Not Recorded	Likely to be a regular foraging visitor to all habitats. No diurnal roosting habitat present.

Species	Conservation Status*				Likelihood of Occurrence	Recorded in Development Envelope	Notes
	EPBC Act	BC Act	DBCA Priority	Locally Significant			
Liasis olivaceus barroni **Pilbara Olive Python**	Vu	Vu			Likely	Not Recorded	Known to occur nearby, this species is likely to be a foraging visitor and possible breeding resident of the Major River and Rocky Outcrop habitats. Not recorded in eDNA analysis.
Falco hypoleucos **Grey Falcon**	Vu	Vu			Likely	Not Recorded	Known to occur nearby, this species is likely to be a foraging visitor to open habitats and possible breeding resident of the Major River habitat.
Migratory Species							
Charadrius veredus **Oriental Plover**	Mi	Mi			Possible	Not recorded	May be a non-breeding summer visitor to open plains and recently burnt areas, but there are very few records of this species in the region.
Actitis hypoleucos **Common Sandpiper**	Mi	Mi			Likely	Not recorded	Non-breeding summer visitor to waterholes on Major Rivers, possibly also to claypans in the Sandplain Drainage habitat.
Calidris acuminata **Sharp-tailed Sandpiper**	Mi	Mi			Potential	Not Recorded	Non-breeding summer visitor to waterholes on Major Rivers, possibly also to claypans in the Sandplain Drainage habitat.
Calidris melanotos **Pectoral Sandpiper**	Mi	Mi			Possible	Not Recorded	May be a non-breeding summer visitor to waterholes on Major Rivers, possibly also to claypans in the Sandplain Drainage habitat.
Calidris ruficollis **Red-necked Stint**	Mi	Mi			Potential	Not Recorded	Non-breeding summer visitor to waterholes on Major Rivers, possibly also to claypans in the Sandplain Drainage habitat.

Species	Conservation Status*				Likelihood of Occurrence	Recorded in Development Envelope	Notes
	EPBC Act	BC Act	DBCA Priority	Locally Significant			
Tringa glareola **Wood Sandpiper**	Mi	Mi			Likely	Not Recorded	Non-breeding summer visitor to waterholes on Major Rivers, possibly also to claypans in the Sandplain Drainage habitat.
Tringa nebularia **Common Greenshank**	Mi	Mi			Likely	Not Recorded	Non-breeding summer visitor to waterholes on Major Rivers, possibly also to claypans in the Sandplain Drainage habitat.
Pandion haliaetus **Osprey**	Mi	Mi			Potential	Not Recorded	Foraging visitor to waterholes on Major Rivers. No breeding habitat present.
Apus pacificus **Fork-tailed Swift**	Mi	Mi			Known to occur	Not Recorded	Recorded in the study area, however outside of the Development Envelope, in March 2022. Although likely to occur on occasion, this species is largely aerial in Australia so the terrestrial habitats in the study area are unlikely to be of particular importance to the species.
Gelochelidon nilotica **Gull-billed Tern**	Mi	Mi			Potential	Not Recorded	Foraging visitor to waterholes on Major Rivers. No breeding habitat present.
Hydroprogne caspia **Caspian Tern**	Mi	Mi			Likely	Not Recorded	Foraging visitor to waterholes on Major Rivers. No breeding habitat present.
Plegadis falcinellus **Glossy Ibis**	Mi	Mi			Potential	Not Recorded	Occasional foraging visitor to waterholes on Major Rivers. No breeding habitat present.

* EPBC Act/BC Act = CE (Critically Endangered), En (Endangered), Vu (Vulnerable), Mi (Migratory)

6.6.4 Introduced Vertebrate Fauna

Feral fauna species predate on native species and/or compete with native species for habitat, food, and resources. Feral herbivores can damage vegetation, contribute to soil erosion, and contribute to the spread of weeds. Feral species, particularly cats and foxes are cited as a significant threatening process for several Threatened species located at Hemi.

Six introduced mammals have been recorded at Hemi:

- *Camelus dromedarius* – camel
- *Bos taurus* – cow
- *Canis familiaris* – dog
- *Vulpes vulpes* – fox
- *Felis catus* – cat
- *Mus musculus* - mouse

An additional two introduced mammals are considered to potentially occur:

- *Equus asinus* – donkey
- *Equus caballus* – horse

6.7 Subterranean Fauna

6.7.1 Studies

Subterranean fauna surveys for the Proposed Action were undertaken by Bennelongia and consisted of a desktop assessment followed by field and targeted surveys. The subterranean fauna reports (Bennelongia, 2023a) are attached as Appendix 24. Unless otherwise referenced, the text in this section of the document is drawn from these reports, and detailed monitoring results can be found in the reports.

The desktop assessment identified that the shallow alluvial aquifer (upper and lower) at the Proposed Action is considered high prospective habitat for stygofauna and subsequently a level 2 survey was completed. The shallow water table was considered less prospective for troglofauna although some potential habitat was identified in the vicinity of the proposed pits, as such a level 1 survey was undertaken.

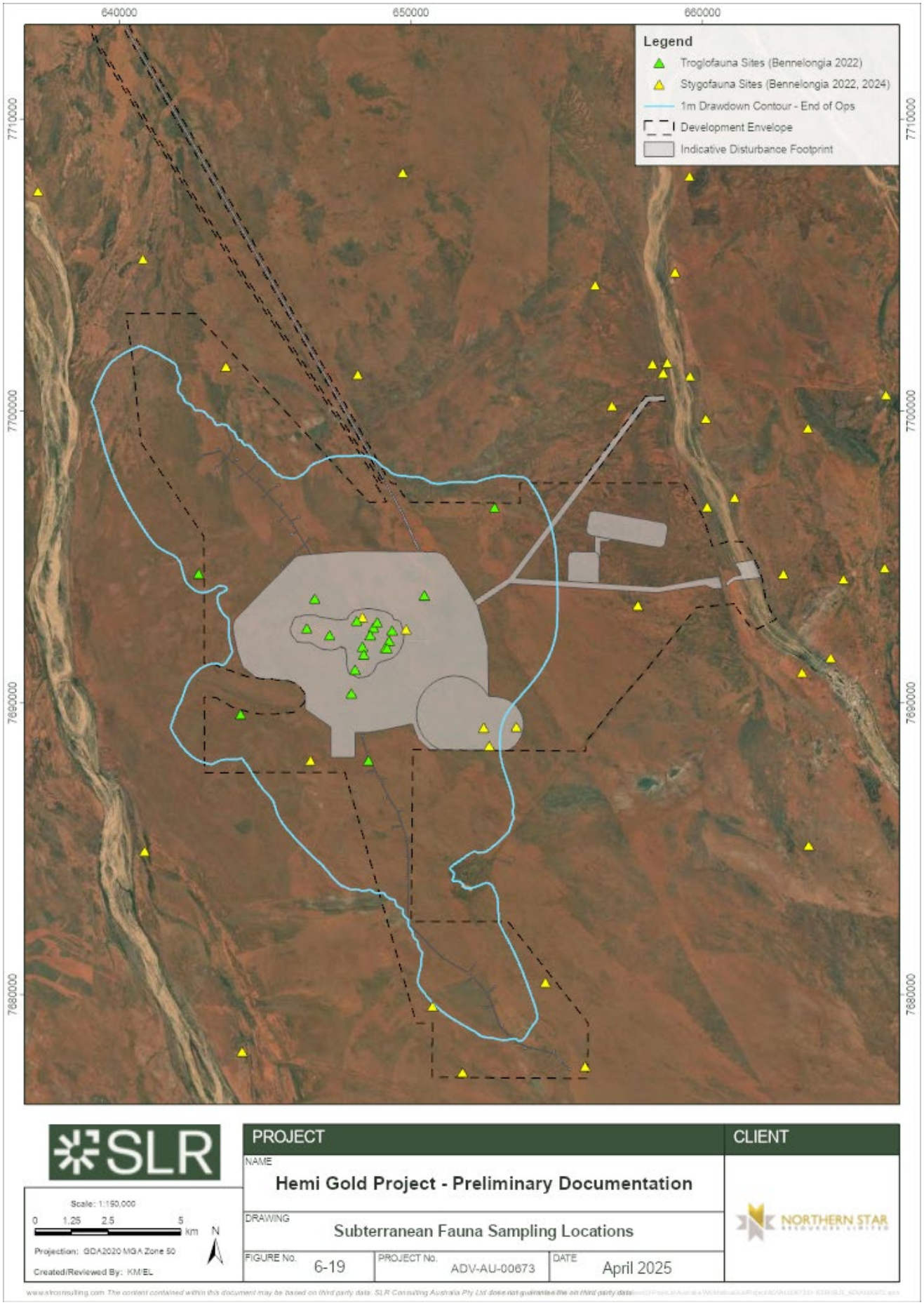
Sampling was conducted in accordance with EPA Technical Guidance (EPA, 2021d). Surveys consisted of three rounds of sampling for stygofauna (October 2021, December 2021, March 2022) and one round of sampling for troglofauna (October 2021). No troglofauna were recorded during the survey, therefore Bennelongia (2023a) considered the troglofauna community depauperate and recommended additional sampling was not required. In each round, 40 bores and drill holes were sampled for stygofauna, while 20 holes were sampled once for troglofauna. A targeted survey for stygofauna was also completed in early 2024, which sampled 33 sites (Bennelongia 2024).

Sampling for stygofauna focused on the stygofauna impact area, defined as the zone where dewatering drawdown is expected to be 1 m or more as well as suitable reference sites outside of this zone. Sampling for troglofauna focused on the mine impact area as well as suitable reference sites. A map of sampling locations and the impact areas is provided in Figure 6-19.

6.7.2 Results

A total of 3,967 stygofauna specimens were collected representing at least 52 species, whilst two troglofauna specimens were collected representing one species. None of the species collected are listed under the EPBC Act.

Figure 6-19: Subterranean Fauna Sampling Locations



7 Matters of National Environmental Significance

The DCCEEW administers the EPBC Act, which is the Australian Government's primary legislation that provides a legal framework for protecting and managing Matters of National Environmental Significance (MNES).

Under the EPBC Act, any proposed action that has or is likely to impact a MNES significantly requires approval from the Commonwealth Minister for the Environment. DCCEEW has identified one flora, seven fauna and 12 migratory species listed as MNES that are potentially impacted by the Proposed Action. A summary of the species, local population, potential impacts and proposed management measures is provided in the following subsections.

7.1 Flora and Vegetation

7.1.1 Fringed Fire-bush (*Seringia exastia*)

7.1.1.1 Overview

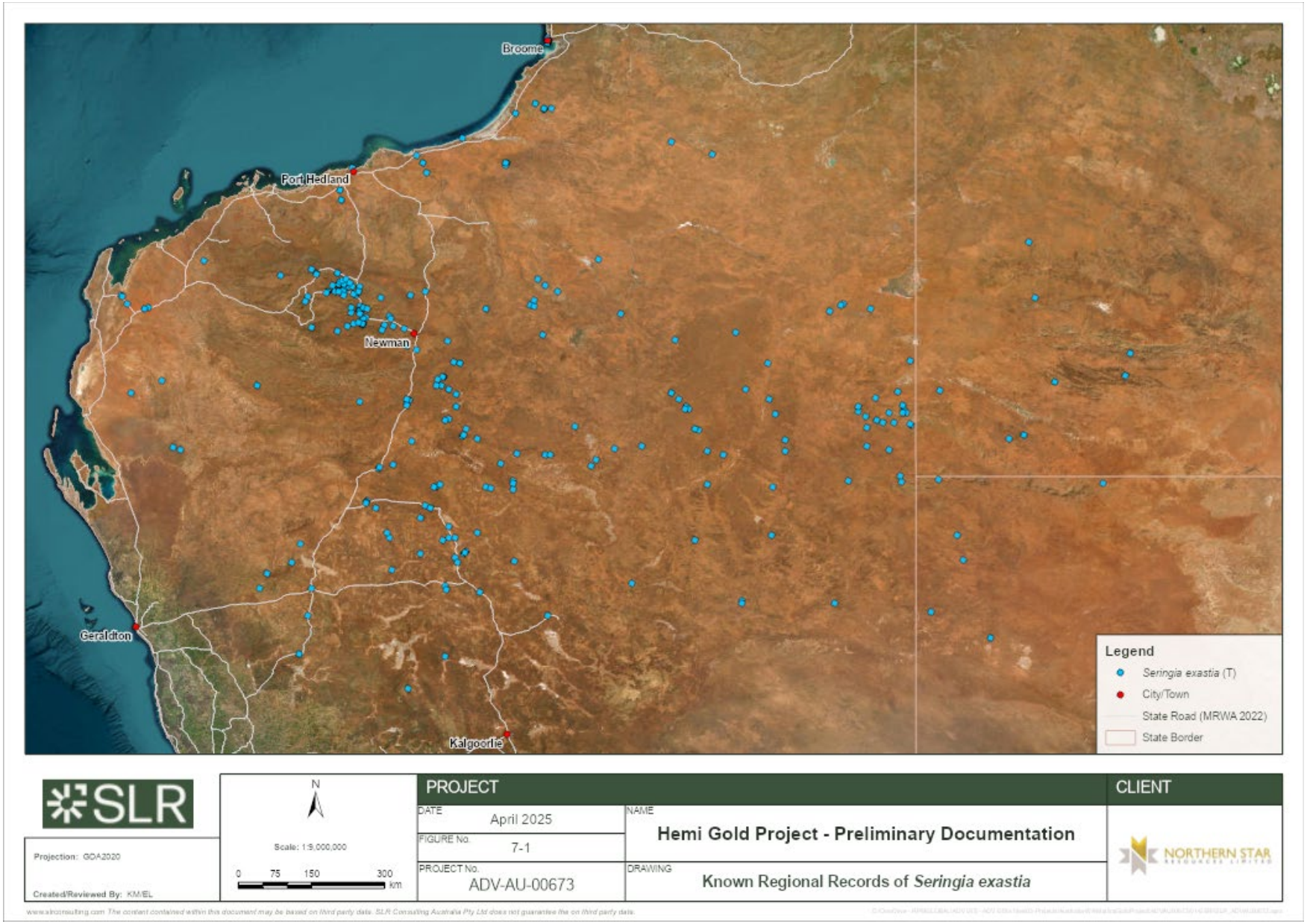
Seringia exastia (Fringed Fire-bush) (formerly known as *Keraudrenia exastia*) is endemic to Western Australia and is listed as Critically Endangered under the EPBC Act. The species was originally known from seven sub-populations within the Port of Broome until a second population was discovered in the Great Sandy Desert area, approximately 130 km south of Broome, in 2012.

A recent taxonomic review of *Seringia exastia* (Binks et al., 2020) concluded that it is identical to the widespread common species *Seringia elliptica*. These two species were subsequently synonymised as *Seringia exastia*, which is the older valid name (by nomenclatural rules). *Seringia exastia* was subsequently delisted as a Threatened species under the WA BC Act on 30 September 2022 (Minister for Environment, 2022). If *Seringia elliptica* was the oldest name, this would have been the name given to the amalgamated species and administrative processes of delisting would have been avoided.

Given that the formerly known *Seringia elliptica* is known from over 300 populations ranging from the Pilbara region, central WA, Northern Territory and extending in South Australia, it has been nominated for delisting as an MNES under the EPBC Act. The species will retain its conservation status under the EPBC Act until statutory change is impacted by the formal review procedures of the Threatened Species Scientific Committee (TSSC).

All records of *Seringia exastia* (including recordings of previously known *Seringia elliptica*) are provided in Figure 7-1.

Figure 7-1: Known Regional Records of *Seringia exastia*



7.1.1.2 Local Population

Approximately 220 individuals across two populations of *Seringia exastia* were recorded during the flora and vegetation field surveys as shown in Figure 7-2. The populations are located in two closely related vegetation types from Group 3 being:

- Vegetation Type 04: Tall sparse shrubland of mixed species such as *Acacia*, *Melaleuca*, and hummock grassland dominated by *Triodia* species on red or red-brown sandy loam on plains.
- Vegetation Type 10: Tall open to sparse shrubland dominated by Acacia *ancistrocarpa*, *Acacia inaequilatera*, *Acacia sericophylla*, *Acacia acradenia* and occasionally *Melaleuca lasiandra* over low shrubland to sparse shrubland dominated by *Acacia stellaticeps* and occasionally *Sida arenicola*, *Indigofera monophylla*, *Pluchea tetranthera* and *Corchorus parviflorus* over low hummock grassland to open hummock grassland dominated by *Triodia lanigera* and/or *Triodia schinzii* on red or red-brown sandy loam on plains.

The local populations were recorded within the Development Envelope, however outside of the proposed indicative disturbance footprint, noting that the southern population occurs on a pastoral track

The field surveys were undertaken by Ecoscape and Umwelt after the amalgamation of the species occurred requiring the populations to be recorded as *Seringia exastia*. However, if the field surveys occurred 12-24 months earlier, the populations would have been recorded as *Seringia elliptica* (the common and widespread species of the Pilbara region).

7.1.1.3 Significance Test

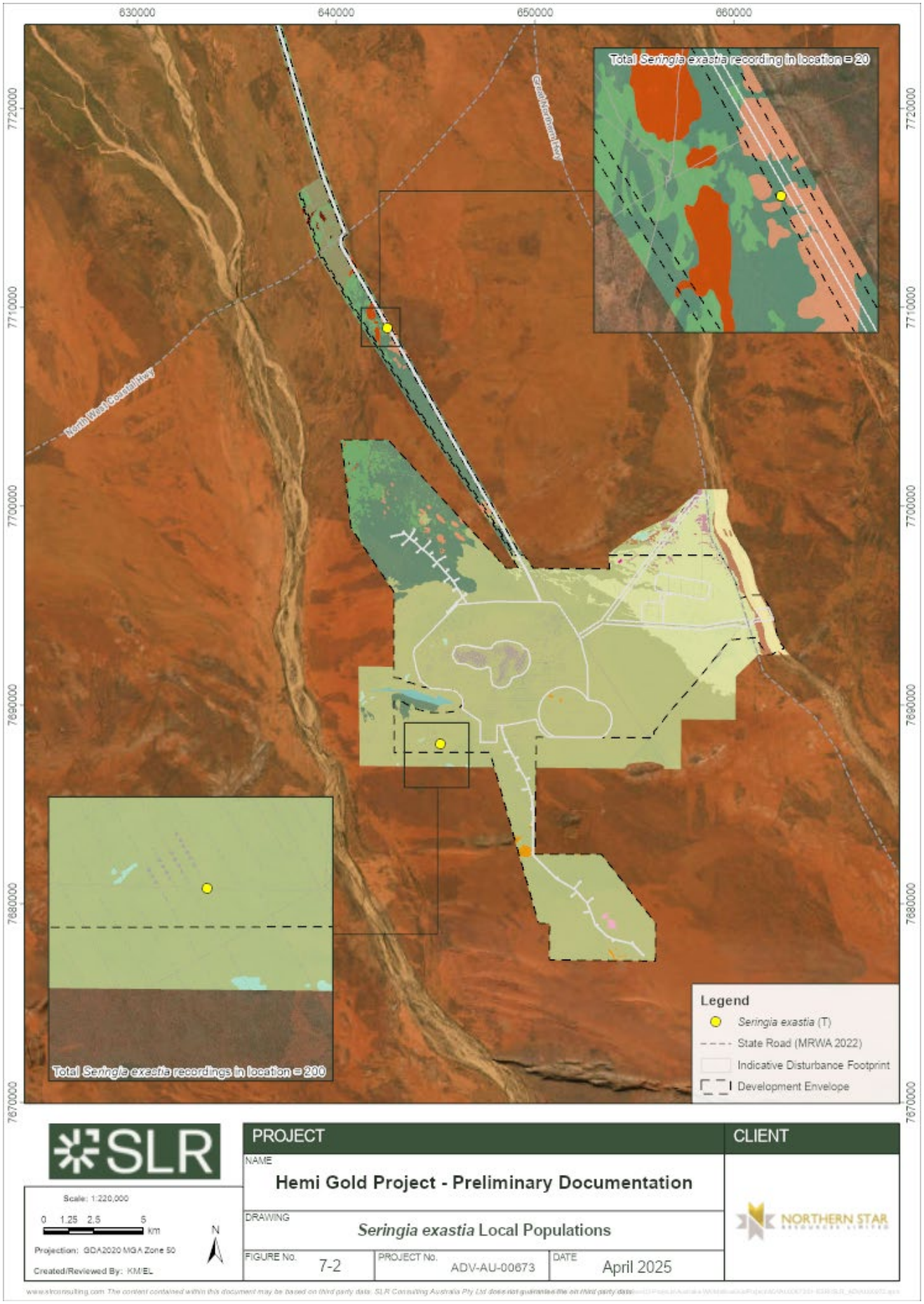
An assessment of the significance of the Proposed Action to *Seringia exastia* is presented in Table 7-1. Given the species is known to be common, widely distributed across multiple regions and local recordings are outside of the indicative disturbance footprint, the Proposed Action will not significantly impact *Seringia exastia* within the scope of EPBC Act Significant Impact Guidelines.

Table 7-1: Significant Impact Assessment for *Seringia exastia*

Significant Impact Criteria	Determination of Significance
Will the Project lead to a long-term decrease in the size of a population?	**No.** A taxonomic review of *Seringia elliptica* and *Seringia exastia* was undertaken in 2020 leading to an amalgamation of the species. The species is now known as *Seringia exastia* due to nomenclature rules stating the oldest of the two names is to be used, even though *Seringia elliptica* is the more common and widespread of the two species. The current population of *Seringia exastia* expands 2.6 million km^2 across northern and central Western Australia, South Australia and Northern Territory. Although two populations were recorded within the Development Envelope of the Proposed Action, both were located outside of the indicative disturbance footprint. In the event these populations were required to be cleared in the future and prior to the species being delisted Northern Star would seek the appropriate approvals. To prevent unintentional clearing Northern Star has placed each population within a Mine Exclusion Zone on its internal GIS system and will place signs in the field to a similar effect.
Will the Project reduce the area of occupancy of a species?	**No**. *Seringia exastia* has been recorded across a range of 2.6 million km^2 through northern and central Western Australia, Northern Territory and South Australia. The proposed Development Envelope of 22,194 ha and indicative disturbance footprint of 5,830 ha is 0.85% and 0.22% respectively of the total known range for the species.

Significant Impact Criteria	Determination of Significance
Will the Project fragment an existing population into two or more populations?	**No**. The recorded locations of the two *Seringia exastia* populations within the proposed Development Envelope are shown in Figure 7-2. The northern population is located within the infrastructure corridor proposed for power transmission to Hemi. This population will not be disturbed during the construction and operation of this infrastructure. The southern population is located outside of the indicative disturbance footprint and is unlikely to be disturbed by the Proposed Action. The common and widespread nature of the species indicates the separation of these two species will not have a significant impact on the size, ability to reproduce, or affect the conservation status of *Seringia exastia*.
Will the Project adversely affect habitat critical to the survival of a species?	**No.** The species distribution across 2.6 million km^2 covers a range of habitat types throughout Western Australia, Northern Territory and South Australia. The species is located across 15 IBRA regions being Carnarvon, Central Ranges, Coolgardie, Dampierland, Finke, Gascoyne, Gibson Desert, Great Sandy Desert, Great Victoria Desert, Little Sandy Desert, McDonnell Ranges, Murchison, Pilbara, Tanami and Yalgoo. A review of regional vegetation types against recorded locations *Seringia exastia* demonstrates the widespread and common nature of suitable habitat across northern and central Australia. Habitat suitable for *Seringia exastia*, is shown in Figure 7-3. The Proposed Action will impact approximately 0.22% of the of identified suitable habitat for the species.
Will the Project disrupt the reproduction of a population?	**Unlikely.** Flowering occurs between April and December each year producing a distinctive purple flower. It is unlikely the reproduction of the populations recorded at Hemi will be disrupted. However, as the species is common and widespread, any disruptions will not affect the overall size of the population across Western Australia, South Australia and Northern Territory. Furthermore, the population in the Northern Infrastructure Corridor is located approximately 45 m from proposed infrastructure, indirect impacts are not expected to impact this population as construction associated with the activity will be short term and limited in nature. To prevent unintentional clearing Northern Star has placed each population within a Mine Exclusion Zone on its internal GIS system and will place signs in the field to a similar effect.
Will the Project modify, destroy, remove, or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	**No**. The species is distributed across a range of 2.6 million km^2 with large areas of suitable habitat spread across 15 separate IBRA regions in Western Australia, Northern Territory and South Australia. As previously discussed and shown in Figure 7-3, *Seringia exastia* has been recorded in numerous vegetation types across three separate states. The Proposed Action will impact approximately 0.22% of identified suitable habitat for the species as compared against recorded locations.
Will the Project result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered or endangered species' habitat?	**No.** Northern Star has implemented a vehicle hygiene system where vehicles and machinery entering the Proposed Action are confirmed to be free from seeds, soils, and plant material. Northern Star will also implement weed control measures in the area of the Proposed Action.
Will the Project introduce disease that may cause the species to decline?	**No.** Northern Star has implemented a vehicle hygiene system where vehicles and machinery entering Hemi will be free from seeds, soils, and plant material. There are no known diseases that cause *Seringia exastia* to decline in health. Approximately 300 recordings of *Seringia exastia* populations occur over 2.6 million km^2 with any diseases unlikely to spread to remaining populations across northern and central Australia.
Will the Project interfere with the recovery of the species?	**No.** *Seringia exastia* is a common and widespread species and is to be assessed for declassification of conservation status due to a taxonomic amalgamation between two species. Therefore, the species is no longer required to have management measure applied for either threat abatement or recovery.

Figure 7-2: *Seringia exastia* Local Populations



Legend

Vegetation Type - Description (Umwelt 2023)

1 - Low isolated shrubs including Acacia stellaticeps and Pluchea tetranthera over low hummock grassland dominated by Triodia longiceps and Triodia epactia over ephemeral low sparse sedgeland, tussock grassland and forbland of mixed taxa including Fimbristylis dichotoma, Bulbostylis barbata, Calandrinia stagnensis, Streptoglossa decurrens and Eriachne aristidea on red-brown clay loam, sandy clay loam or sandy clay on plains and flats

2 - Low tussock grassland to sparse tussock grassland dominated by a combination of Eriachne glauca var. glauca, Eriachne benthamii and Eriachne flaccida over low sparse hummock grassland of Triodia epactia and Triodia longiceps over ephemeral low sparse sedgeland and forbland of mixed species including Cyperus iria, Fimbristylis dichotoma, Neptunia dimorphantha, Marsilea hirsuta and Calandrinia pumila on orange, red-brown or brown clay in clay pans

3 - Low woodland to open woodland dominated by Corymbia candida subsp. candida over tall shrubland to open shrubland dominated by Acacia colei and Acacia tumida var. pilbarensis over low open to sparse shrubland of mixed species including Pluchea tetranthera, Afrohybanthus aurantiacus and Sida rohlenae subsp. rohlenae over low open to sparse hummock grassland dominated by Triodia epactia over low sparse tussock grassland of mixed species including Chrysopogon fallax, Aristida holathera var. holathera, Eragrostis eriopoda, Eriachne obtusa and Cenchrus ciliaris on orange sandy or sandy clay loam on flats

4 - Tall sparse shrubland of mixed species including Acacia ancistrocarpa, Acacia inaequilatera, Acacia colei and Melaleuca lasiandra over low open to sparse shrubland dominated by Acacia stellaticeps, Pluchea tetranthera, Sida arenicola and Corchorus elachocarpus over low hummock grassland to open hummock grassland dominated by Triodia epactia, Triodia lanigera and Triodia schinzii on red or red-brown sandy loam on plains

5 - Tall open to sparse shrubland dominated by Acacia trudgeniana and Acacia colei over low open to sparse shrubland dominated by Acacia stellaticeps, Corchorus incanus subsp. incanus and Pimelea ammocharis over low hummock grassland of Triodia epactia over low sparse tussock grassland of mixed species including Aristida holathera var. holathera, Eragrostis eriopoda, Chrysopogon fallax and Eriachne obtusa on red-brown clay or sandy loam on plains

6 - Tall sparse shrubland dominated by Acacia trachycarpa and Acacia colei over low sparse shrubland of mixed species including Acacia stellaticeps and Corchorus incanus subsp. incanus over low hummock grassland dominated by Triodia lanigera on red-brown sandy loam on low dunes within river channels

7 - Tall sparse shrubland dominated by Acacia tumida var. pilbarensis over low sparse shrubland dominated by Corchorus incanus subsp. incanus and Tephrosia rosea var. clementii over ephemeral low sparse forbland and grassland of mixed species including Calocephalus beardii, Aristida contorta, Eragrostis cumingii, Indigofera colutea and Perotis rara on brown sandy loam with granite outcropping and stones on and around low granite outcrops

8 - Low open woodland to isolated trees dominated by Corymbia hamersleyana over tall open to sparse shrubland dominated by Acacia bivenosa, Acacia inaequilatera, Grevillea wickhamii subsp. aprica and Hakea loreus subsp. loreus over low sparse shrubland of mixed species dominated by Acacia stellaticeps, Scaevola amblyanthera var. centralis and Corchorus elachocarpus over low hummock grassland dominated by Triodia epactia on red or red brown clay or sandy loam with calcrete and silica stones, occasionally with calcrete or silica outcropping, on low rises or plains

9 - Tall sparse shrubland of mixed species including Acacia inaequilatera and Grevillea wickhamii subsp. aprica over low sparse shrubland of mixed species dominated by Corchorus parviflorus over low hummock grassland dominated by Triodia wiseana and Triodia epactia on red-brown clay loam with chert stones and often chert outcropping on hills and low rises

10 - Tall open to sparse shrubland dominated by Acacia ancistrocarpa, Acacia inaequilatera, Acacia sericophylla, Acacia acradenia and occasionally Melaleuca lasiandra over low shrubland to sparse shrubland dominated by Acacia stellaticeps and occasionally Sida arenicola, Indigofera monophylla, Pluchea tetranthera and Corchorus parviflorus over low hummock grassland to open hummock grassland dominated by Triodia lanigera and/or Triodia schinzii on red or red-brown sandy loam on plains

11 - Low open woodland to isolated trees of Corymbia hamersleyana over tall open to sparse shrubland dominated by Acacia orthocarpa, Acacia inaequilatera and Grevillea wickhamii subsp. aprica over low sparse shrubland dominated by Acacia stellaticeps over low hummock grassland dominated by a combination of Triodia lanigera, Triodia angusta, Triodia epactia and Triodia chichesterensis on red or red brown sandy or clay loam with primarily quartz and calcrete stones, occasionally with calcrete or quartz outcropping, on low rises and undulating plains

12 - Isolated low trees dominated by Corymbia hamersleyana over low open to sparse shrubland of mixed species including Acacia inaequilatera, Acacia acradenia, Acacia ancistrocarpa and Grevillea wickhamii subsp. aprica over low sparse shrubland of mixed species dominated by Goodenia stobbsiana over low hummock grassland dominated by Triodia epactia and occasionally Triodia wiseana on red or red-brown clay loam with silica and chert stones and often silica and chert outcropping on low rises

13 - Low open woodland dominated by Corymbia hamersleyensis and/or Corymbia candida subsp. candida over tall open to sparse shrubland dominated by Acacia ancistrocarpa, Acacia tumida var. pilbarensis, Acacia acradenia and Acacia colei over low hummock grassland of Triodia epactia on red or red-brown clay or sandy loam on flats or plains

14 - Tall open shrubland to isolated shrubs dominated by Acacia ancistrocarpa, Acacia colei and Acacia inaequilatera over low open shrubland to isolated shrubs dominated by Acacia stellaticeps and Pluchea tetranthera over low hummock grassland dominated by Triodia epactia on red or red brown sandy or clay loam on plains and flats

15 - Low open woodland of Eucalyptus victrix over tall sparse shrubland dominated by Acacia colei over low open hummock grassland of Triodia epactia over ephemeral low sparse herbland of mixed species including Bergia perennis subsp. perennis, Marsilea hirsuta, Cyperus iria and Centipeda minima subsp. macrocephala on pale brown sandy clay loam on the margins of clay pans

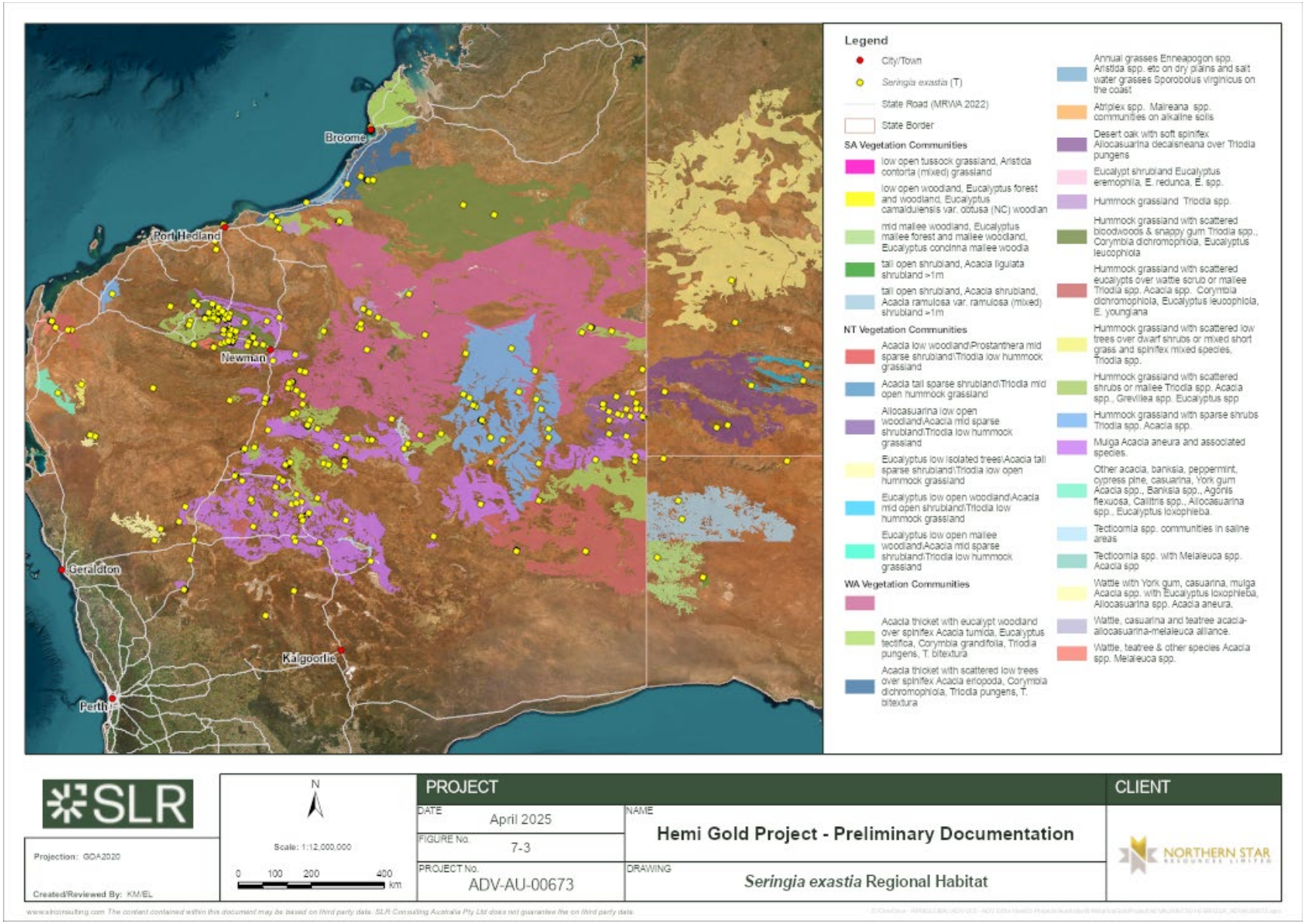
16 - Mid to low open woodland dominated by Eucalyptus camaldulensis subsp. refulgens and Melaleuca argentea over tall sparse shrubland dominated by Melaleuca glomerata, Acacia coriacea subsp. pendens and Acacia trachycarpa over mid to low sparse shrubland dominated by Acacia pyrifolia var. pyrifolia, Crotalaria cunninghamii and Corchorus incanus subsp. incanus over low sparse hummock grassland dominated by Triodia epactia over low sparse sedgeland dominated by Cyperus vaginatus on pale red or brown sand with patchy mixed stones in river channels

17 - Tall open to sparse shrubland dominated by Acacia sabulosa over mid open to sparse shrubland of mixed species dominated by Corchorus incanus subsp. incanus, Sida arenicola, Ptilotus arthrolasius, Gyrostemon tepperi and Triumfetta deserticola over low open to sparse hummock grassland dominated by Triodia lanigera and Triodia schinzii over low sparse tussock grassland dominated by Aristida holathera var. holathera and Eragrostis eriopoda on red sand on dunes

D - Disturbed Land

	PROJECT	CLIENT
SLR	NAME: **Hemi Gold Project - Preliminary Documentation**	NORTHERN STAR RESOURCES LIMITED
	DRAWING: ***Seringia exastia* Local Populations**	
Created/Reviewed By: KM/EL	FIGURE No. 7-2 | PROJECT No. ADV-AU-00673 | DATE April 2025	

Figure 7-3: Seringia exastia Regional Habitat



7.2 Threatened Fauna

7.2.1 Ghost Bat (*Macroderma gigas*)

No significant impact is anticipated on the Ghost Bat as a result of the Proposed Action. Field surveys conducted at Hemi did not identify habitat that would support diurnal roosts, with the nearest known roost 35 km south of the Proposed Action. Habitat deemed suitable for foraging was identified, however as the Development Envelope is outside of the 12 km foraging buffer surrounding the known diurnal roost, it is not considered important to the species. Upon assessment against the Significant Impact Guidelines for Vulnerable species, Northern Star concludes the Proposed Action will not have a significant impact on the Ghost Bat. A detailed description of this assessment is provided in the following subsections.

7.2.1.1 Overview

The Ghost Bat is listed as Vulnerable under the EPBC Act as their range contracts northwards. The Ghost Bat occurs in isolated populations ranging from the WA Pilbara region to central Queensland coastal and hinterland regions, incorporating the Kimberley, Northern Territory and wet and dry tropics of Queensland.

The Ghost Bat is a carnivorous bat that persists as a relictual species in arid areas where suitable roosting caves are present. Their broad diet comprises of small mammals (including other bats), birds, reptiles, frogs and large insects hunted via either ambush of passing prey or gleaning of the surface while in flight. The Ghost Bat does not use echolocation continuously while foraging like other bats, increasing the difficulty of recording their presence during field surveys.

7.2.1.2 Relevant Policy and Guidance

There is no national recovery plan in place for the Ghost Bat, however '*A Review of Ghost Bat Ecology, Threats and Survey Requirements*' was prepared for the Department of Agriculture, Water and the Environment (DAWE) in 2021 (Bat Call WA, 2021a). Relevant Commonwealth policy and guidance for the Ghost Bat, which are informing studies, planning, and development of the Proposed Action, are summarised in Table 7-2.

Table 7-2: Relevant Policy and Guidance for the Ghost Bat

Author	Year of Publication	Policy/ Guidance
Threatened Species Scientific Committee (TSSC)	2016	Conservation Advice *Macroderma gigas* Ghost Bat.
CoA	2010	Survey guidelines for Australia's threatened Bats: Guidelines for detecting Bats listed as threatened under the EPBC Act.
	2011	Survey guidelines for Australia's threatened mammals: Guidelines for detecting mammals listed as threatened under the EPBC Act (DCCEEW, 2011)
	2013	EPBC Act Significant Impact Guideline 1.1.
Bat Call WA	2021	A review of Ghost Bat ecology, threats, and survey requirements.

7.2.1.3 Habitat

Ghost Bats located in the Pilbara region are genetically distinct to those that occur in the Kimberley, Northern Territory and Queensland. The Pilbara population is divided between the Hamersley Ranges and Chichester Ranges, though the genetic differentiation is low, suggesting individual Ghost Bats move between these populations (Western Wildlife, 2023).

In the Chichester region, Ghost Bats are often found in large maternal roosts (Category 1 and 2) essential for the survival of the species. However, smaller roosts are also likely to be important, allowing individuals to occupy and forage through larger areas of the landscape, resulting in dispersal and gene-flow between larger roosts. As the overall Chichester population is small, all populations are likely to be important.

Ghost Bats utilise several diurnal and nocturnal roost caves within an area for feeding, resting, breeding and maternity. These roosts are categorised from Category 1 through to Category 4 (with Categories 1 and 2, and some Category 3 roosts considered critical habitat). In the Pilbara, numerous natural formations are used by the Ghost Bat intermittently as short-term transient roosts and for feeding activity for single or small numbers of individuals, whilst others are used by maternity colonies (Western Wildlife, 2023).

Recent studies using Very High Frequency (VHF) tracking and Global Positioning System (GPS)/satellite tracking technologies demonstrate that Ghost Bats forage up to 12 km from their critical roost. These studies are also being used to define foraging habitat preferences within these large areas and identify foraging areas of crucial importance to the species.

7.2.1.4 Threats

Threats to the conservation status of the Ghost Bat are listed from the conservation advice for the Ghost Bat (TSSC, 2016a) being:

- Habitat loss (destruction of, or disturbance to, roost sites and nearby areas) due to mining.
- Disturbance of (human visitation at) breeding sites.
- Modification to foraging habitat.
- Collision with fences, especially those with barbed wire.
- Collapse or reworking of old mine adits.
- Contamination by mining residue at roost site.
- Disease.
- Poisoning by cane toads.
- Competition for prey with foxes and feral cats.

7.2.1.5 Survey Effort

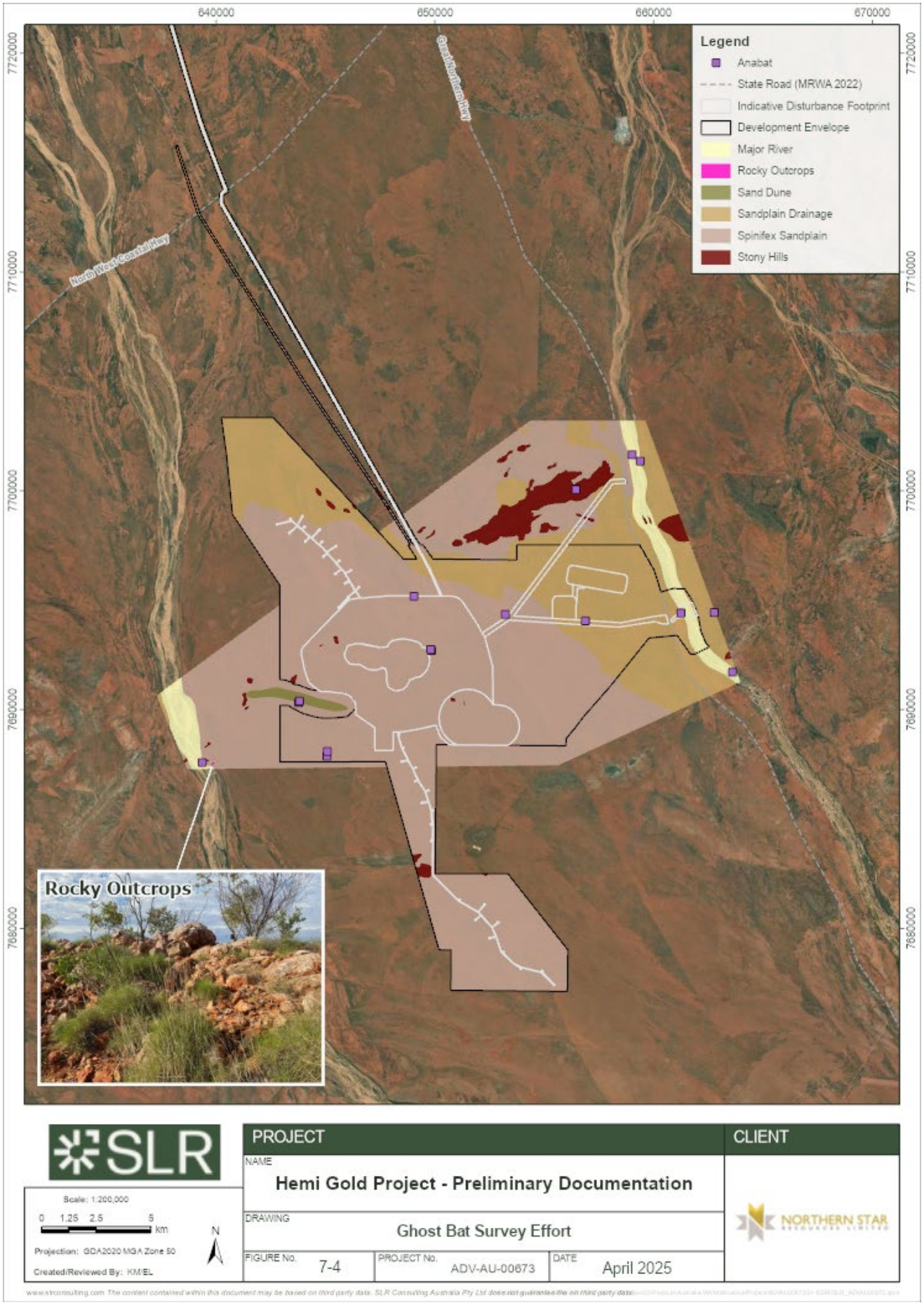
The timing and adequacy of the Detailed Vertebrate Fauna Survey undertaken by Western Wildlife was consistent with that recommended in the Technical Guidelines (EPA 2020) and Ghost Bat survey requirements (Bat Call, 2021). The fauna habitats were identified and mapped using the habitat assessments and observations made in the field during the fauna survey, interpretation of vegetation mapping (Umwelt, 2024), aerial photography and land system mapping.

No roosts were identified or considered likely in the study area, primarily due to the absence of suitable cave-bearing rocky formations (as previously demonstrated in Section 6.6.2, Table 6-7). Ghost Bats are only recorded using ultrasonic detectors from within roosts or while foraging at specific locations such as water holes (Bat Call WA, 2021a), limiting the targeted work for the Ghost Bat throughout the study area.

Bat calls were captured using AnaBat Swift call detectors set to record from dusk until dawn, strategically positioned in areas most likely to be visited by Ghost Bats. Ultrasonic detectors were placed at 22 selected sites for one to three nights across the study area. This methodology resulted in a total of 16 nights of recordings in September 2021 and another 16 nights in March 2022 (Figure 7-4).

The survey did not record the presence of Ghost Bat which can be attributed to the non-existence of available roosting habitat. Recent studies have identified Ghost Bats foraging up to 12 km from their diurnal roosts, with round trips up to 30 km recorded. As the closest roost site is 35 km south of Hemi, the Development Envelope is unlikely to host foraging habitat that is considered critical to the survival of the species as it is widespread and not close to roosting sites (Western Wildlife, 2023).

Figure 7-4: Ghost Bat Survey Effort

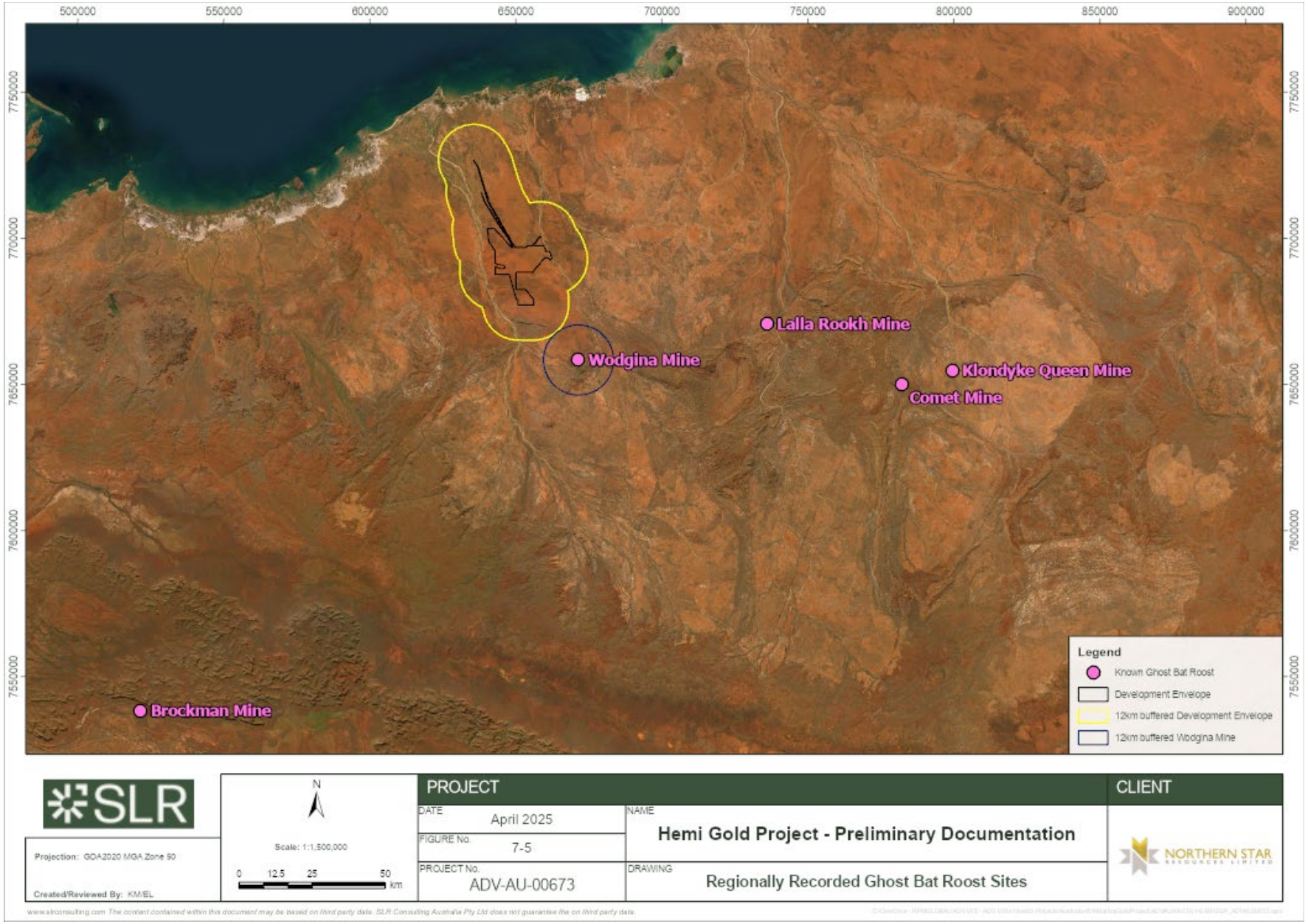


7.2.1.6 Local Population

A search of the EPBC Protected Matters Search Tool recorded the Ghost Bat within the 50 km buffer with a search of known diurnal Ghost Bat roosts shown in Figure 7-5. The study area falls within the Chichester Range subpopulation, estimated to be approximately 1,500 individuals (TSSC, 2016a). This population is unlikely to be supported by the foraging habitat within the Development Envelope due to the large distance from the closest known diurnal roost site.

Known roosts, in comparison with the location of the Proposed Action are provided in Figure 7-5 with a 12 km buffer applied. The nearest known roost, Wodgina, is 35 km south of Hemi, with the Development Envelope outside of the foraging buffer zone. Western Wildlife concluded that suitable foraging habitat was available for the Ghost Bat within the study area, however with no available roosting habitat, it is unlikely to be critical to the survival of the species.

Figure 7-5: Regionally Recorded Ghost Bat Roost Sites



7.2.1.7 Potential Impacts and Management

The potential impacts on Ghost Bat and the management measures Northern Star will implement are presented in Table 7-3.

Table 7-3: Ghost Bat Potential Impacts and Management Measures

Potential Impact	Extent or Likelihood	Management and Mitigation Measures
Habitat loss (destruction of or disturbance to roost sites and nearby areas) due to mining	Unlikely	No roosts have been recorded within 35 km south of the Proposed Action therefore mining is unlikely to result in loss of habitat considered critical to the survival of the species.
Disturbance of breeding sites caused by human visitation	Unlikely	No roosts have been recorded within the Development Envelope and therefore will not be disturbed from human visitation.
Modification to foraging habitat	Unlikely	The Development Envelope is outside the known foraging range of the Ghost Bat from known roosts. However, the study area does contain suitable foraging habitat. Therefore, Northern Star will limit impacts to foraging habitat via the following measures: • Limit clearing to the amount required. • Use of previously disturbed areas where possible. • Implementation of the internal clearing permit system. • Annual review of disturbance areas. • Avoid Major River habitat where possible. • Implementation of weed monitoring program and subsequent weed control measures when required. • Progressive rehabilitation of disturbed areas where feasible.
Collision with fences, especially those with barbed wire	Unlikely	Northern Star notes that the Proposed Action is located on an active Pastoral Lease where barbed wire fencing is already in use. Northern Star will manage the potential impacts of fencing for the Proposed Action by: • Minimising fencing to the amount required. • Not using barbed wire fencing where practicable. • If barbed wire fencing is required (due to legislative, safety or pastoral requirements) the top strands will be plain wire, and 10 cm disc bat reflectors will be used. • Inspection of areas requiring barbed wire fencing due to legislative, safety or pastoral requirements. • Reporting of all fauna related incidents.
Poisoning by cane toads	Unlikely	• Northern Star will inspect vehicles arriving from the Northern Territory and Kimberley for cane toads to prevent inadvertent introduction to Hemi.
Competition for prey with foxes and feral cats	Unlikely	Existing populations of feral fauna will be managed in the context of implementation of the Proposed Action by: • Implementing best practice waste management measures. • Limiting the creation of permanent water bodies. • Fencing of artificial water sources where practicable and any putrescible landfills. Monitoring and control measures as required. • Personnel feeding of feral fauna is prohibited. • Pets on site are prohibited.

7.2.1.8 Significance Test

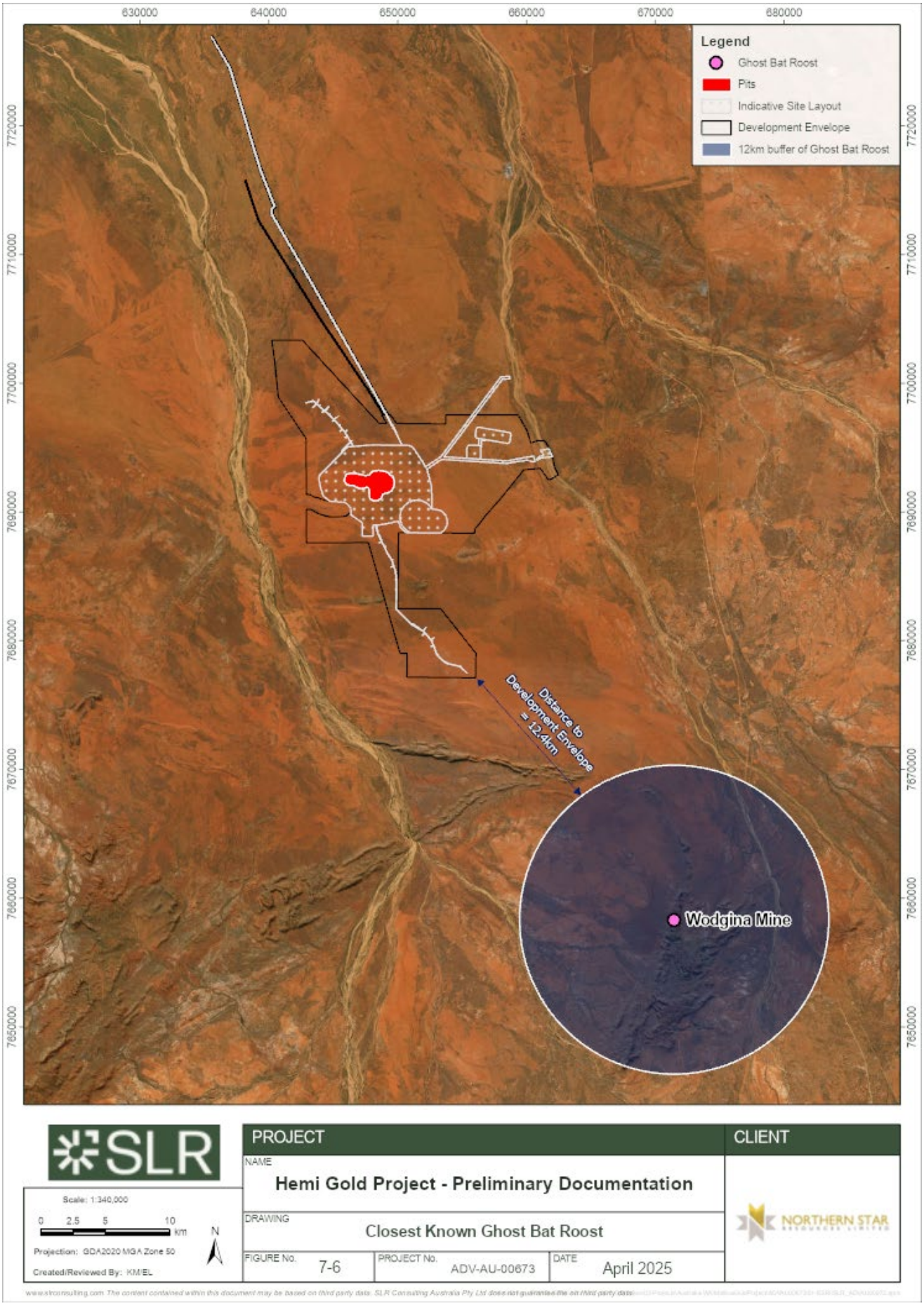
An assessment of the proposed actions against the significance criteria for Vulnerable species in the Significant Impact Guidelines is presented in Table 7-4 for the Ghost Bat.

Table 7-4: Significant Impact Assessment for the Ghost Bat

Significant Impact Criteria	Determination of Significance
Will the Project lead to a long-term decrease in the size of an important population of a species?	**No.** The estimated size of the Chichester region sub-population is 1,500 individuals with the total Ghost Bat population across Australia estimated between 7,000 and 9,000 individuals. The Ghost Bat moves between a number of caves including caves, rock crevices and disused mine adits. The closest known roost of the Ghost Bat is 35 km south of the Proposed Action. There is no evidence to suggest a known population of Ghost Bat is utilising the area within the Development Envelope due to unavailable roosting habitat and the scarcity of records, therefore the Proposed Action is unlikely to lead to a long-term decrease in the size of an important population.
Will the Project reduce the area of occupancy of an important population?	**No.** Roost site availability is a key factor in the area of occupancy of the Ghost Bat and with no roost sites recorded and the lack of suitable roosting habitat within the Development Envelope, the Proposed Action will not reduce the area of occupancy of an important population. Foraging habitats present in the Development Envelope are regionally common and not within 12 km of known roosting site.
Will the Project fragment an existing important population into two or more populations?	**No**. Known roost sites across the Pilbara region are shown in Figure 7-5, demonstrating the lack of available roosting habitat in the vicinity of the Proposed Action. Mapped habitats within the Development Envelope are considered suitable for foraging, however due to the lack of roosting caves, it is unlikely the Development Envelope provides important habitat for a population. Therefore, the Proposed Action is not considered to fragment an existing population into two or more populations.
Will the Project adversely affect habitat critical to the survival of a species?	**No.** The Ghost Bat relies on suitable roosting sites in caves, rocky crevices and disused mine adits. There will be no direct disturbance from the Proposed Action to Ghost Bat roost sites or foraging habitat within 12 km of the roost site. The fauna habitats mapped within the Development Envelope are considered suitable for foraging, however, as no roost sites are present, this habitat is not considered critical for the survival of the species.
Will the Project disrupt the breeding cycle of an important population?	**No**. Ghost Bats tend to concentrate in relatively few roost sites when breeding during the dry season with Pilbara colonies giving birth in mid-October to late-November. Category 1 and 2 and some Category 3 roosts are considered critical to the survival of the species due in large part to the presence of breeding females (Bat Call, 2021). No roost sites, including Category 1, 2 or 3, are present within the Development Envelope of the Proposed Action. Therefore, as no disturbance is proposed in or near critical roost sites where breeding occurs, the Proposed Action is not considered to disrupt the breeding cycle of an important population.
Will the Project modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	**No**. Ghost Bats utilise Category 1, 2 and some Category 3 roost sites such as caves, rock crevices and mine adits to rest, breed and raise young, making them critical to the survival of the species. Satellite tracking has shown Ghost Bats forage up to 12 km from their critical roost site (Bat Call, 2021). The mapped habitats within the Development Envelope are deemed suitable for foraging by Ghost Bats, however as the closest known roost site is 35 km south of the Proposed Action (Figure 7-6), it is unlikely to be supporting Ghost Bat population. Therefore, the Proposed Action will not decrease the availability or quality of habitat that would result in a decline of the species.

Significant Impact Criteria	Determination of Significance
Will the Project result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?	**Unlikely**. The main predatory threats to the Ghost Bat in the Pilbara region include the Cane Toad (*Rhinella marina*) and Cats (*Felis catus*). The Cane Toad is yet to reach the Pilbara; however, studies show significant decreases in some populations of Ghost Bat in the Northern Territory and Queensland after Cane Toad invasion. Northern Star will implement strict quarantine and inspection processes for all transport vehicles entering site from regions where Cane Toads are recorded. There are few records of predation by cats on Ghost Bats, however piles of remains have been observed within roosting sites, a known behaviour of cats. A precautionary approach is recommended to be taken against feral cats as they are known to prey on other bat and flying fox species. Northern Star will implement a feral cat monitoring program and implement control measures when required. The closest known roost 35 km south of Hemi provides a relatively large buffer from indirect invasive species predation on the Ghost Bat individuals, however Northern Star will implement monitoring and control measures for other MNES species known to occur within the Development Envelope. These measures will indirectly ensure the nearest Ghost Bat population is not directly or indirectly impacted from the Proposed Action. Measures to minimise the Proposed Action causing an increase in the feral cat population include implementing best practice waste management measures, limiting the creation of artificial water sources and prohibiting onsite personnel from feeding fauna species.
Will the Project introduce disease that may cause the species to decline?	**No.** The introduction of a disease to a population of Ghost Bat would most likely occur by a lack of hygiene when entering any roost site. The Development Envelope does not support critical roost sites, therefore there is no risk of introducing a disease that may cause the species to decline.
Will the Project interfere substantially with the recovery of the species?	**Unlikely**. The recovery of the Ghost Bat population relies on the preservation of critical roost sites for breeding. The Proposed Action will not remove any roosts from the environment, with the closest known roost approximately 35 km south of the main mine activities. The Development Envelope occurs outside of the 12 km foraging habitat buffer from this known roost site. The Proposed Action is unlikely to interfere substantially with the recovery of the Ghost Bat.

Figure 7-6: Closest Known Ghost Bat Roost



7.2.1.9 Conclusion

No significant impact is anticipated to the Ghost Bat as a result of the Proposed Action as no diurnal roosts are present within the Development Envelope, with the nearest 35 km south of the main mine activities. Suitable foraging habitat was mapped during the field surveys across the study area, however as the Development Envelope is outside of the 12 km foraging buffer surrounding the known diurnal roost, it is not considered critical habitat for the species. Northern Star believes the Proposed Action will not have any direct or indirect impacts on the Ghost Bat.

7.2.2 Greater Bilby (*Macrotis lagotis*)

The Proposed Action is not anticipated to impact a current population, nor interfere with the recovery of the Greater Bilby in the Pilbara bioregion. The broad definition of critical habitat for the Greater Bilby means the Proposed Action will require clearing of 5,759 ha of habitat that is deemed critical, however is equates to 0.16% of Greater Bilby habitat within the Pilbara IBRA region.

With mitigation measures in place, a decline in the significant population is not expected, nor is fragmentation of its habitat. The residual significant impact, after implementation of the mitigation hierarchy, is clearing of up to 5,100 ha of critical Spinifex Sandplain and 800 ha of Sandplain Drainage habitat within the Development Envelope. Environmental offsets are proposed for this clearing and are discussed in Section 9.

7.2.2.1 Overview

The Greater Bilby is listed as Vulnerable under the EPBC Act due to their fragmented distribution and limited area of occupancy. The Greater Bilby once occupied more than 75% of Australia (drier areas) which has been reduced by more than 80%. Restricted populations occur in the Northern Territory, central and northern Western Australia and small isolated populations in Queensland (DCCEEW, 2023).

The Greater Bilby is a medium sized burrowing marsupial with large ears responsible for regulating their body temperature and sharp hearing. The Greater Bilby is the last remaining species from the *Macrotis* genus, with the Lesser Bilby understood to have become extinct in the 1950s. The Greater Bilby is able to survive without drinking water, hydrating through food including seeds, fruit, bulbs, small insects, small mammals, reptiles, snails and eggs (Australian Geographic, 2024b).

7.2.2.2 Relevant Policy and Guidance

Relevant Commonwealth policy and guidance for the Greater Bilby, which have informed studies, planning and development of the Proposed Action, are summarised in Table 7-5.

Table 7-5: Relevant Commonwealth Policy and Guidance for the Greater Bilby

Author	Year of Publication	Policy/ Guidance
CoA	2013	EPBC Act Significant Impact Guideline 1.1.
	2011	Survey guidelines for Australia's threatened mammals: Guidelines for detecting mammals listed as threatened under the EPBC Act
	2016	Conservation Advice *Macrotis lagotis* Greater Bilby (TSSC, 2016c)
	2023	Recovery Plan for the Greater Bilby (*Macrotis lagotis*)

7.2.2.3 Habitat

The existing populations of the Greater Bilby occupy three main habitats being:

- Open tussock grassland on uplands and hills.
- *Acacia aneura* (mulga) woodland/shrubland growing on ridges and rises.
- Hummock grassland in plains and alluvial areas.

The habitat of the Greater Bilby varies across its range, so it is not possible to generate one description or definition of critical habitat (CoA, 2023). However, an interim guide, habitat critical to the survival of the Greater Bilby can be considered to include:

- Any area where the species is known or likely to occur as shown on the distribution map in the Greater Bilby Species Profile and Threats (SPRAT) Database.
- Any location outside the known or likely distribution where Greater Bilbies are found to occur.
- Any area, between the areas noted above, that may be periodically occupied by Greater Bilbies.
- Any area, which Greater Bilbies may naturally colonise or may feasibly be reintroduced.

7.2.2.4 Threats

The 'Recovery Plan for the Greater Bilby' (DCCEEW, 2023) identifies threats to the Greater Bilby as the following:

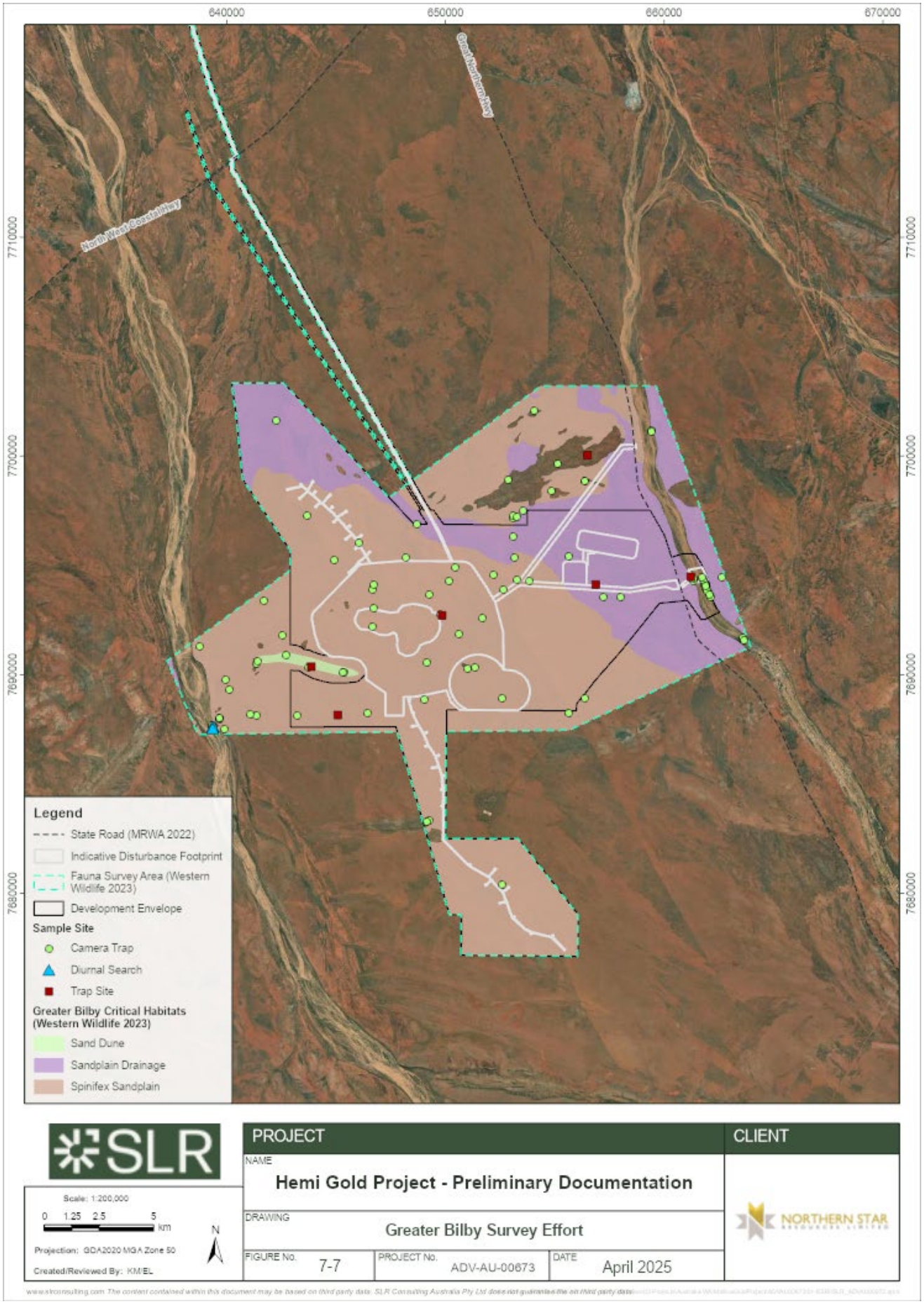
- Predation by foxes and cats.
- Predation by wild canids in Queensland.
- Habitat loss, degradation and fragmentation.
- Domestic and other introduced species.
- Unmanaged fire and inappropriate fire regimes.
- Loss of Traditional Owner knowledge and land management.
- Reduction in population resilience and genetic fitness in wild and intensively managed populations.
- Disease.

7.2.2.5 Survey Effort

Western Wildlife conducted a two-phase detailed vertebrate fauna survey across the study area in September 2021 and March 2022, with additional targeted surveys conducted in August 2022 (Western Wildlife, 2023). The timing and adequacy of the targeted fauna surveys were consistent with that recommended in the relevant guidelines for the Greater Bilby (EPA, 2020; DBCA, 2017) with the survey effort provided in Figure 7-7.

Camera traps were deployed at 36 sites in September 2021 for a total of 180 trap-nights, 31 sites in March 2022 for 221 trap-nights and five sites in August 2022 for 40 trap-nights, with a cumulative survey effort of 441 trap nights. Cameras were deployed in sandplain habitats that potentially supported the Greater Bilby and lured with a mixture of rolled oats, peanut butter and sardines. Each individual camera was set for between 5 and 8 nights. In addition, diurnal transect and point searches were undertaken during the 2021-2022 surveys for signs of the Greater Bilby. Signs include burrows, diggings, tracks or scats throughout the sandplain habitat. Long term camera traps left out in the field, particularly near the sand dune habitat have not detected the Greater Bilby to date.

Figure 7-7: Greater Bilby Survey Effort



7.2.2.6 Local Population

A search of the EPBC Protected Matters Search Tool recorded the Greater Bilby within the 50 km buffer and the WA DBCA's Threatened and Priority Fauna database has 36 records of the Greater Bilby within 20 km of the study area. The Greater Bilby moves their home range as food availability changes, therefore local populations are not always present in an area even though critical habitat is present (Western Wildlife, 2023). Sand Dune, Spinifex Sandplain and Sandplain Drainage fauna habitat types have been assessed as critical habitat in accordance with the criteria. Greater Bilby critical habitat across the Development Envelope is shown in Figure 7-8 and described in Table 7-6.

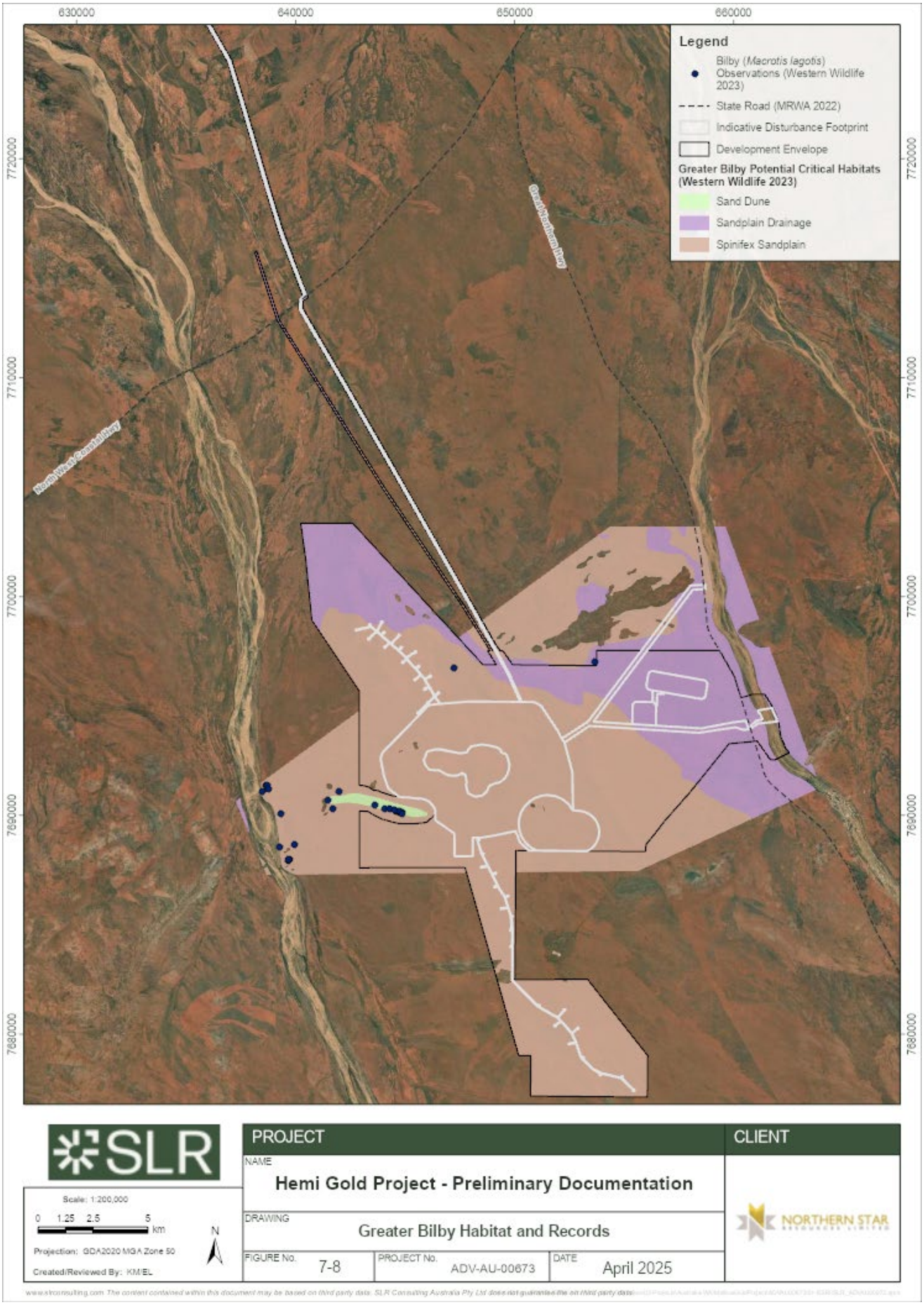
Table 7-6: Critical Greater Bilby Habitat

Critical Habitat	Mapped Survey Area (ha)	Area inside Development Envelope (ha)	Area inside Indicative Disturbance Footprint (ha)
Sand Dune	190.1	0.0	0.0 (0%)
Sandplain Drainage	9,349.5	6,029.4	721.2 (12.37%)
Spinifex Sandplain	22,718.6	15,809.8	5,037.1 (86.40%)
Total*	32,259	21,840	5,759 (98.78%)

*Rounded up to nearest one

Secondary signs of the Greater Bilby were recorded during the initial field surveys, primarily consisting of old burrows (inactive, but have been active in the past year). The burrows were recorded in the Sand Dunes and Spinifex Sandplain habitats, particularly in the vicinity of the Yule River (Figure 7-8). Unlike critical habitat for other species, Bilby habitat is often widespread and, in this case, extends well beyond the study area.

Figure 7-8: Greater Bilby Habitat and Records



7.2.2.7 Potential Impacts and Management

The potential impacts to the Greater Bilby from the Proposed Action and the management measures Northern Star propose to implement are presented in Table 7-7.

Table 7-7: Greater Bilby Potential Impacts and Management Measures

Potential Impact	Extent or Likelihood	Management Measure
Increase in predation by foxes and cats.	Unlikely	Existing populations of feral fauna will be managed by: • Implementing best practice waste management measures. • Limiting the creation of permanent water bodies. • Fencing of artificial water sources where practicable and any putrescible landfills. • Monitoring and control measures as required. • Personnel feeding of feral fauna is prohibited. • Pets on site are prohibited
Habitat loss and fragmentation	5,759 ha	Habitat loss will be managed by: • Limiting clearing to the minimum required. • Clearing of no more than 5,830 ha within the Development Envelope. • Clearing of no more than 5,759 ha of sandplain habitats (Sandplain Drainage and Sandplain Spinifex) within the Development Envelope. • Using previously disturbed areas, where possible. • Implementation of the internal ground disturbance permit system. • Annual review of disturbance areas. • Progressive rehabilitation where feasible.
Loss or injury of individuals during clearing and general operations	Unlikely	Northern Star acknowledges that the Greater Bilby is a mobile species and may move frequently between different burrow systems. For this reason, Northern Star will implement an CSSMP (Appendix 2) which will include the following: • Pre-clearance searches to identify the presence of Bilby. • Where individuals are identified, they will be intercepted, captured and relocated. • If injured/sick animals are encountered, a nominated fauna carer listed under the Pilbara Wildlife Carers Association will be called to care for the animal. • Any burrows located in proposed clearing areas will be confirmed inactive before clearing proceeds.
Accidental vehicle strikes	Unlikely	• Enforce strict traffic management rules for mine vehicles. • Implement speed limits of 80 and 60 km/h on sealed and unsealed roads for mine vehicles within the Development Envelope. • Mine vehicles will be required to stay on existing roads and tracks. • Personnel hooning and misadventure by personnel will be prohibited. • Sightings and incidents will be reported. • Personnel will be educated on conservation significant fauna.
Changes to fire intensity due to changes in landscape	Unlikely	Changes to the landscape from mining activities is not anticipated to change the fire intensity within the Development Envelope. Potential impacts to the fire regime will be managed by: • Employee, contractor and visitor site inductions. • Effective maintenance of mine vehicles. • No unauthorised off-road driving of mine vehicles.

Potential Impact	Extent or Likelihood	Management Measure
		• Installation of firebreaks around critical infrastructure. • Any controlled burns would be conducted in consultation with the DBCA. • Emergency response capacity will be maintained. • Hot works conducted within designated, specially designed workshops or with controls required by a Hot Work Permit System • All mine vehicles will be fitted with firefighting equipment.
Loss of Traditional Owner knowledge and land management	Unlikely	Northern Star will minimise any loss of Traditional Owner knowledge and land management by: • Continue engagement with Kariyarra People regarding environmental values. • Encourage participation in pre-clearance surveys for the Greater Bilby. • Participate in an Aboriginal ranger program.

7.2.2.8 Significance Test

An assessment of the Proposed Action against the significance criteria for Vulnerable species for Greater Bilby in the 'Significant Impact Guidelines' (CoA, 2013) is presented in Table 7-8.

Table 7-8: Significant Impact Assessment for Greater Bilby

Significance Impact Criteria	Determination of Significance
Will the Project lead to a long-term decrease in the size of an important population of a species?	**Unlikely**. The Recovery Plan for the Greater Bilby (DCCEEW, 2023) states that the species is intended to be managed as a metapopulation due to the lack of information of population structure and local cultural significance of each occurrence. As such, the concept of 'important populations' is not relevant to the overall conservation of the species. While signs of the Greater Bilby were recorded during the fauna surveys, the Development Envelope is not continuously inhabited by the species, which is thought to only pass through the area periodically. Northern Star will implement an approved CSSMP (Appendix 2) that includes management measures to control feral fauna populations, ensure that the existing fire regime is not affected and describe the pre-clearance survey procedure.
Will the Project reduce the area of occupancy of an important population?	**Unlikely**. Records of Greater Bilby during the fauna surveys demonstrate that the species does not continuously inhabit the Development Envelope. The Greater Bilby does not depend on a single location and moves according to food availability and breeding purposes. The Pilbara IBRA region has a total area of 14,054,517 ha of habitat suitable for Greater Bilby, of which 21,839 ha (0.16%) occurs within the Development Envelope and 5,759 ha (0.04%) occurs within the indicative disturbance footprint. As critical habitat is regionally common, the Proposed Action is unlikely to significantly reduce the area of occupancy of the Greater Bilby.
Will the Project fragment an existing important population into two or more populations?	**Unlikely**. Most signs of the Greater Bilby were recorded in the southwest of the study area near the Yule River and Sand Dune habitat (excluded from the Development Envelope), with one record in the northeast of the Development Envelope. The Sand Dune habitat continues south of the Development Envelope providing continuous habitat for the population as shown in Figure 7-9. As suitable habitat is regionally common and the Greater Bilby does not continuously inhabit the Development Envelope, the Proposed Action is unlikely to fragment the metapopulation of the Greater Bilby.
Will the Project adversely affect habitat critical to the survival of a species?	**Likely**. The Proposed Action is located within habitat deemed critical habitat for the Greater Bilby, in part due to the broad definition within the 'Recovery Plan of the Greater Bilby' (DCCEEW, 2023). These habitats include Sand

Significance Impact Criteria	Determination of Significance
	Dune, Sandplain Drainage and Spinifex Sandplain of which the Sand Dune habitat has been excluded from the Development Envelope. An assessment of these habitats across the Pilbara IBRA region has been undertaken in context with the area of the Development Envelope and indicative disturbance footprint. Critical habitat was extrapolated using Soil Landscape Mapping – Rangelands (DPIRD, 2022) to the extent of the Pilbara bioregion boundary as shown in Figure 7-10. The assessment demonstrates approximately 14,054,517 ha of habitat suitable for the Greater Bilby occurs within the Pilbara IBRA region of which 21,839 ha (0.16%) occurs within the Development Envelope and 5,759 ha (0.04%) within the indicative disturbance footprint.
Will the Project disrupt the breeding cycle of an important population?	**Unlikely**. The Greater Bilby is adaptable and tends to move across the landscape primarily due to food availability. However, burrows are important for breeding where after a pouch life of 75-80 days, the females tend to their young in a burrow for a further two weeks. No active burrows were identified during the field surveys, however pre-clearance surveys for active burrows will be undertaken prior to the commencement of clearing activities.
Will the Project modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	**Unlikely**. The Development Envelope is not continuously inhabited by the Greater Bilby with habitat deemed critical regionally common and widespread as shown in Figure 7-10. Pre-clearance surveys will be undertaken prior to the commencement of the clearing activities to ensure no active burrows are within the proposed disturbance area. Once the area is cleared, it is likely any individuals will relocate outside of the disturbance area in search for food and suitable burrows. Northern Star will progressively rehabilitate sections of cleared areas when available allowing the Greater Bilby to periodically recolonise areas once rehabilitated. Due to the common and widespread nature of critical habitat across the Pilbara bioregion, it is unlikely the Proposed Action will decrease the availability or quality of habitat to the extent the Greater Bilby is expected to decline.
Will the Project result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat?	**Unlikely**. Foxes, and to a lesser extent cats, are deemed to have had the single largest negative effect on the conservation of the Greater Bilby. Northern Star will implement a monitoring program and appropriate management measures to control feral animals and weed species to ensure the Proposed Action does not result in an increase.
Will the Project introduce disease that may cause the species to decline?	**Unlikely**. Although disease is not recorded as threatening process for the Greater Bilby, it could hinder the recovery of the Greater Bilby (DCCEEW, 2023). The Proposed Action is not likely to introduce disease to the Greater Bilby population with handling of individuals limited to accredited personnel during pre-clearance surveys.
Will the Project interfere substantially with the recovery of the species?	**Unlikely**. The Proposed Action occurs on critical habitat for the Greater Bilby that is 0.16% of available critical habitat in the Pilbara IBRA region. There has been little evidence of activity recorded during field surveys within the Development Envelope. Pre-clearance surveys will be undertaken with any individuals identified re-located prior to clearing activities. It is unlikely the Proposed Action will have a significant impact on the Greater Bilby or its recovery.

Figure 7-9: Inferred Regionally Significant Habitat

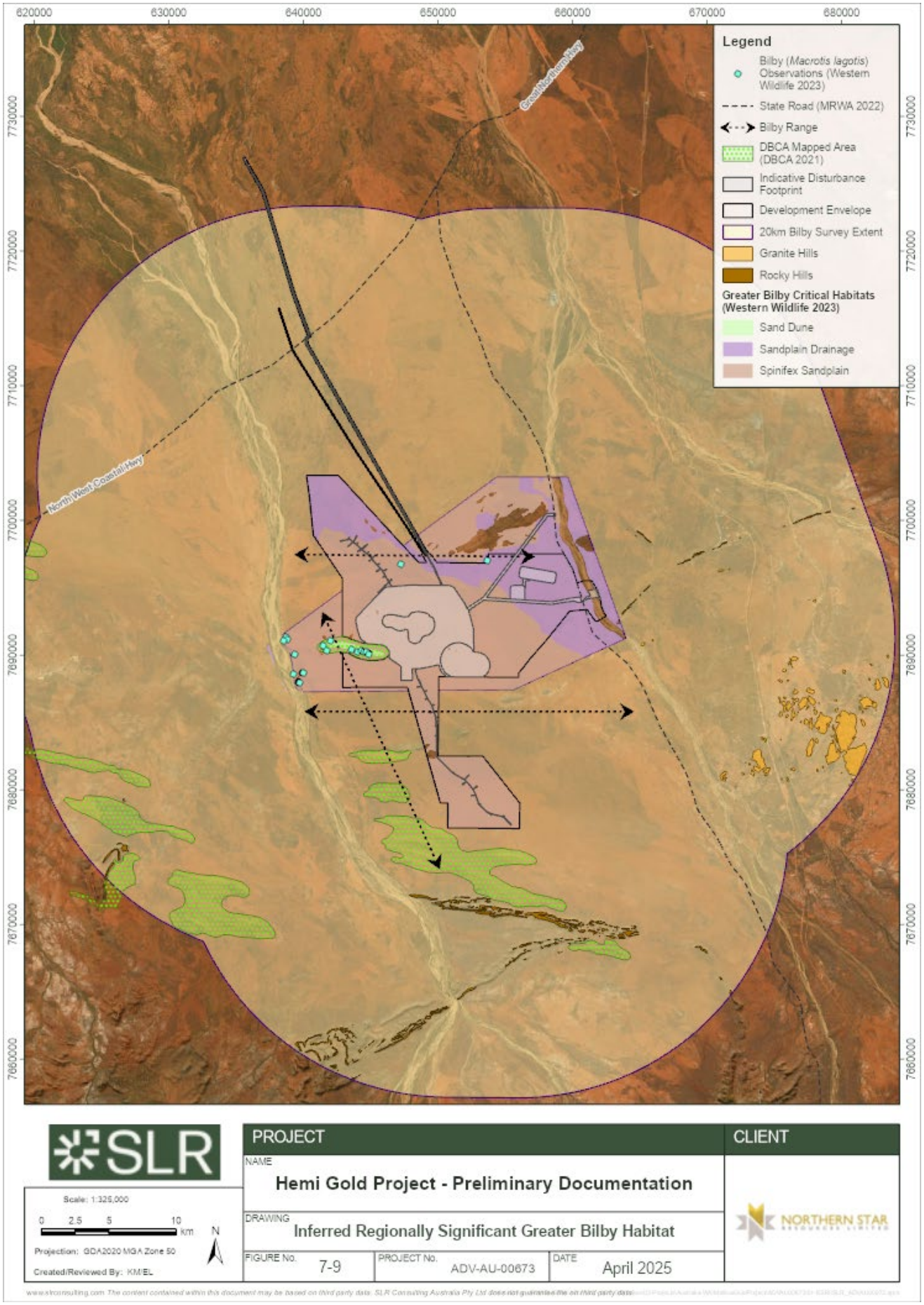
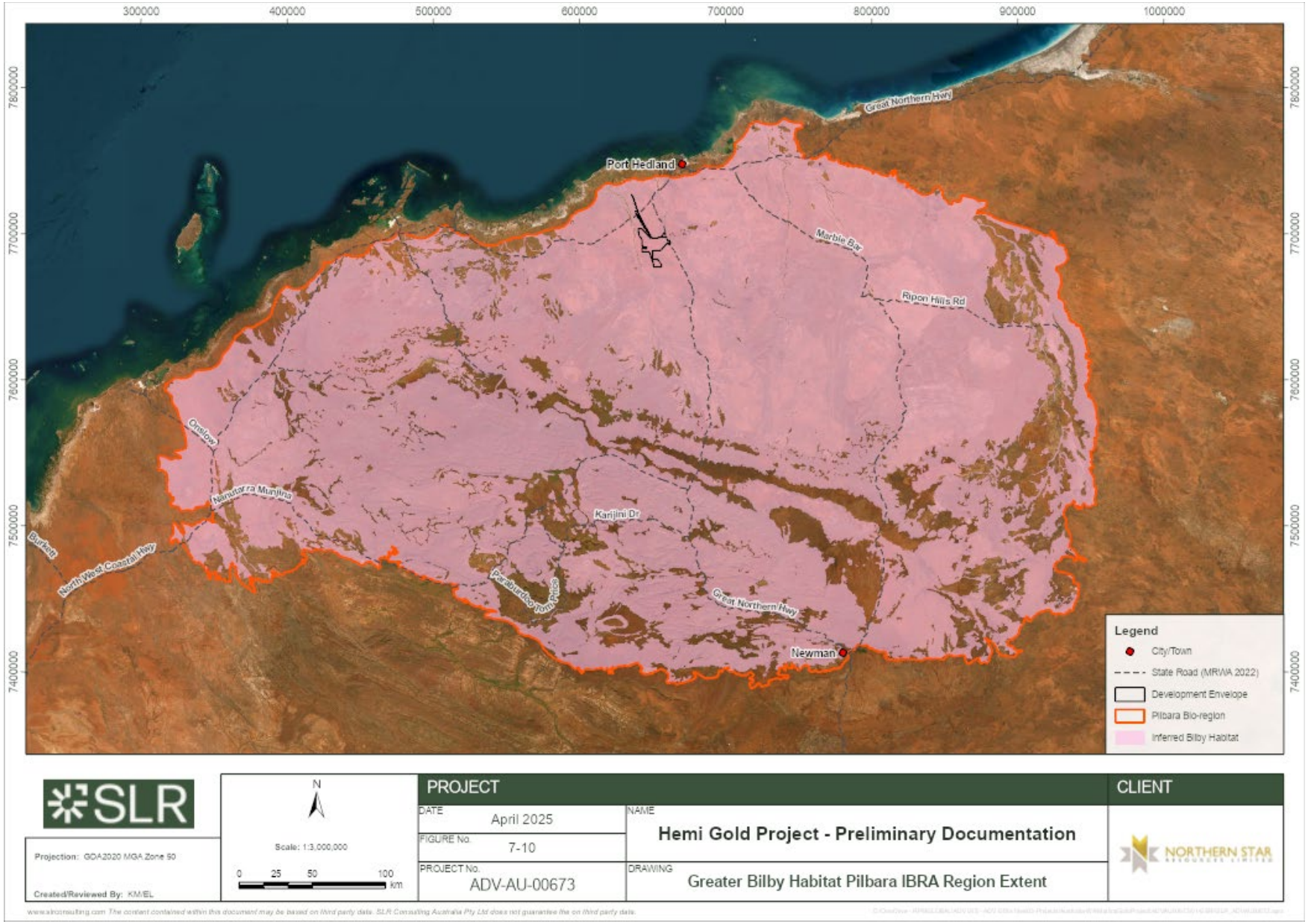


Figure 7-10: Greater Bilby Habitat Pilbara IBRA Region Extent



7.2.2.9 Conclusion

To address potential impacts on the conservation-significant Greater Bilby, a comprehensive CSSMP has been developed, outlining targeted mitigation measures.

The Proposed Action is not anticipated to impact a current population, nor to interfere with the recovery of the Greater Bilby in the Pilbara bioregion. The definition of critical habitat for the Greater Bilby is broad, in that it includes all habitats in which it is recorded. The Proposed Action requires the clearing of 5,759 ha of critical habitat which equates to 0.16% of Greater Bilby habitat within the Pilbara IBRA region. With mitigation measures in place, a decline in the significant population is not expected, nor is fragmentation of its habitat.

Northern Star acknowledges that the clearing of Spinifex Sandplain and Sandplain Drainage habitats within the Development Envelope will result in a loss of habitat considered critical to the survival of the species and as such proposes the following Environmental Outcomes:

- Avoid, or otherwise minimise direct and indirect impacts from the Proposed Action upon the Greater Bilby habitat within the Development Envelope.
- Northern Star shall clear no more than5,759 ha of sandplain habitats (Spinifex Sandplain and Sandplain Drainage) within the Development Envelope.

The residual significant impact, after implementation of the mitigation hierarchy, is clearing of up to 5,759 ha of sandplain habitats (Spinifex Sandplain and Sandplain Drainage) within the Development Envelope. Environmental offsets are proposed for this clearing and are discussed in Section 9.

7.2.3 Grey Falcon (*Falco hypoleucos*)

The Proposed Action is not anticipated to have a significant impact on the Grey Falcon. The low impact clearing of the Turner River for mine surplus water discharge will avoid, where possible, the removal of tall trees suitable for nesting and is not anticipated to impact the overall habitat quality or result in a population decline. The remaining habitats of the Development Envelope have been assessed as not critical habitat for the Grey Falcon.

Northern Star will limit the clearing of Major River habitat within the Development Envelope to a maximum of 10 ha. Additionally, measures will take place to avoid or minimise any adverse effects on Grey Falcon including the avoidance of large breeding trees, where possible, within Major River habitat.

7.2.3.1 Overview

The Grey Falcon is listed as Vulnerable under the EPBC Act due to low density populations affected by degradation of habitat. The species is currently thought to number fewer than 1,000 breeding pairs across arid and semi-arid inland Australia including the Murray-Darling Basin, Eyre Basin, central Australia and Western Australia (TSSC, 2020).

Whilst breeding, the Grey Falcon feeds predominantly on small birds with the occasional small mammal and reptile also preyed upon. Breeding occurs from June to November with clutches (usually one to four eggs) laid in old nests of other birds often in the tallest trees along watercourses. It is typical for the young to stay with their parents for at least up to 12 months after fledging, even when the parents are caring for a new brood (TSSC, 2020).

7.2.3.2 Relevant Policy and Guidance

Relevant Commonwealth policy and guidance for the Grey Falcon which have informed studies, planning and development of the Proposed Action, are summarised in Table 7-9.

Table 7-9: Relevant Commonwealth Policy and Guidance for the Grey Falcon

Author	Year of Publication	Policy/ Guidance
CoA	2013	EPBC Act Significant Impact Guideline 1.1.

Author	Year of Publication	Policy/ Guidance
	2010	Survey guidelines for Australia's threatened birds: Guidelines for detecting birds listed as threatened under the EPBC Act.
	2020	Conservation Advice *Falco hypoleucos* Grey Falcon.

7.2.3.3 Habitat

The Grey Falcon can cross a large portion of arid and semi-arid Australia, with its distribution centred on inland drainages. It forages over timbered plains, including *Acacia* shrublands, also ranging out onto treeless plains. The Grey Falcon nests in tall trees on watercourses and occasionally on man-made structures such as transmission line towers.

Habitat critical to the survival of the species is not defined in the conservation advice. However given the small size of the population, any local occurrence is likely to be important and Western Wildlife consider the Major River habitat critical.

7.2.3.4 Threats

The Conservation Advice for *Falco hypoleucos* (Grey Falcon) (TSSC, 2020) acknowledges an absence of relevant studies and provides the following extrapolated and speculative, but nonetheless plausible threats to the Grey Falcon. Lowest priority threats have been excluded, as they are not considered relevant to the Proposed Action. Threats to the Grey Falcon include:

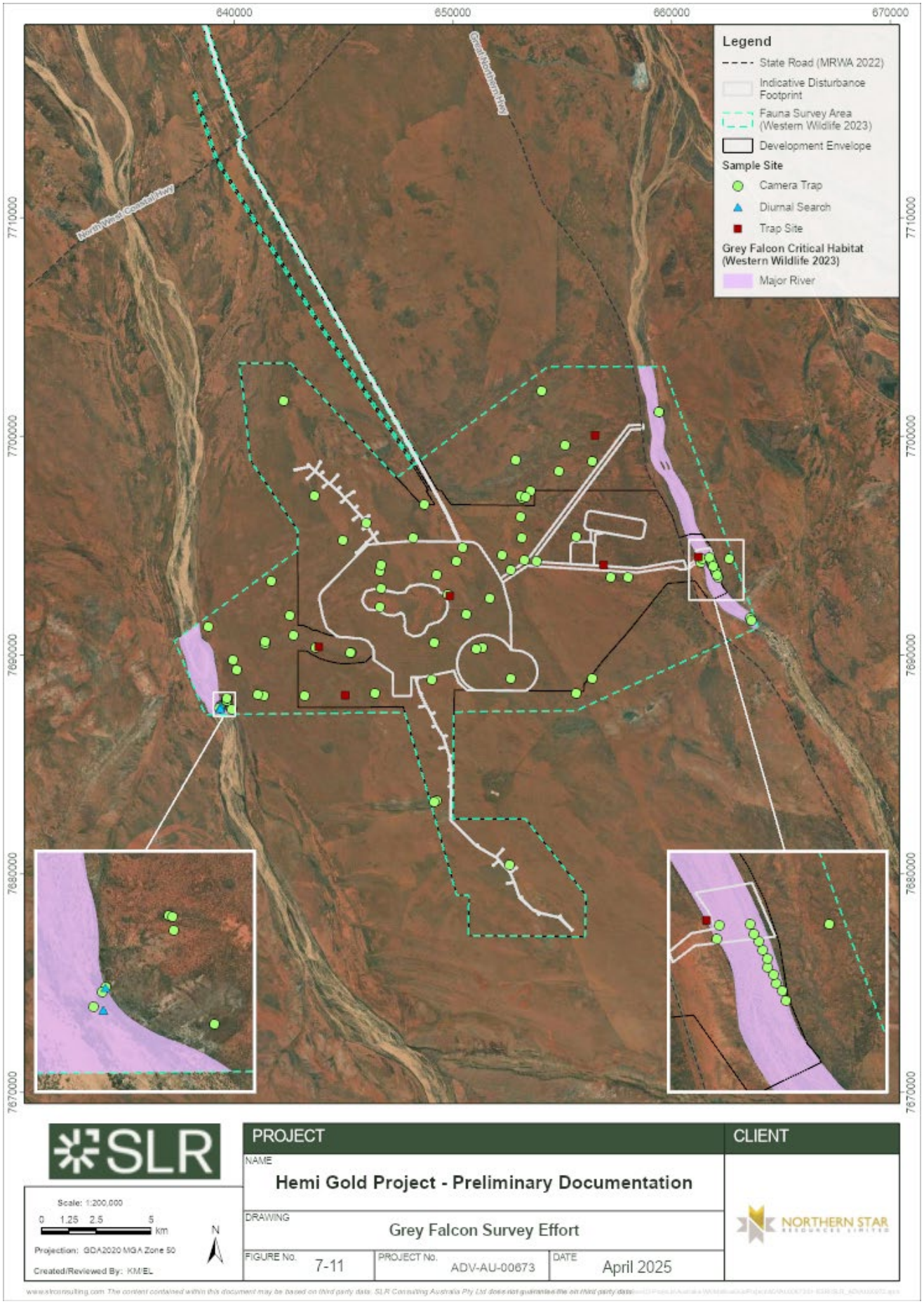
- Very High Priority (immediate mitigative action required):
  - Predation by cats
  - Climate change leading to increased temperatures in arid and semi-arid Australia.
  - Habitat loss and fragmentation due to grazing by exotic herbivores.
- High Priority (mitigative action adaptive management plan required):
  - Susceptibility to demographic and genetic stochastic events due to the small population size.
  - Nest shortage due to land clearing and overgrazing of arid zone rangelands.
- Moderate Priority (information gathering, develop mitigative action if required):
  - Disturbance from bird watchers and photographers which impacts breeding success.
  - Vehicle strike.
  - Collision with fences and powerlines.

7.2.3.5 Surveys

The Detailed Vertebrate Fauna Survey undertaken by Western Wildlife was consistent with the recommended survey guidelines for Threatened Birds (DEWHA, 2010b). Bird surveys were undertaken at each trapping site to give a total of six 20-minute surveys resulting in 72 surveys or 24 hours of survey across the two phases. Surveys were within 300 m of the trapping site and were undertaken concurrently with morning trap checks, between sunrise and approximately 9 AM. Birds were recorded if seen or heard during the surveys and also recorded opportunistically throughout the study area (Western Wildlife, 2023).

The survey effort across the Development Envelope for the Grey Falcon is provided in Figure 7-11.

Figure 7-11: Grey Falcon Survey Effort



7.2.3.6 Local Population

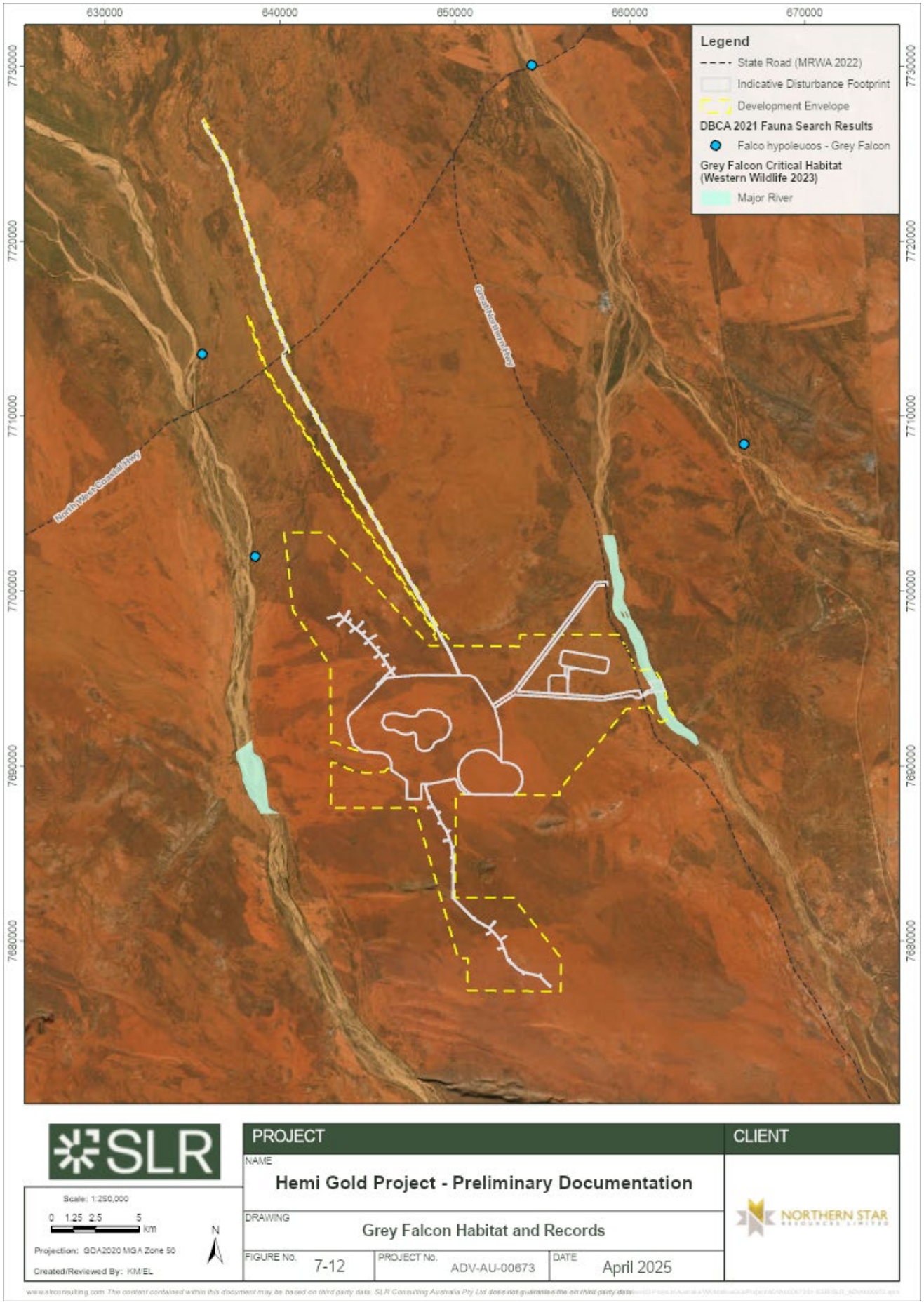
A search of the EPBC Protected Matters Search Tool recorded the Grey Falcon as likely to be present within the 50 km buffer and the WA DBCA's Threatened and Priority Fauna database has 10 records of Grey Falcon within 20 km of the study area. Western Wildlife identified one critical habitat type across the study area, with details provided in Table 7-10 and shown in Figure 7-12. Disturbances in Major River habitats are limited to clearing for the dewatering pipeline and outfall where tall trees that serve as potential breeding sites will be avoided, where possible.

Table 7-10: Critical Grey Falcon Habitat Areas

Critical Habitat	Mapped Survey Area (ha)	Area inside Development Envelope (ha)	Area inside Indicative Disturbance Footprint (ha)
Major River	1,231.9	181.2	10
Total	1,231.9	181.2	10

The Grey Falcon was not recorded during terrestrial fauna surveys (Western Wildlife, 2023), however it is considered likely to occur due to nearby records. The Grey Falcon may breed along the Major River habitat within the Development Envelope of the Proposed Action with larger trees potentially providing nesting habitat. Individuals may be a foraging visitor to open habitats such as Sandplain Spinifex and Sandplain Drainage habitats; however none have been sighted during bird surveys.

Figure 7-12: Grey Falcon Habitat and Records



7.2.3.7 Potential Impacts and Management

The potential impacts, as outlined in the Conservation Advice (2020), to the Grey Falcon from the Proposed Action and the management measures Northern Star propose to implement are presented in Table 7-11.

Table 7-11: Grey Falcon Potential Impacts and Management Measures

Potential Impact	Extent or Likelihood	Management Measures
Predation by Feral Cats.	Unlikely	Existing populations of feral fauna will be managed by: • Implementing best practice waste management measures. • Limiting the creation of permanent water bodies. • Fencing of artificial water sources where practicable and the putrescible landfill. • Monitoring and control measures as required. • Personnel feeding of feral fauna is prohibited. • Pets on site are prohibited
Climate change leading to increased temperatures in arid and semi-arid Australia.	No	Greenhouse gas emissions will be managed through: • Implementation of a greenhouse gas reduction strategy approved through a Greenhouse Gas Management Plan. • Greenhouse gas reductions strategies will be regulated under Part IV of the EP Act (WA) and Safeguard Mechanism (Cth).
Nest shortage due to land clearing and overgrazing of arid zone rangelands.	10 ha	• Limited clearing of Major River habitat required for the Proposed Action for the surplus mine dewatering outfall to 10 ha. • All large trees will be avoided within the Major River habitat, where possible. • An internal ground disturbance permitting system has been developed to prevent clearing outside of permitted areas.
Disturbance from bird watchers and photographers which impacts breeding success.	Unlikely	• Non-project personnel are excluded from the mining operation. • All visitors must complete an induction or be escorted by inducted personnel while on site.
Collision with fences and powerlines.	Unlikely	Northern Star will manage the potential impacts of fencing for the Proposed Action by: • Limiting use of fencing to the amount required. • Limiting extent of power corridor to minimum required.
Accidental vehicle strike	Unlikely	The potential for collision with mine vehicles will be reduced by: • Implement speed limits of 80 and 60 km/h on sealed and unsealed roads for mine vehicles within the Development Envelope. • Mine vehicles will be required to stay on existing roads and tracks. • Personnel hooning and misadventure will be prohibited. • Sightings and incidents will be reported. • Personnel will be educated on conservation significant fauna.

7.2.3.8 Significance Test

An assessment of the proposed action against the significance criteria for Vulnerable species in the Significant Impact Guidelines is presented in Table 7-12. No significant impact on the Grey Falcon is anticipated by the Proposed Action.

Table 7-12: Significant Impact Assessment for Grey Falcon

Significance Impact Criteria	Determination of Significance
Will the Project lead to a long-term decrease in the size of an important population of a species?	**Unlikely**. Grey Falcons are sparsely distributed and may occur occasionally in the Development Envelope with no nesting sites identified during field surveys. Although no sightings of individuals or identification of breeding nests have been made within the Development Envelope, records are known to exist along the Yule and Turner Rivers. Up to 10 ha of Major River habitat is proposed to be cleared for access tracks and mine surplus dewatering discharge outfall with all large trees suitable for nesting by Grey Falcons avoided, where possible. The Proposed Action will have no impact to the Yule River. It is unlikely that with the implementation of management measures by Northern Star, the Proposed Action will lead to a long-term decrease in the size of an important population of Grey Falcon.
Will the Project reduce the area of occupancy of an important population?	**Unlikely**. Grey Falcons are sparsely distributed and may occur occasionally in the Development Envelope. The Proposed Action will have no impact to the Yule River which extends beyond the vertebrate fauna study area and is approximately 250 km in length. Up to 10 ha of Major River habitat is proposed to be cleared for access tracks and mine surplus dewatering discharge outfall with all large trees suitable for nesting by Grey Falcons avoided. Major River habitat extends beyond the Development Envelope along the Turner River, which is approximately 220 km in length. The Proposed Action is unlikely to reduce the area of occupancy of an important population.
Will the Project fragment an existing important population into two or more populations?	**Unlikely**. Only 10 ha of Major River habitat is proposed to be cleared for access tracks and mine surplus dewatering discharge outfall with all large trees suitable for nesting by Grey Falcons avoided, where possible. Any disturbance is easily avoided by Grey Falcon, and it is unlikely the Proposed Action will fragment an important population into two or more populations.
Will the Project adversely affect habitat critical to the survival of a species?	**Unlikely**. Habitat assessed as critical to the survival of the Grey Falcon by Western Wildlife, is limited to the Major River habitat. Up to 10 ha of Major River habitat is proposed to be cleared for access tracks and mine surplus dewatering discharge outfall with all large trees suitable for nesting by Grey Falcons avoided. The Turner River extends outside of the Development Envelope and is approximately 220 km in length.
Will the Project disrupt the breeding cycle of an important population?	**Unlikely**. Grey Falcons typically nest in the tallest trees along watercourses (TSSC, 2020), which will be avoided during clearing activities for the Proposed Action. Grey Falcons breed once a year, however depending on climatic conditions, are known to either breed twice in a year (during abundant seasons) or not nest at all (times of drought). Records of Grey Falcons extend along both the Yule (250 km long) and Turner (220 km long) Rivers, all outside of the Development Envelope and will not be impacted by the Proposed Action. It is therefore unlikely that the Proposed Action will disrupt the breeding cycle of the Grey Falcon.
Will the Project modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	**Unlikely**. Up to 10 ha of Major River habitat is proposed to be cleared for access tracks and mine surplus dewatering discharge outfall with all large trees suitable for nesting by Grey Falcons avoided.
Will the Project result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat?	**Unlikely**. Predation by cats is a high priority threat listed in the Conservation Advice for the Grey Falcon. Northern Star will implement a feral cat and fox monitoring program and implement control measures when required across the Development Envelope to protect all MNES from being indirectly or directly impacted from the Proposed Action.

Significance Impact Criteria	Determination of Significance
	Measures include implementing best practice waste management measures, limiting the creation of artificial water sources and prohibiting onsite personnel from feeding fauna species.
Will the Project introduce disease that may cause the species to decline?	**No**. Disease is not listed as a threatening process to the Grey Falcon. The Proposed Action will not introduce disease to the Grey Falcon population with handling of individuals, collection of eggs and investigation of potential nesting sites prohibited for all employees, contractors and visitors.
Will the Project interfere substantially with the recovery of the species?	**Unlikely**. Grey Falcons occur in low abundance across semi-arid and arid regions of Australia nesting in tall trees along watercourses. Up to 10 ha of Major River habitat is proposed to be cleared for access tracks and mine surplus dewatering discharge outfall with all large trees suitable for nesting by Grey Falcons avoided.

7.2.3.9 Conclusion

The Proposed Action is not anticipated to have a significant impact on the Grey Falcon. The proposed clearing of the Major River habitat of the Turner River for mine surplus water discharge will avoid the removal of tall trees suitable for nesting, where possible, and is not anticipated to impact the overall habitat quality or result in a population decline. The remaining habitats of the Development Envelope have been assessed as not critical habitat for the Grey Falcon. Therefore, avoiding any additional impacts for proposed activities.

Environmental outcomes committed to by Northern Star for the Northern Quoll also apply to the Grey Falcon being:

- Upper clearing limit of 10 ha of Major River habitat along the Turner River.
- Avoidance of removal of tall trees suitable for nesting, where possible.

7.2.4 Night Parrot (*Pezoporus occidentalis*)

It is not anticipated the Proposed Action will have a significant impact on the Night Parrot. Sandplain Drainage and Sandplain Spinifex have been identified as potential habitats across the Development Envelope however surveys did not record mature large clumps of spinifex suitable for nesting and roosting. These habitats extend across the Pilbara IBRA region with an estimated total area of 14,054,517 ha. Of this, 21,839.2 ha (0.16%) occurs within the Development Envelope, and 5,758 ha (0.04%) occurs within the indicative disturbance footprint.

Pre-clearance surveys designed for the Greater Bilby will be conducted across the Spinifex Sandplain and Sandplain Drainage habitats and are likely to flush roosting Night Parrot if located within the indicative disturbance footprint.

7.2.4.1 Overview

The Night Parrot is listed as Endangered under the EPBC Act due to the severe decline in population following European settlement (DCCEEW, 2018). The species was presumed extinct until 2013, when a population was discovered in southwest Queensland. Since 2013, there have been two confirmed sightings in Western Australia with promising potential records from two to three other locations. Despite increased research and monitoring of the species, it still remains highly elusive and poorly understood.

The ecology of the Night Parrot is largely unknown with conclusions variable across few observations made. There are indications that access to water may not be required in all circumstances with some researchers stating the species does not rely on surface water, however drinking has been recorded. Individuals tend to roost in clumps of mature spinifex by day and forage for food at night producing one to two chicks each year (TSSC, 2016b).

7.2.4.2 Relevant Policy and Guidance

Relevant Commonwealth policy and guidance for the Night Parrot, which have informed studies, planning and development of the Proposed Action, are summarised in Table 7-13.

Table 7-13: Relevant Commonwealth Policy and Guidance for the Night Parrot

Author	Year of Publication	Policy/ Guidance
CoA	2013	EPBC Act Significant Impact Guideline 1.1.
The Night Parrot Recovery Team	No date	Looking & Listening for Night Parrots
Department of Parks and Wildlife (DPAW)	2017	Interim guideline for preliminary surveys of night parrot (*Pezoporus occidentalis)* in Western Australia
Threatened Species Scientific Committee (TSSC)	2016	The Approved Conservation Advice *Pezoporus occidentalis*, Night Parrot

7.2.4.3 Habitat

Historically, the Night Parrot was recorded across a large range in Australia's arid and semi-arid interior. The key habitats for the Night Parrot are thought to be chenopod shrublands and Spinifex grasslands, with the chenopod shrublands a refuge during dry conditions (Garnett et al., 2011). Nesting sites are in mature Spinifex, often large ring-forming clumps, usually in *Triodia longiceps* (DPAW, 2017) and other species. Foraging habitats are likely to vary across Australia but include herbs, grasses, grass-like plants, *Sclerolaena* spp. and other chenopods (DPAW, 2017).

It should be noted that critical habitat is not defined in the conservation advice (TSSC, 2016b) or SPRAT Profile (DCCEEW, 2022) for the Night Parrot.

The Spinifex Sandplain and Sandplain Drainage habitats provide potential breeding and roosting habitat within the study area (patches of mature spinifex); however Western Wildlife considered it unlikely Night Parrot would be present as contemporary Western Australian records of this species have been associated with salt lakes and marshes. In addition, the landscape has been subjected to numerous fires causing a reduction in suitably sized spinifex, a requirement for roosting by Night Parrot.

7.2.4.4 Threats

The 'Conservation Advice *Pezoporus occidentalis*, Night Parrot' (TSSC, 2016b) acknowledges that with very little detail about the species, threats are also assumed and are likely to vary across their range (TSSC, 2016b). Threats based on available evidence include:

- Predation by feral cats and foxes.
- Soil disturbance, erosion and subsequent loss of habitat caused by feral herbivores and livestock.
- Degradation of habitat around water points by livestock and feral herbivores.
- Competition for food by livestock or feral herbivores.
- Changes to fire regimes and extent which reduce areas of long-unburnt dense vegetation, seemingly favoured as habitat.
- Infection with psittacine beak and feather disease, Avian pox, and other diseases.
- Illegal collection of birds or eggs (wildlife trafficking).
- Disturbance by bird-watching activities.
- Fences: the species tends to fly low over the ground, increasing the risk of collision.
- Reduction in water availability through over-use of waterholes by camels.

- Reduction in water availability through reduced waterhole maintenance by Aboriginal people.

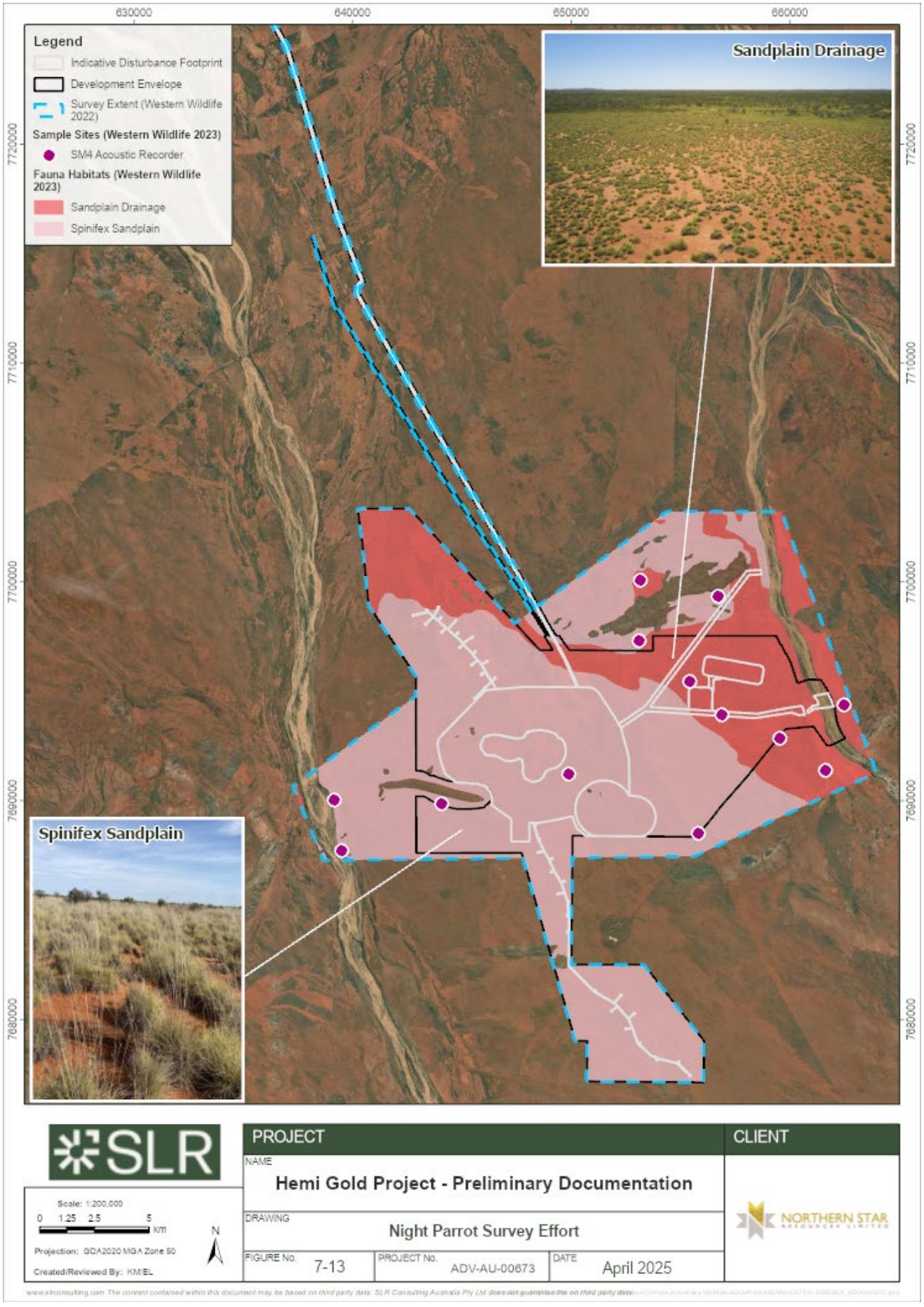
7.2.4.5 Surveys

The timing and adequacy of the Detailed Vertebrate Fauna Survey undertaken by Western Wildlife was consistent with that recommended in the relevant guidelines for the Night Parrot. The targeted survey in March 2022 occurred after summer rainfall and included the use of Songmeter 4 (SM4) passive acoustic detectors in potentially suitable habitat (Sandplain Drainage and Spinifex Sandplain), as identified by Western Wildlife during field surveys, across the Development Envelope (Figure 7-13).

Each SM4 was set to record between dusk and dawn each night for six nights, across 13 sites giving 78 recording nights in total. The data collected by the SM4s was analysed by Adaptive NRM for the presence of Night Parrot calls. The survey effort is provided in Figure 7-13.

The survey also considered the size and distribution of the spinifex across the Development Envelope. The site lacks the presence of large, mature spinifex due to regular occurrence of fire and lack of salt lakes and marshes associated with known records of Night Parrot in Western Australia.

Figure 7-13: Night Parrot Survey Effort



7.2.4.6 Local Population

A search of the EPBC Protected Matters Search Tool listed that Night Parrot may be present within the 50 km buffer. There are very few verified records of Night Parrot across Australia, with the species thought to be extinct until 2013. Western Australia records are from six sites, including Lake Gregory, a site near Wiluna and near the Fortescue Marsh in the Pilbara (Davis & Metcalf, 2008; Garnett & Baker, 2021; NPRT, n.d.). Over the last few years, sampling with passive acoustic detectors has failed to find any further birds, and no more than 30 individual Night Parrots have been detected from 2013 – 2020 (Garnett & Baker, 2021).

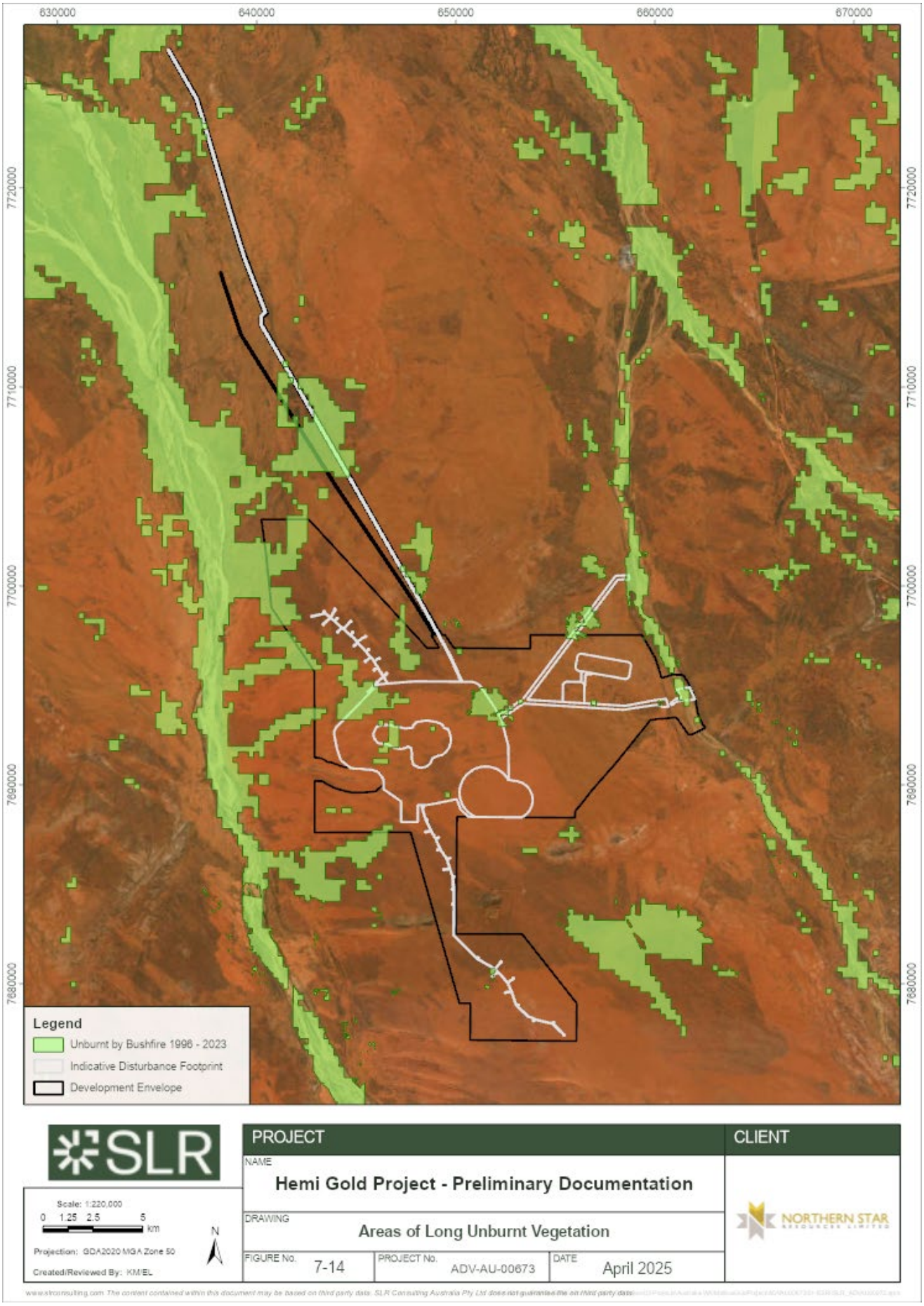
Knowledge about the Night Parrot's current distribution and habitat requirements in Western Australia is based on very few records. Therefore, there is considerable uncertainty when assessing the likelihood of occurrence of this species. Fauna surveys by Western Wildlife included a targeted Night Parrot survey using 12 passive acoustic detectors deployed across the survey area which did not detect the Night Parrot in the Development Envelope (Western Wildlife, 2023).

Triodia is slow to recover biomass after fire and usually take several consecutive fire-free years before they are able to set seed (Murphy, 2012). An assessment of fire scar mapping has been undertaken across the Development Envelope as shown in Figure 7-14 and detailed in Table 7-14.

Table 7-14: Details of Fire Across Development Envelope

Years	Area within 20 km Buffer of Development Envelope (ha)	Area within Development Envelope (ha)
2001-2005	105,162	5,513
2006-2010	174,568	9,409
2011-2015	174,956	14,401
2016-2020	85,628	1,759
2021-2023	112,082	8,896

Figure 7-14: Areas of Long Unburnt Vegetation



7.2.4.7 Potential Impacts and Management

The potential impacts on the Night Parrot and the management measures Northern Star will implement are presented in Table 7-15.

Table 7-15: Night Parrot Potential Impacts and Management Measures

Potential Impact	Extent or Likelihood	Management and Mitigation Measures
Death or injury of individuals caused by vehicle movements	Unlikely	• Enforce strict traffic management rules for mine vehicles. • Implement speed limits of 80 and 60 km/h on sealed and unsealed roads for mine vehicles within the Development Envelope. • Mine vehicles will be required to stay on existing roads and tracks. • Personnel hooning and misadventure will be prohibited. • Sightings and incidents will be reported. • Personnel will be educated on conservation significant fauna.
Clearing habitat	5,758 ha	• Pre-clearance surveys for the Greater Bilby are likely to detect any Night Parrots during the process. • Clearing of no more than 5,830 ha within the Development Envelope. • Clearing of no more than 5,100 ha of Spinifex Sandplain within the Development Envelope. • Clearing of no more than 800 ha of Sandplain Drainage within the Development Envelope. • Use of previously disturbed areas to the extent possible.
Habitat degradation due to overgrazing	Not Applicable	Proposed Action does not include grazing by animals; therefore, this is not applicable.
Habitat loss due to fire	Unlikely	The Proposed Action is unlikely to change the existing fire regime in the Development Envelope. Potential impacts to the fire regime will be managed by: • Employee, contractor and visitor site inductions. • Effective maintenance of mine vehicles. • No unauthorised off-road driving of mine vehicles. • Installation of firebreaks around critical infrastructure. • Any controlled burns would be conducted in consultation with the DBCA. • Hot works being conducted within designated, specially designed workshops or with the controls required by the Hot Work Permit system. • All mine vehicles fitted with firefighting equipment.
Collision with fences	Unlikely	Northern Star notes that the Proposed Action is located on an active Pastoral Lease where barbed wire fencing is already in use. Northern Star will manage the potential impacts of fencing for the Proposed Action by: • Minimising fencing to the amount required. • Not using barbed wire fencing where practicable. • If barbed wire fencing is required (due to legislative, safety or pastoral requirements) the top strands will be plain wire, and 10 cm disc bat reflectors will be used. • Inspection of areas requiring barbed wire fencing due to legislative, safety or pastoral requirements. • Reporting of all fauna related incidents.
Predation by feral animals	Unlikely	Existing populations of feral fauna will be managed by: • Implementing best practice waste management measures.

Potential Impact	Extent or Likelihood	Management and Mitigation Measures
		• Limiting the creation of permanent water bodies. • Fencing artificial water bodies where possible and any putrescible landfills. • Monitoring and control measures as required. • Personnel feeding of feral fauna is prohibited. • Prohibit pets on site.

7.2.4.8 Significance Test

An assessment of the Proposed Action against the significance criteria for Vulnerable species in the 'Significant Impact Guidelines 1.1' (DoE, 2013) is presented in Table 7-16.

Table 7-16: Significant Impact Assessment for Night Parrot

Significance Impact Criteria	Determination of Significance
Will the Project lead to a long-term decrease in the size of a population?	**Unlikely**. The surveys completed across the Development did not record the presence of the species through sightings or passive acoustic recordings. Although spinifex is widespread across the Development Envelope, large areas have been burnt regularly limiting the areas of mature large spinifex to isolated locations. It is unlikely that the Proposed Action will lead to a long-term decrease in the size of the population.
Will the Project reduce the area of occupancy of the species?	**Unlikely**. Night Parrot has not been recorded across the Development Envelope although habitat deemed suitable is present, large mature spinifex is largely absent. Therefore, it is unlikely that the area is occupied by the species. The fauna habitat types of Sandplain Drainage and Sandplain Spinifex extend across the Pilbara IBRA region with an estimated total area of 14,054,517 ha. Of this, 21,839.2 ha (0.16%) occurs within the Development Envelope, and 5,759 ha (0.04%) occurs within the indicative disturbance footprint. It is unlikely that the Proposed Action will reduce the area of occupancy of the species.
Will the Project fragment an existing important population into two or more populations?	**Unlikely**. There are very few verified records of Night Parrot across Western Australia including Lake Gregory (near Wiluna) and Fortescue Marsh (approximately 125 km from the Proposed Action). Surveys have not recorded the Night Parrot within the Development Envelope, and there is no evidence that Spinifex within this area is utilised by the species. Therefore, it is unlikely that the Proposed Action will fragment an existing population into two or more populations.
Will the Project adversely affect habitat critical to the survival of a species?	**Unlikely**. While mature spinifex is present in the Development Envelope, regular fires limit the growth of clumps of individual plants, with only small, isolated patches remaining. Night Parrot records within Western Australia are associated with salt marshes and salt lakes, thought to provide succulent species for foraging. The Development Envelope and surrounding area lacks any salt lake or marsh habitat. Due to the lack of mature spinifex clumps and associated salt lakes and marshes it is unlikely that the Proposed Action will adversely affect habitat critical to the survival of the Night Parrot.
Will the Project disrupt the breeding cycle of an important population?	**Unlikely**. Night Parrot breeding can occur at any time of year following large rainfall events. Large mature spinifex is required for roosting, protecting eggs and young chicks from predators and unfavourable climatic events. With the absence of Night Parrot recordings from surveys, and lack of large mature spinifex, it is unlikely the Proposed Action will disrupt the breeding cycle of an important population.

Significance Impact Criteria	Determination of Significance
Will the Project modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	**Unlikely**. The surveys completed across the Development Envelope did not record the presence of the species through sightings or passive acoustic recordings. Although spinifex is widespread across the Development Envelope, large areas have been burnt regularly limiting the areas of mature large spinifex to isolated locations Large clumps of spinifex suitable for nesting are present in small, isolated patches in the Development Envelope. Sandplain Drainage and Sandplain Spinifex extend across the Pilbara IBRA region with an estimated total area of 14,054,517 ha. Of this, 21,839.2 ha (0.16%) occurs within the Development Envelope, and 5,758 ha (0.04%) occurs within the indicative disturbance footprint. There have been no recordings of Night Parrot from surveys across the Development Envelope, however pre-clearance surveys undertaken prior to disturbance for the Proposed Action will provide additional survey work for the species. The Proposed Action is unlikely to decrease habitat availability or quality to the extent that a decline in the species will occur.
Will the Project result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat?	**Unlikely**. Northern Star will implement a feral cat and fox monitoring program and implement control measures when required. Northern Star will implement a feral cat and fox monitoring program and implement control measures when required across the Development Envelope to protect all MNES from being indirectly or directly impacted from the Proposed Action. Measures include implementing best practice waste management measures, limiting the creation of artificial water sources and prohibiting onsite personnel from feeding fauna species.
Will the Project introduce disease that may cause the species to decline?	**No**. The Proposed Action will not introduce bird diseases to the Development Envelope with handling of individuals, collection of eggs and investigation of potential nesting sites prohibited for all employees, contractors and visitors.
Will the Project interfere with the recovery of the species?	**Unlikely**. The surveys completed across the Development Envelope did not record the presence of the species through sightings or passive acoustic recordings. Although spinifex is widespread across the Development Envelope, large areas have been burnt regularly limiting the areas of mature large spinifex to isolated locations. Large clumps of spinifex suitable for nesting are present in small, isolated patches in the Development Envelope. Sandplain Drainage and Sandplain Spinifex extend across the Pilbara IBRA region with an estimated total area of 14,054,517 ha. Of this, 21,839.2 ha (0.16%) occurs within the Development Envelope, and 5,758 ha (0.04%) occurs within the indicative disturbance footprint.

7.2.4.9 Conclusion

Night Parrots are unlikely to be present in the Development Envelope due to large clumps of spinifex suitable for nesting present in only small, isolated patches across the Development Envelope. Sandplain Drainage and Sandplain Spinifex extend across the Pilbara IBRA region with an estimated total area of 14,054,517 ha. Of this, 21,839.2 ha (0.16%) occurs within the Development Envelope, and 5,758 ha (0.04%) occurs within the indicative disturbance footprint.

Pre-clearance surveys designed for the Greater Bilby will be conducted across the Spinifex Sandplain and Sandplain Drainage habitats and are likely to flush roosting Night Parrot if located within the indicative disturbance footprint.

7.2.5 Northern Quoll (*Dasyurus hallucatus*)

The Proposed Action is not anticipated to have a significant impact on Northern Quoll. Northern Star however acknowledges that the clearing of Major River habitat within the Development Envelope will result in a loss of habitat considered critical to the survival of the species and as such proposes the following Environmental Outcomes:

- Avoid, or otherwise minimise direct and indirect impacts from the Proposed Action upon Northern Quoll habitat within the Development Envelope.
- An upper clearing limit of 10 ha of Major River habitat within the Development Envelope.

Management and mitigation measures are discussed in detail in the CSSMP provided as Appendix 2 with proposed environmental offsets discussed in Section 9.

7.2.5.1 Overview

The Northern Quoll is listed as Endangered under the EPBC Act with an estimated population size reduction of 50% over the last decade. The Northern Quoll occurs across northern Australia occurring as several disjunct populations in Queensland, Northern Territory and Western Australia (Western Wildlife, 2023). Recent studies have shown the Northern Quoll forms two subpopulations in the Pilbara with a great deal of mixing, indicating the species has a large capacity for dispersal.

The Northern Quoll is a nocturnal, carnivorous marsupial and the smallest of Australia's four quoll species (three of which are listed as Threatened under the EPBC Act). The Northern Quoll have an average of seven young per breeding season, however both males and females have a very short life span. Females generally only survive for one or two breeding seasons, while males have a near-complete annual die-off due to the intense physical effort during breeding season (DoE, 2016a).

7.2.5.2 Relevant Policy and Guidance

Relevant Commonwealth policy and guidance for the Northern Quoll, which have informed studies, planning and development of the Proposed Action are summarised in Table 7-17.

Table 7-17: Relevant Policy and Guidance for the Northern Quoll

Author	Year of Publication	Policy/ Guidance
CoA	2013	EPBC Act Significant Impact Guideline 1.1.
	2005	Commonwealth Listing Advice on Northern Quoll (*Dasyurus hallucatus*)
	2011	Survey guidelines for Australia's threatened mammals: Guidelines for detecting mammals listed as threatened under the EPBC Act
	2016	EPBC Act Referral Guideline for the Endangered Northern Quoll *Dasyurus hallucatus*: EPBC Act Policy Statement
Hill and Ward	2010	National Recovery Plan for the Northern Quoll, *Dasyurus hallucatus*
EPA	2020	Terrestrial Vertebrate Fauna Surveys Technical Guidelines

7.2.5.3 Habitat

The Northern Quoll occurs in various habitats across its range, with the Pilbara populations favouring dissected rocky escarpments. Habitat described as critical to the survival of Northern Quoll includes:

- Offshore islands where the Northern Quoll is known to exist.
- Rocky habitats such as ranges, escarpment, mesas, gorges, breakaways, boulder fields, major drainage lines or treed creek lines.

- Structurally diverse woodland or forest areas containing large diameter trees, termite mounds or hollow logs.
- Dispersal and foraging habitat associated with or connecting populations important to the long-term survival of the Northern Quoll.

Little is known about Northern Quoll foraging and dispersal habitats; however, the EPBC Act referral guidelines recognise that all native vegetation within 1 km of shelter habitat or Northern Quoll records may be considered foraging and dispersal habitat (DoE, 2016).

7.2.5.4 Threats

The National Recovery Plan for the Northern Quoll (*Dasyurus hallucatus*) (Hill & Ward, 2010) lists the following threats to the Northern Quoll:

- Cane Toads.
- Feral predators through competition for food or direct predation (cats and foxes).
- Inappropriate fire regimes changing habitat structure and floristics.
- Habitat degradation by trampling and grazing by large herbivores.
- Habitat destruction for development of mining, housing and/or agriculture.
- Introduction and spread of weeds.
- Spread of disease.

7.2.5.5 Surveys

The timing and adequacy of the Detailed Vertebrate Fauna Survey undertaken by Western Wildlife were consistent with that recommended in the Technical Guidelines (EPA, 2020). The Western Wildlife survey included camera trap surveys, transects, and point searches particularly targeting Northern Quoll (*Dasyurus hallucatus*) in preference habitat as shown in Figure 7-15. Stantec also conducted eDNA analysis from the Yule and Turner Rivers (Stantec, 2022).

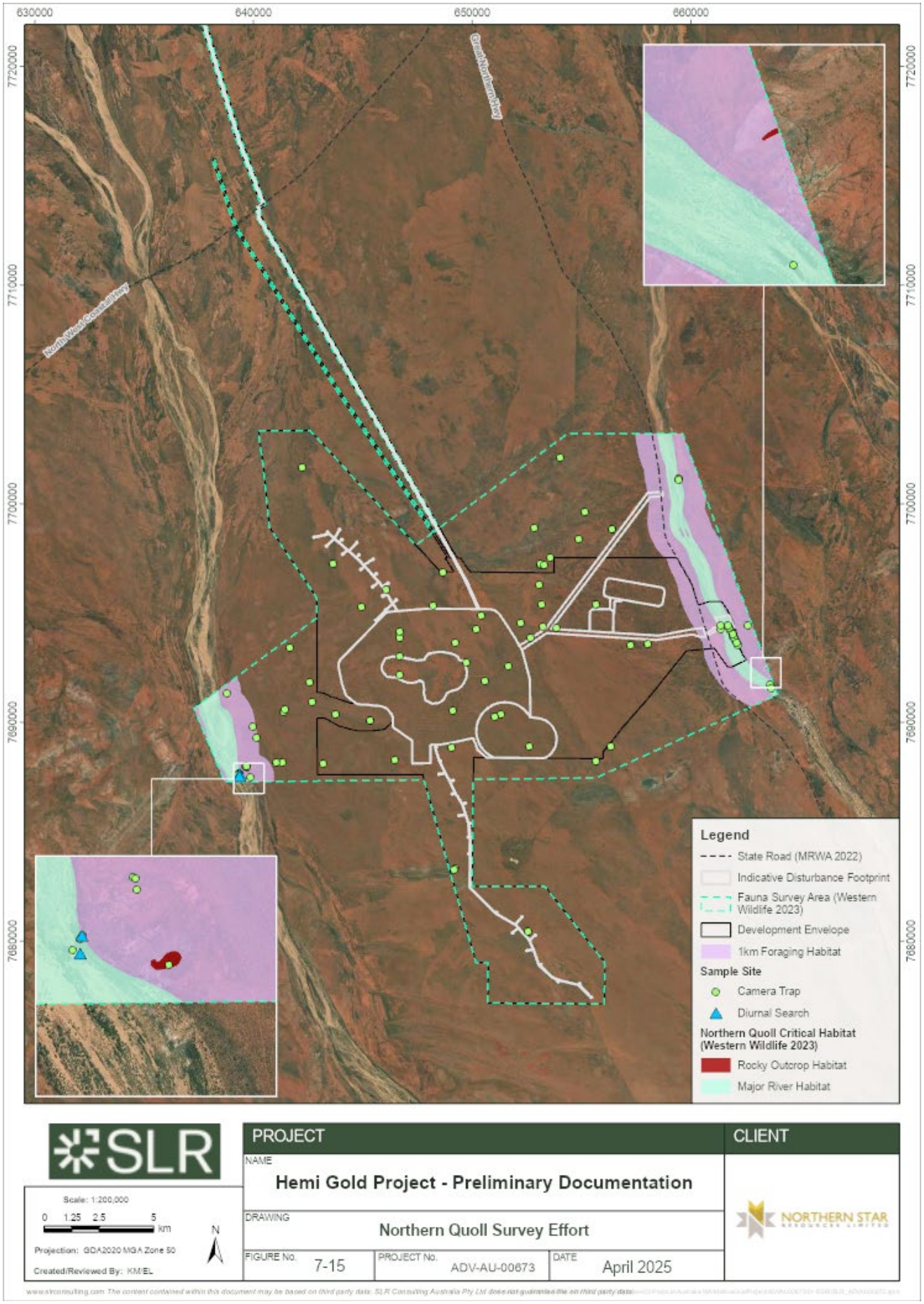
Camera traps were deployed at 36 sites in September 2021 for a total of 180 trap-nights, 31 sites in March 2022 for a total of 221 trap-nights and five sites in August 2022 for a total of 40 trap-nights. Cameras were primarily deployed to target rocky or riverine habitats that may support the Northern Quoll (*Dasyurus hallucatus*). Transects and point searches for fauna were undertaken across the study area to search for scats of the Northern Quoll (*Dasyurus hallucatus*) in rocky habitats and tracks in sandy habitats such as riverbeds.

The Northern Quoll was recorded during targeted fauna surveys by Western Wildlife via records on camera traps in the Yule and Turner Rivers, and through secondary signs (scats and tracks). eDNA analysis at one site on the Yule River and two sites on the Turner River detected the Northern Quoll (Stantec, 2022).

The ERA for the Surplus Water Discharge into the Turner River completed by MBS Environmental (Appendix 25) analysed the potential impacts on the Northern Quoll. The study concluded:

- Predation/consumption of aquatic organisms potentially exposed to naturally occurring elevated Uranium levels a very minor food source for the Northern Quoll.
- Terrestrial plants are unlikely to be exposed to the dewatering discharge water as it will be constrained to a small area of existing river channel unless significant rainfall occurs. Any significant rainfall would have a dilutionary effect decreasing Uranium concentrations to near background levels.
- Transfer of Uranium from food sources to Northern Quoll, a higher trophic organism, is likely to be very low due to the lack of accumulation and losses at each trophic level.

Figure 7-15: Northern Quoll Survey Effort



7.2.5.6 Local Population

A search of the EPBC Protected Matters Search Tool recorded the Northern Quoll within the 50 km buffer. The WA DBCA has been conducting long-term monitoring of a Northern Quoll population located at Indee Station adjacent to the Proposed Action since 2013 (Western Wildlife, 2023). Trapping sites are established by DBCA 1 km east of the Proposed Action at Wingina Ridge and at Red Rock. Western Wildlife concluded the population of Northern Quoll recorded within the Turner River are likely to form part of the population monitored by DBCA due the contiguous habitat extending eastwards from the Development Envelope (Western Wildlife, 2023). This population is classified as part of the DBCA's studied 'Important Population,' signifying its importance for the long-term survival of the Northern Quoll.

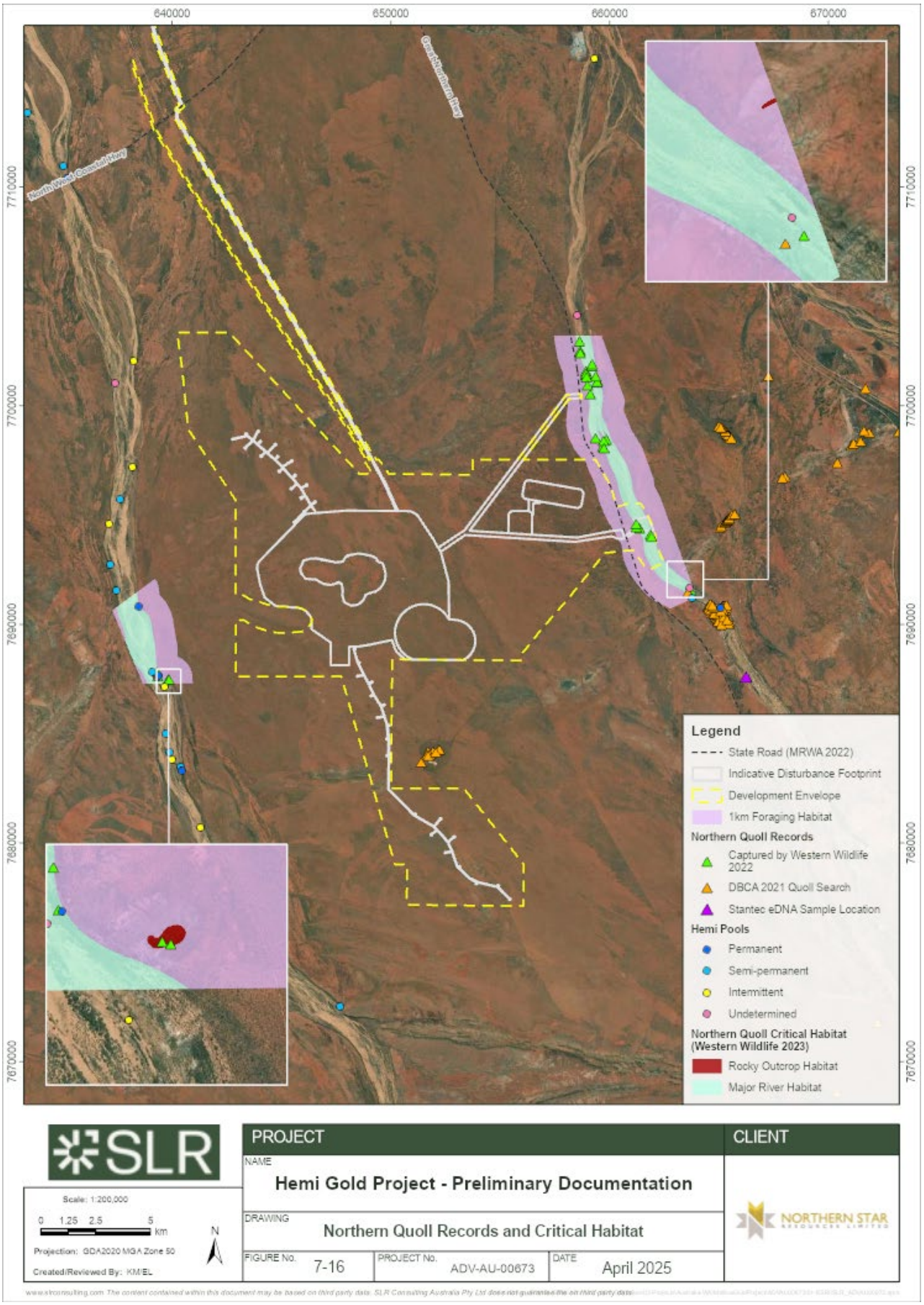
The Major River habitat is likely to be important for foraging and dispersal as it contains tree hollows for shelter the presence of water provides a high productivity foraging environment. Breeding is restricted to Rocky Outcrops only. Foraging and dispersal habitat within 1 km of these areas, including Major River and Rocky Outcrop habitats, is also considered critical. This encompasses Sandplain Drainage, Stony Hills, and Sandplain Drainage.

Western Wildlife survey records and Stantec eDNA records within critical habitats of the survey area are shown in Figure 7-16. Additional information on the impacts to the critical habitats mapped are provided in Table 7-18.

Table 7-18: Critical Northern Quoll Habitat Areas

Critical Habitat	Mapped Survey Area (ha)	Area inside Development Envelope (ha)	Area inside Indicative Disturbance Footprint (ha)
Major River	1,231.9	181.2	10
Rocky Outcrops	1.5	0.0	0.0
Foraging and Dispersal habitat (within 1km of the above)	3,003.3	423.9	40.4
Total	**4,236.7**	**605.1**	**50.4**

Figure 7-16: Northern Quoll Records and Critical Habitat



7.2.5.7 Potential Impacts and Management

The potential impacts for the Northern Quoll from the Proposed Action and the proposed management controls Northern Star will implement are presented in Table 7-19.

Table 7-19: Northern Quoll Potential Impacts and Management

Potential Impacts	Extent or Likelihood	Proposed Management
Disturbances of critical habitat	10 ha of Major River habitat.	• Limiting clearing to as low as reasonably possible during Project design. • Upper clearing limit of 10 ha of Major River habitat within the Development Envelope. • Rocky Outcrop habitat has been excluded from the Development Envelope. • Clearing of Major River habitat associated with the Turner River is limited to the amount required to install surplus mine water dewatering outfall infrastructure. • All large trees will be avoided within the Major River habitat. • Ensuring discharge meets quality criteria in the site environmental licence.
Accidental vehicle strikes.	Unlikely	• Enforce strict traffic management rules for mine vehicles. • Implement speed limits of 60 and 80 km/h on sealed and unsealed roads for mine vehicles within the Development Envelope. • Mine vehicles will be required to stay on existing roads and tracks. • Personnel hooning and misadventure will be prohibited. • Sightings and incidents will be reported. • Personnel will be educated on conservation significant fauna.
Loss or injury of individuals during clearing and general operations.	Unlikely	• Implement educational awareness on the theme among employees and contractors
Introduction and increases of feral fauna species, including cane toads, foxes and cats.	Unlikely	• Implement additional vehicle hygiene measures for vehicles arriving from known cane toad range (Kimberley, Northern Territory). • Fencing of artificial water sources where practicable and any putrescible landfills. • Implementing best practice waste management measures. • Ongoing feral fauna monitoring. • Control measures as required. • Personnel prohibited from feeding of feral fauna. • Prohibit pets on site.
Loss of vegetation structure and composition from introduced herbivores.	Unlikely	• Fencing of artificial water sources to limit access by feral herbivore species. • to the Proposed Action is unlikely to introduce additional herbivore species.
Population isolation and fragmentation.	Unlikely	• Rocky Outcrop habitat is excluded from the Development Envelope. • Retain fauna movement corridors. • Progressive rehabilitation where feasible.

Potential Impacts	Extent or Likelihood	Proposed Management
Project activities may increase the risk of accidental fire ignition.	Unlikely	The Proposed Action is unlikely to change the existing fire regime. Potential impacts to the fire regime will be managed by: • Employee, contractor and visitor site inductions. • Effective maintenance of mine vehicles. • No unauthorised off-road driving of mine vehicles. • Installation of firebreaks around critical infrastructure. • Any controlled burns would be conducted in consultation with the DBCA. • Emergency response capacity will be maintained. • Hot works conducted within designated, specially designed workshops or with controls required by a Hot Work Permit System. • All mine vehicles fitted with firefighting equipment.
Sickness or death due to direct and indirect contact with contaminated water discharged in the Turner River by the Project	Unlikely	• Implement treatment options to reduce pollutant concentrations below trigger value established to safeguard at least 95% of species protection. • Monitoring of surplus mine water for discharge in accordance with the CSSMP. • Explore options for selling the water to another organisation for mining, commercial or agricultural use. • Monitor the wetted front, fauna, and vegetation along the Turner River to ensure discharge is not causing adverse significant impacts as per CSSMP. • Gradually reduce the discharged volume (after year 3) to provide sufficient time for flora adaptation, especially tree root systems, and fauna.

7.2.5.8 Significance Test

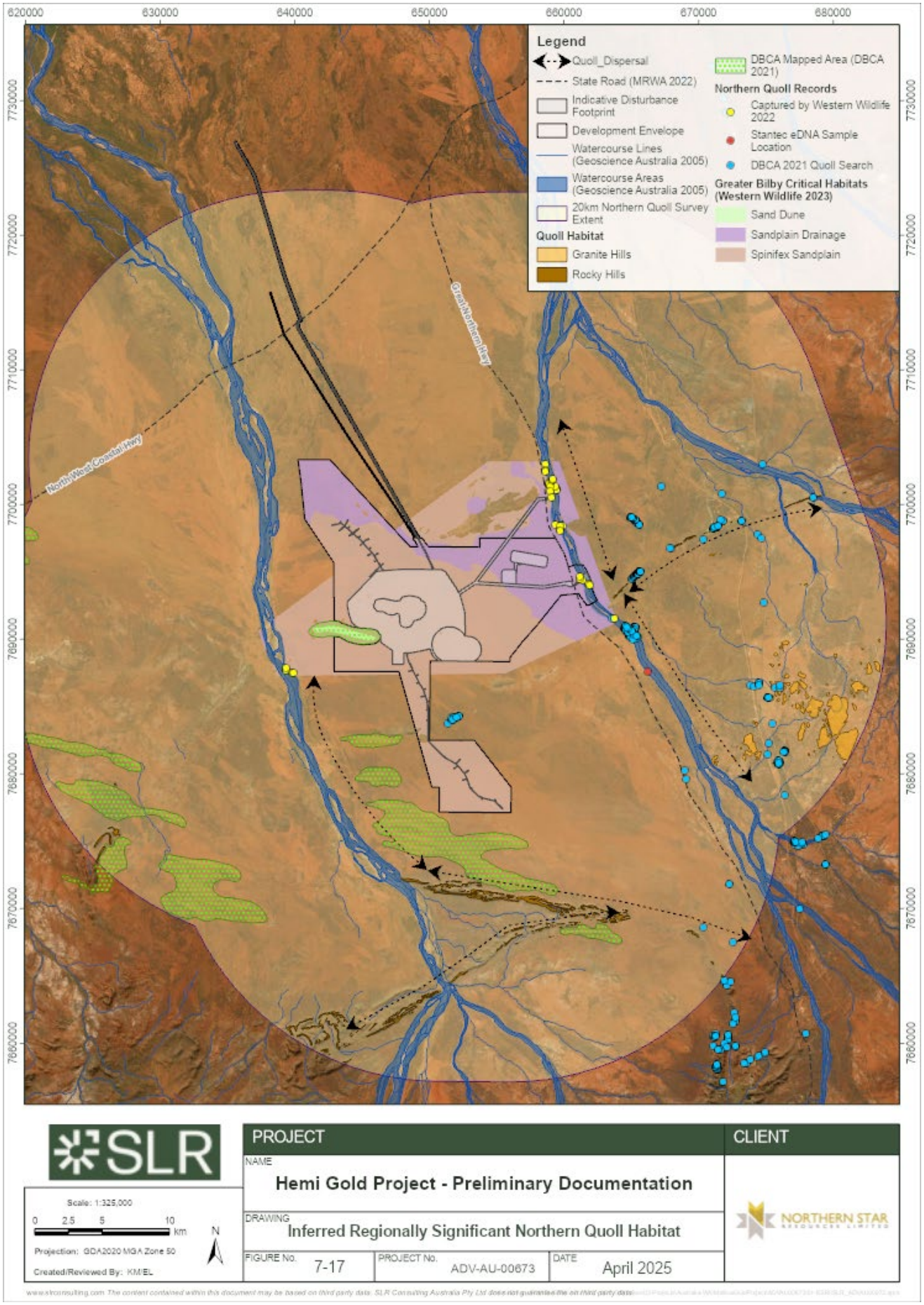
Section 6 of the Northern Quoll Referral Guideline (DoE, 2016a) outlines criteria to assess if an action will have a significant impact on the Northern Quoll. This assessment for the Proposed Action is provided in Table 7-20.

Table 7-20: Significant Impact Assessment on Northern Quoll

Significant Impact Criteria	Determination of Significance
Will the Project result in the loss of habitat critical to the survival of the Northern Quoll?	**Yes.** Minimal disturbance is required to construct mine surplus water dewatering outfall infrastructure in the Turner River including 10 ha of Major River and 41 ha of foraging and dispersal habitat. However, Major River habitat and associated foraging and dispersal habitat along the Yule River has been excluded from the Development Envelope. In addition, Rocky Outcrop habitat where Northern Quolls were recorded and assessed as potential breeding habitat, has been excluded from the Development Envelope. The proposed northern infrastructure corridors have been diverted to avoid disturbance to critical Major River habitat in the Yule River. The discharge of surplus water into the Turner River has been minimised via aquifer reinjection and through reuse as process water from year three of the Proposed Action. Although the Proposed Action will result in the loss of critical habitat for the Northern Quoll, avoidance and minimisation measures ensure the overall impact on critical habitat is unlikely to be significant and cause a decline in the population.
Will the Project decrease the size of a population important for the long-term survival of the Northern Quoll and therefore interfere with the recovery of the species?	**Unlikely**. Significant disturbance to Rocky Outcrop habitat used for breeding has been avoided at the design stage of the Proposed Action. The location of mining and processing infrastructure does not coincide with a Northern Quoll population with only small areas of disturbance to Major River habitat for the mine surplus water discharge outfall in the Turner River. Northern Star will ensure that: • Existing feral fauna populations are controlled. • The Proposed Action does not introduce the cane toad. • The existing fire regime is not changed. • Direct mortality is unlikely. With the above avoidance and minimisation measures in place, a decrease in an important population is unlikely to occur.
Will the Project introduce inappropriate fire regimes or grazing activities (i.e., increasing the risk of late dry season high intensity fires to the area) that substantially degrade habitat critical to the survival of the Northern Quoll or decrease the size of a population important for the long-term survival of the species?	**No.** The Proposed Action is unlikely to alter the fire regime or existing pastoral activities. Fire prevention measures will be implemented, and emergency response will be maintained. The main mine and processing infrastructure is located on the opposite side of the Great Northern Highway from critical habitat providing a permanent fire break for any accidental or controlled burns (only undertaken in consultation with DBCA). Given the location of the Proposed Action any accidental fires or controlled burns are unlikely to impact critical habitat.

Significant Impact Criteria	Determination of Significance
Will the Project fragment a population important for the long-term survival into two or more populations?	**No.** The important population monitored by DBCA is located along the Wingina Ridge east of the Turner River and outside of the Development Envelope. The Great Northern Highway provides an existing barrier between the main mine and processing infrastructure to the location of the important population. Males may disperse up to 10 km during breeding season, however as the main mine infrastructure occurs with contiguous sandplain habitat, existing outside the Development Envelope, it is unlikely the Proposed Action will isolate the populations from each other. The Turner and Yule Rivers provide important ecological corridors for dispersal extending for 220 km and 250 km respectively. Of which, only 3 km of the Turner River is located within the Development Envelope, with no sections of the Yule River in the Development Envelope. The minor short-term disturbance proposed for the Turner River will not impede the use by Northern Quolls. Regionally significant habitat for the Northern Quoll surrounding the Proposed Action is provided in Figure 7-17. The Proposed Action will not fragment an important population of Northern Quoll.
Will the Project result in invasive species or increases of them that are harmful to the Northern Quoll becoming established in its habitat, namely cane toads, feral cats, red foxes or exotic grasses which increase fire risk. This includes actions which have inadequate quarantine measures in place for movements between the mainland and offshore islands where Northern Quolls occur?	**Unlikely**. Northern Star will implement a feral cat and fox monitoring program and implement control measures when required. Northern Star will implement a feral cat and fox monitoring program and implement control measures when required across the Development Envelope to protect all MNES from being indirectly or directly impacted from the Proposed Action. Measures include implementing best practice waste management measures, limiting the creation of artificial water sources and prohibiting onsite personnel from feeding fauna species.

Figure 7-17: Inferred Regionally Significant Northern Quoll Habitat



7.2.5.9 Conclusion

To ensure the Proposed Action is carried out in a manner that minimises direct and indirect impacts on the Northern Quoll, a comprehensive CSSMP has been developed. The CSSMP outlines targeted mitigation measures to address potential impacts on this conservation-significant species.

The Proposed Action is not anticipated to have a significant impact on Northern Quoll. Disturbance of Northern Quoll's critical habitat has been avoided wherever possible and minimised where unavoidable. The mining and processing infrastructure location does not coincide with the Northern Quoll population. With minimisation methods in place, a decrease in an important population is not anticipated. Fragmentation of an important population is not anticipated. Northern Quoll habitat is widespread across the region, and the impacts of the Proposed Action will not significantly impact the species.

Northern Star however acknowledges that the clearing of Major River habitat within the Development Envelope will result in a loss of habitat considered critical to the survival of the species and as such proposes the following Environmental Outcomes:

- Avoid, or otherwise minimise direct and indirect impacts from the Proposed Action upon Northern Quoll habitat within the Development Envelope.
- An upper clearing limit of 10 ha of Major River habitat within the Development Envelope.

The residual significant impact, after implementation of the mitigation hierarchy, is clearing of up to 10 ha of critical Major River habitat within the Development Envelope. Environmental offsets are proposed for this clearing and are discussed in Section 9.

7.2.6 Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*)

No significant impact is anticipated on the Pilbara Leaf-nosed Bat from the Proposed Action. Field surveys did not identify habitat suitable for roosting across the Development Envelope. In addition, no Priority 1, 2 or 3 foraging habitats were recorded within the Development Envelope.

The Proposed Action is not anticipated to result in a decline of the Pilbara Leaf-nosed Bat population, nor will it impact the Pilbara Leaf-nosed Bat recovery effort.

7.2.6.1 Overview

The Pilbara Leaf-nosed Bat is listed as Vulnerable under the EPBC Act. The Pilbara Leaf-nosed Bat is an insectivorous bat occurring throughout the Pilbara and adjacent upper Gascoyne regions of Western Australia. The Pilbara Leaf-nose Bat is an isolated population in slightly divergent form of the Orange Leaf-Nosed Bat that is endemic to northern Australia (TSSC, 2016c).

Pilbara Leaf-nosed Bat roost in caves all year round, mating during the dry season. Females give birth to a single-young in the mid-wet season months of late-December and January. The Pilbara Leaf-nosed Bat is mainly recorded through echolocation calls with bat detectors either at cave and mine entrances or whilst foraging across a range of habitats.

7.2.6.2 Relevant Policy and Guidance

Relevant Commonwealth policy and guidance for the Pilbara Leaf-nosed Bat, which have informed studies, planning and development of the Proposed Action, are summarised in Table 7-21.

Table 7-21: Relevant Commonwealth Policy and Guidance for the Pilbara Leaf-nosed Bat

Author	Year of Publication	Policy/ Guidance
CoA	2010	Survey guidelines for Australia's threatened Bats: Guidelines for detecting Bats listed as threatened under the EPBC Act.
	2011	Survey guidelines for Australia's threatened mammals: Guidelines for detecting mammals listed as threatened under the EPBC Act.

Author	Year of Publication	Policy/ Guidance
	2013	EPBC Act Significant Impact Guideline 1.1.
Threatened Species Scientific Committee (TSSC)	2016	Conservation Advice *Rhinonicteris aurantia* (Pilbara form) (Pilbara Leaf-nosed Bat).

7.2.6.3 Habitat

The Pilbara Leaf-nosed Bat requires warm, humid diurnal (daytime) roost sites and forages in gorges, along watercourses and over low Spinifex-covered hills (TSSC, 2016c). The local distribution of the Pilbara Leaf-nosed Bat is strongly influenced by the suitability of roost caves (hot with a high humidity level) rather than habitat type.

Permanent diurnal roosts known in the region are at Yule River (17 km south), East Turner River (40 km southeast) and Abydos (64 km southeast). Transitory diurnal roosts are known from Wodgina (35 km south) with foraging thought to occur between 20 to 30 km from a roost (Bat Call WA, 2021). Other diurnal and transitory diurnal roosts may occur across the region that are not yet known publicly.

Critical foraging habitat for the Pilbara Leaf-nosed Bat is difficult to define due to a current lack of understanding of the type and quality of foraging habitat that is required to sustain a colony. However, based on observations and assumptions, foraging habitats used by Pilbara Leaf-nosed Bat have been categorised as described in Table 7-22.

Table 7-22: Pilbara Leaf-nosed Bat Foraging Categories (TSSC, 2016c)

Priority	Category Name	Description
1	Gorges with pools	Watercourses through upland areas bounded by sheer rock walls for parts of their length, often containing pools that remain for weeks or months, sites of relatively large biomass production, sometimes containing caves.
2	Gullies	Primary drainage with limited riparian development in upland rocky habitats, sometimes containing small pools that may last for weeks, with less biomass production than Priority 1 gorge habitat.
3	Rocky outcrop	Areas of exposed rock at the top of rocky outcrop and mesa hills that contain caves and overhangs, and boulder piles in the granite terrains.
4	Major watercourses	Riparian vegetation on flat land plus the main gravelly or sandy channel of the riverbed, sometimes containing pools that persist for weeks or months, and generally supporting higher productivity of biomass than the surrounding habitats.
5	Open grassland and woodland	Dominated by *Triodia*, on lowland plains, colluvial slopes and hilltops.

7.2.6.4 Threats

The Conservation Advice for the Pilbara Leaf-nosed Bat lists nine threats to the conservation status of the species (TSSC, 2016c):

- Heat and water loss: the species is known for its poor ability to maintain body temperature and water.
- Mine collapse: resulting in direct mortality.
- Flooding: resulting in the destruction of roost sites and possibly direct mortality.
- Natural predators.
- Mine development: may result in the destruction of roost sites.
- Blasting in adjacent workings: resulting in abandoning of roost sites by bats.

- Human entry of roosts: resulting in animals abandoning the site.
- Road kills: direct mortality resulting from increased vehicle activity.
- Site rehabilitation.

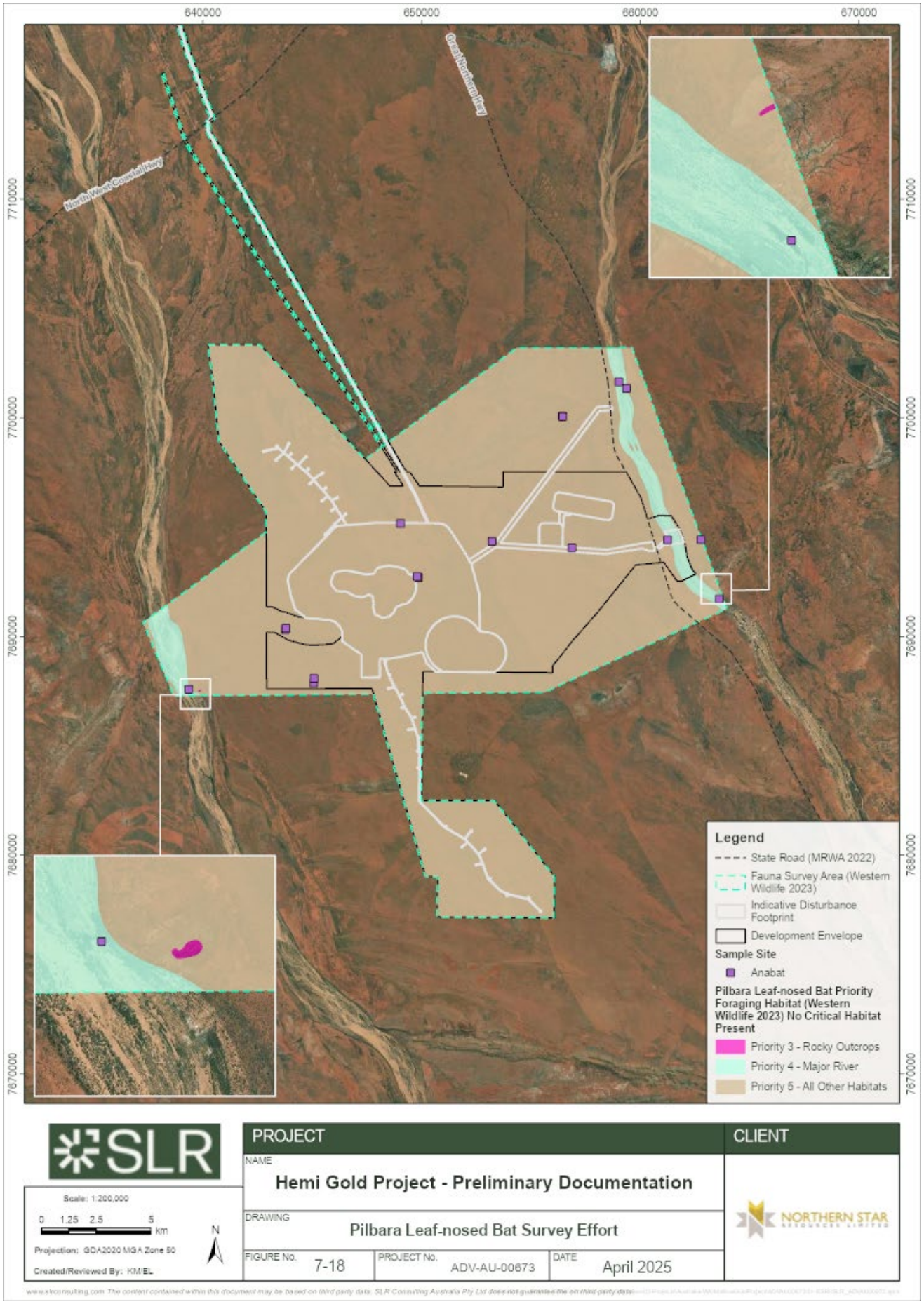
7.2.6.5 Surveys

The timing and adequacy of the Detailed Vertebrate Fauna Survey undertaken by Western Wildlife was consistent with that recommended in the Technical Guidelines (EPA, 2020) and Pilbara Leaf-nosed Bat survey requirements (Bat Call, 2021). No diurnal roosts were found or considered likely in the study area, primarily due to the absence of suitable cave-bearing rocky formations (Table 6-7).

Bat calls were captured using AnaBat Swift call detectors set to record from dusk until dawn, strategically positioned in areas most likely to be visited by Pilbara Leaf-nosed Bat. Ultrasonic detectors were placed at six trap sites and an additional 16 sites, totaling 22 sites. These detectors were operational for one to two nights at each trap site and then for one to three nights at selected sites across the study area. This methodology resulted in a total of 16 nights of recordings in September 2021 and another 16 nights in March 2022. Locations of detectors across the study area are provided in Figure 7-18.

Pilbara Leaf-nosed Bat were recorded in the surveys, with its calls detected at five sites across the study area, Pilbara Leaf-nosed Bat calls were not recorded 30 minutes prior to sunset and 30 minutes prior to sunrise, suggesting a foraging period. Due to the lack of suitable cave-bearing rocky formations, no diurnal roosts were recorded or considered likely to occur in the study area.

Figure 7-18: Pilbara Leaf-nosed Bat Survey Effort



7.2.6.6 Local Population

A search of the EPBC Protected Matters Search Tool recorded the Pilbara Leaf-nosed Bat as likely to be present within the 50 km buffer and the WA DBCA's Threatened and Priority fauna database has 77 records of the Pilbara Leaf-nosed Bat within 70 km of the study area. The Pilbara Leaf-nosed Bat was recorded at five sites across the survey and is considered likely to occur as a foraging visitor to the area. There is no diurnal roosting habitat within the Development Envelope with the closest known roosts at Yule River (17 km south), East Turner River (40 km southeast) and Abydos (64 km southeast). The Pilbara Leaf-nosed Bat in the study area are possibly from the Yule River subpopulation, whose current total population size is unknown.

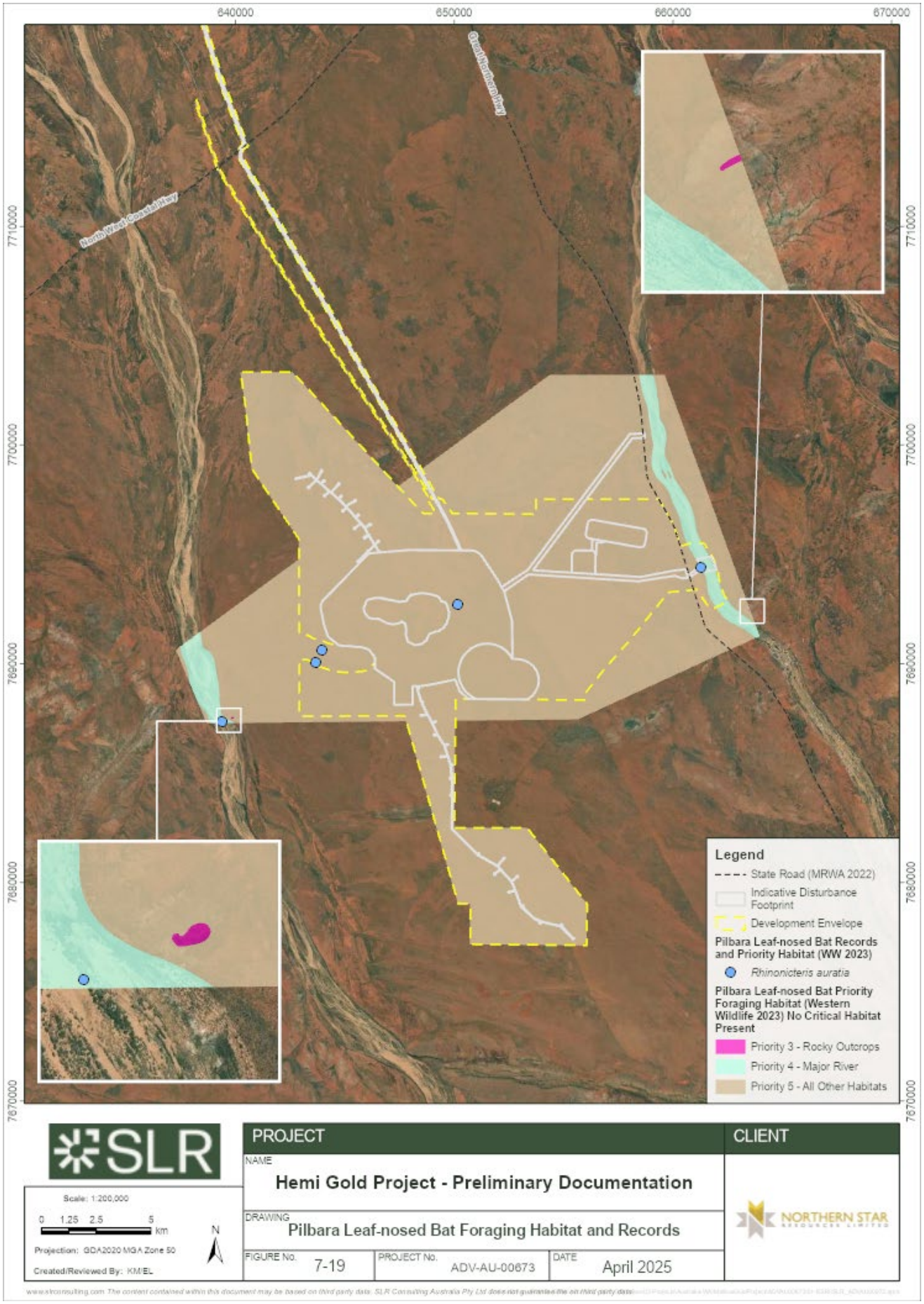
Foraging habitat across the study area has been classified according to the categories outlined in the Conservation Advice for Pilbara Leaf-nosed Bat. These priority categories, shown in Figure 7-19 and detailed in Table 7-23. Of the mapped extent of the Proposed Action, disturbance to Priority 3 foraging habitat is avoided, an upper clearing limit to Priority 4 habitat is 10 ha and the remaining is classified as Priority 5.

Table 7-23: Hemi Pilbara Leaf-nosed Bat Foraging Habitats

Priority	Category Name	Linked Fauna Habitat	Extent		
			Mapped Survey Area (ha)	Area inside Development Envelope (ha)	Area inside Indicative Disturbance Footprint (ha)*
1	Gorges with pools	Not recorded	0.0	0.0	0.0
2	Gullies	Not recorded	0.0	0.0	0.0
3	Rocky outcrop	Rock Outcrops	1.5	0.0	0.0
4	Major watercourses	Major River	1,231.9	181.2	10
5	Open grassland and woodland	Sandplain Spinifex	22,718.6	15,809.8	5,038
		Sandplain Drainage	9,349.5	6,029.4	723
		Sand Dune	190.1	0.0	0.0
		Stony Hills	1,196.4	172.9	34

*Rounded up to nearest one.

Figure 7-19: Pilbara Leaf-nosed Bat Foraging Habitat and Records



7.2.6.7 Potential Impacts and Management

The potential impacts to the Pilbara Leaf-nosed Bat from the Proposed Action and the management measures Northern Star propose to implement are presented in Table 7-24.

Table 7-24: Pilbara Leaf-nosed Bat Potential Impacts and Management

Potential Impact	Extent or Likelihood	Management and Mitigation Measures
Death caused by Vehicle Strike	Unlikely	• Implement speed limits of 80 and 60 km/h on sealed and unsealed roads for mine vehicles within the Development Envelope. • Mine vehicles will be required to stay on existing roads and tracks. • Personnel hooning and misadventure will be prohibited. • Sightings and incidents will be reported. • Personnel will be educated on conservation significant fauna.
Modification to foraging habitat	5,830 ha	• Limit clearing to amount required (no more than 5,830 ha of clearing within the Development Envelope). • Use of previously disturbed areas where possible. • Implementation of the internal clearing permit system. • Annual review of disturbance areas. • Avoid Priority 3 foraging habitat (Rocky Outcrop). • Clearing of no more than 10 ha of Priority 4 foraging habitat (Major River) habitat. • Clearing of no more than 800 ha Priority 5 (Sandplain Drainage) and 800 ha of priority 5 (Spinifex Sandplain) habitat. • Implementation of weed monitoring program and subsequent weed control measures when required. Progressive rehabilitation of disturbed areas where feasible.
Collision with fences, especially those with barbed wire	Unlikely	Northern Star notes that the Proposed Action is located on an active Pastoral Lease with barbed wire fencing already in use. Northern Star will manage the potential impacts of fencing for the Proposed Action by: • Minimising fencing for the Proposed Action to amount required. • Not using barbed wire fencing where practicable. • If barbed wire fencing is required (due to legislative, safety or pastoral requirements) the top strands will be plain wire, and 10 cm disc bat reflectors will be used. • Inspection of areas requiring barbed wire fencing due to legislative, safety or pastoral requirements. • Reporting of all fauna related incidents. • .

7.2.6.8 Significance Test

The significance of impacts is assessed according to the criteria in the conservation advice for the Pilbara Leaf-nosed Bat (TSSC, 2016c). The significant impacts are addressed in Table 7-25.

Table 7-25: Significant Impact Assessment for the Pilbara Leaf-nosed Bat

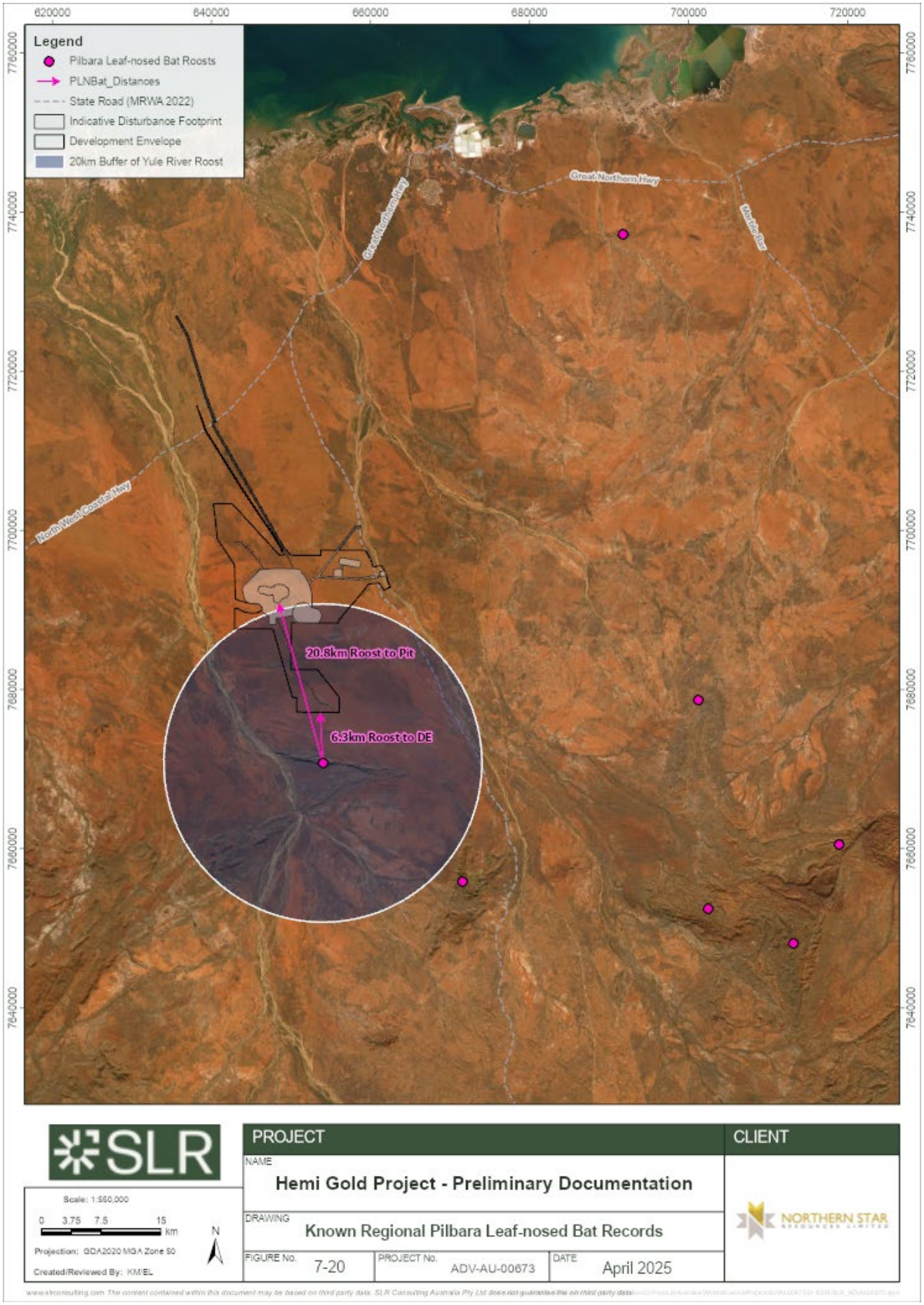
Significance Test	Determination of Significance
Actions that are highly likely to have a significant impact	
Will the Project lead to a long-term decrease in the size of the Pilbara Leaf-nosed Bat population?	**Unlikely**. The size of the Pilbara Leaf-nosed Bat population is largely determined by the availability of suitable diurnal roost sites. It is estimated there are 10,000 to 15,000 individuals across the Pilbara. However, as per the approved conservation advice for Pilbara Leaf-nosed Bat, the decrease in size of the population of Pilbara Leaf-nosed Bat is linked to the removal of critical habitat (Priority 1 and 2 roosts). As there are no roost sites in the Development Envelope, it is unlikely the Proposed Action will impact the Pilbara Leaf-nosed Bat population.
Will the Project reduce the area of occupancy of the Pilbara Leaf-nosed Bat population?	**Unlikely**. The area of occupancy of the Pilbara Leaf-nosed Bat is largely determined by the availability of suitable diurnal roost sites. The closest known permanent diurnal roost is the Yule Rive roost approximately 17 km south of the Proposed Action. The Development Envelope does not provide Priority 1, 2 or 3 foraging habitats for Pilbara Leaf-nosed Bat, with the majority (99.2%) classified as Priority 5 foraging habitat. It is unlikely the Proposed Action will reduce the area of occupancy of Pilbara Leaf-nosed Bat due to the lack of diurnal roosts.
Will the Project adversely affect individuals or habitat critical to the survival of the Pilbara Leaf-nosed Bat?	**Unlikely**. Northern Star will implement measures to minimise the likelihood of mortality or injury due to vehicle strike. Habitat critical to the survival of Pilbara Leaf-nosed Bat is diurnal roosts and the immediate surrounding foraging habitat classified as Priority 1 or 2. No critical habitat was located during the fauna surveys, with the closest known permanent diurnal roost located at the Yule roost 17 km south of the Proposed Action. No Priority 1 or Priority 2 foraging habitat was recorded in the Development Envelope and all habitat classified as Priority 3 has been excluded. A small section of the Turner River (Major River habitat – Priority 4) will be cleared for the mine surplus water discharge outfall with all remaining habitat across the Development Envelope classified as Priority 5. These foraging habitats are regionally common and unlikely to be critical for the survival or local persistence of Pilbara Leaf-nosed Bat.
Actions that may have a significant impact	
Will the Project disrupt the breeding cycle of an important colony?	**Unlikely**. No diurnal roost sites were recorded in the Development Envelope due to the lack of suitable habitat or old mine workings. The closest known permanent diurnal roost is the Yule Rive roost approximately 17 km south of the Proposed Action (Figure 7-20). No Priority 1 or Priority 2 foraging habitat was recorded in the Development Envelope and all habitat classified as Priority 3 has been excluded. It is unlikely the Proposed Action will disrupt the breeding cycle of an important colony.
Will the Project modify, destroy, remove or isolate or decrease the availability of quality Pilbara Leaf-nosed Bat habitat to the extent that the Pilbara Leaf-nosed Bat is likely to decline?	**Unlikely**. No diurnal roost sites were recorded in the Development Envelope due to the lack of suitable habitat or old mine workings. No Priority 1 or Priority 2 foraging habitat was recorded in the Development Envelope and all habitat classified as Priority 3 has been excluded. A small section of the Turner River (Major River habitat – Priority 4) will be cleared for the mine surplus water discharge outfall with all remaining habitat across the Development Envelope classified as Priority 5. These foraging habitats are regionally common and unlikely to be critical for the survival or local persistence of Pilbara Leaf-nosed Bat.

Significance Test	Determination of Significance
	It is unlikely that the majority of disturbance to habitats classified as Priority 5 foraging habitat will cause a decline in the population of Pilbara Leaf-nosed Bat.
Actions that are unlikely to have a significant impact	
Will the Project result in invasive species that are harmful to the Pilbara Leaf-nosed Bat becoming established in its habitat?	**Unlikely**. No specific invasive species are listed as threatening in the conservation advice or guidelines for Pilbara Leaf-nosed Bat. Northern Star will implement a feral cat and fox monitoring program and implement control measures when required across the Development Envelope to protect all MNES from being indirectly or directly impacted from the Proposed Action. Measures include implementing best practice waste management measures, limiting the creation of artificial water sources and prohibiting onsite personnel from feeding fauna species.
Will the Project introduce disease that may cause the Pilbara Leaf-nosed Bat to decline?	**Unlikely**. The introduction of a disease to a population of Pilbara Leaf-nosed Bat would most likely occur by a lack of hygiene when entering any roost site. There are no roost sites within the Development Envelope and as such the risk of introducing a disease that may cause the species to decline is extremely low. However, employee and contractor inductions will provide instruction that entry into possible roost sites is prohibited.

7.2.6.9 Conclusion

No significant impact is anticipated on the Pilbara Leaf-nosed Bat from the Proposed Action as no diurnal roosts are present on-site, and there is no critical foraging habitat near a roost. No Priority 1, 2 or 3 foraging habitats are within the Development Envelope. As no roosts are present in or near the Development Envelope and no Category 1, 2 or 3 foraging habitats, the Proposed Action is not anticipated to result in a decline of the Pilbara Leaf-nosed Bat population, nor will it impact the Pilbara Leaf-nosed Bat recovery effort.

Figure 7-20: Known Regional Pilbara Leaf-nosed Bat Records



7.2.7 Pilbara Olive Python (*Liasis olivaceus barroni*)

The Proposed Action is not anticipated to have a significant impact on the local population or critical habitat of the Pilbara Olive Python. The low impact clearing of the Turner River for dewatering discharge is not anticipated to impact the overall habitat quality or result in a population decline. After three years, the surplus water in the Turner River's disposal volume will be minimised via aquifer reinjection used at the processing facility. Modelling indicated that the expected water flow would be confined to the main channels of the river.

Disruptions to the breeding cycle are not anticipated with the majority of the habitats within the Development Envelope not considered critical for the species. The Rocky Outcrop habitat and Yule River have been excluded from the Development Envelope.

7.2.7.1 Overview

The Pilbara Olive Python (*Liasis olivaceus barroni*) is listed as Vulnerable under the EPBC Act and is restricted to ranges within the Pilbara region. Individuals spend the winter months within caves and rock crevices away from water sources, and summer months moving freely amongst water sources and rocky outcrops.

The Pilbara Olive Python is adept at swimming and uses water holes to hunt and capture prey via submerged ambush. The species may also capture prey via terrestrial ambush on animal trails. Their opportunistic carnivorous diet consists of Rock Wallabies, Fruit Bats, ducks, Spinifex Pigeons, and Coucals.

7.2.7.2 Relevant Policy and Guidance

Relevant Commonwealth policy and guidance for the Pilbara Olive Python, which have informed studies, planning and development of the Proposed Action, are summarised in Table 7-26.

Table 7-26: Relevant Policy and Guidance for the Pilbara Olive Python

Author	Year of Publication	Policy/ Guidance
CoA	2008	Conservation Advice for *Liasis olivaceus barroni* (Olive Python Pilbara subspecies)
	2011	Survey guidelines for Australia's threatened reptiles: Guidelines for detecting reptiles listed as threatened under the EPBC Act
	2013	EPBC Act Significant Impact Guideline 1.1.

7.2.7.3 Habitat

The Pilbara Olive Python is widely distributed within its range with many sizable populations (Pearson, 2003). It is generally associated with large river systems, such as the Coongan, Shaw, Yule, Harding, Fortescue, Ashburton, and Robe Rivers (Western Wildlife, 2023). The favoured habitat of the Pilbara Olive Python is generally considered to be deep gorges with waterholes; however, it also occurs in riverine habitats and on the Burrup Peninsula, it inhabits large rock piles in spinifex grasslands (Western Wildlife, 2023).

Radio tracking studies on the Robe and Fortescue Rivers have found that during the summer months, pythons range along rivers, visiting permanent pools, and in winter, they shelter in rocky areas away from water, including caves in flat-topped hills (DEWHA, 2008; Pearson, 2003). Artificial waters, such as sewage ponds and recreational lakes, are also used (Pearson, 2003).

Critical habitats for the Pilbara Olive Python include Rocky Outcrops and Major River. Major River habitat extends beyond the fauna survey area along the Yule River and the Turner River, approximately 250 km and 220 km in length, respectively.

7.2.7.4 Threats

Threats to the Pilbara Olive Python are listed in the Conservation Advice for the species (DEWHA, 2008):

- Direct predation by feral cats and foxes, particularly of juveniles.

- Loss of prey species, such as Northern Quolls and rock-wallabies to predation by foxes.
- Loss of habitat to gas and mining developments, including changes to hydrology and downstream impacts such as sedimentation or pollution.
- Vehicle strikes.
- Loss of life due to being misidentified as a venomous snake species.

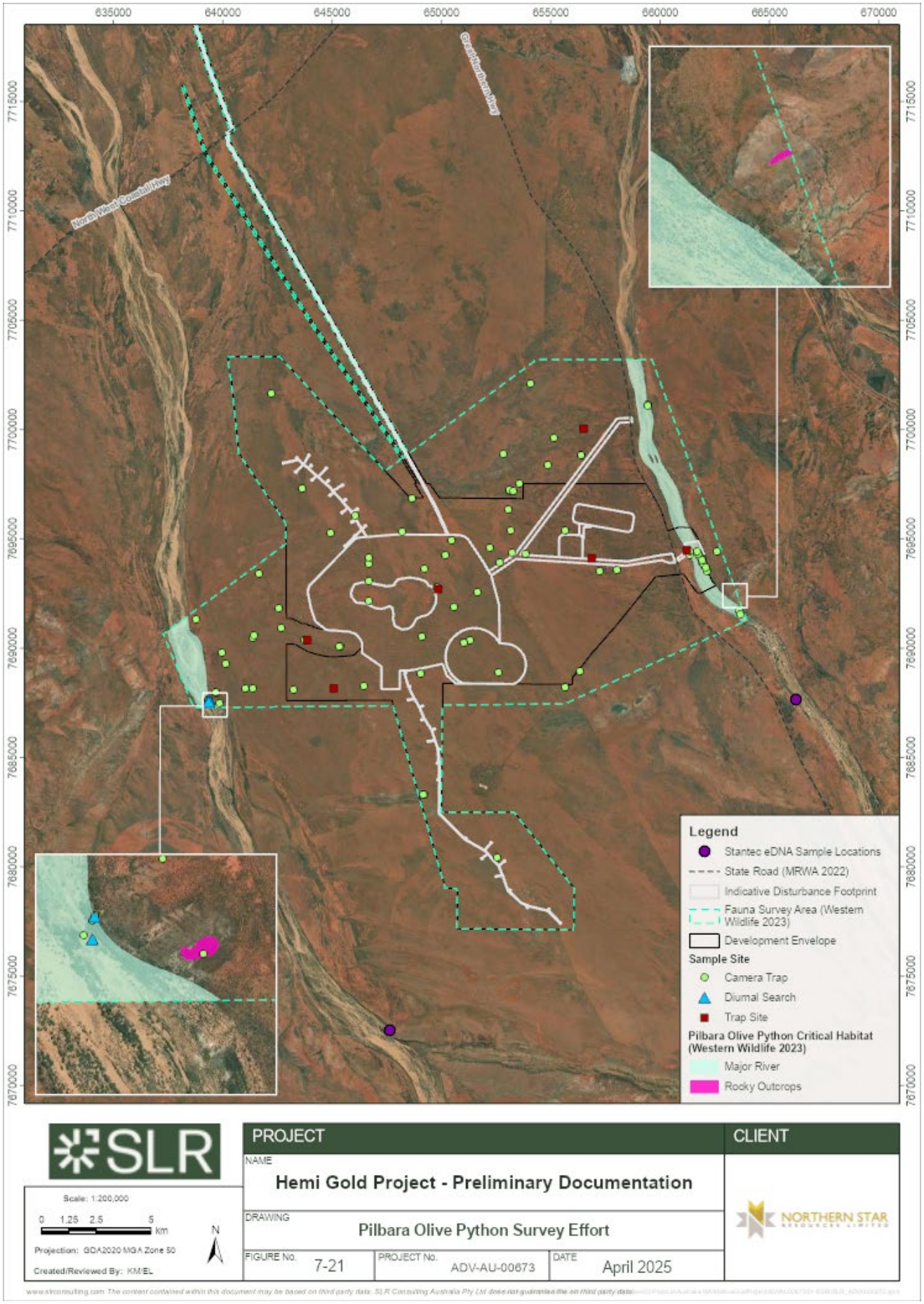
7.2.7.5 Surveys

The timing and adequacy of the Detailed Vertebrate Fauna Survey undertaken by Western Wildlife was consistent with that recommended in the Technical Guidelines (EPA, 2020). The survey for the Pilbara Olive Python in the Western Wildlife survey utilised trapping techniques, camera traps, diurnal transects and opportunistic observations.

During the November 2021 dry season survey, Stantec gathered eDNA samples, primarily focusing on the Pilbara Olive Python. The sampling site selection was based on suitable habitats, typically rocky outcrops, and gorges near waterways. At each site, three replicate eDNA water samples were collected (Figure 7-21). Additionally, three extra water samples were taken from rockpools as shown in Figure 7-21, where the sighting occurred prior to the survey.

The Pilbara Olive Python was not recorded during terrestrial fauna surveys (Western Wildlife, 2023) or in eDNA analysis from the Yule and Turner Rivers (Stantec, 2022).

Figure 7-21: Pilbara Olive Python Survey Effort



7.2.7.6 Local Population

Conservation advice for the Pilbara Olive Python acknowledges the complexity in assessing the population due to its cryptic nature. As a result, reliable population estimates for this species in Western Australia's Pilbara region are lacking (Western Wildlife, 2023).

DBCA's Threatened and Priority Fauna Database, with a 20 km buffer around the Development Envelope tenements, detected six records of the species, the most recent being in 2012 at Indee station near Turner River East. The closest DBCA record is located approximately 12 km northeast of the Proposed Action. An anecdotal record of the species from 'Red Rock', 1.5 km south of the Development Envelope on the Turner River was sampled for eDNA, however the Pilbara Olive Python was not detected.

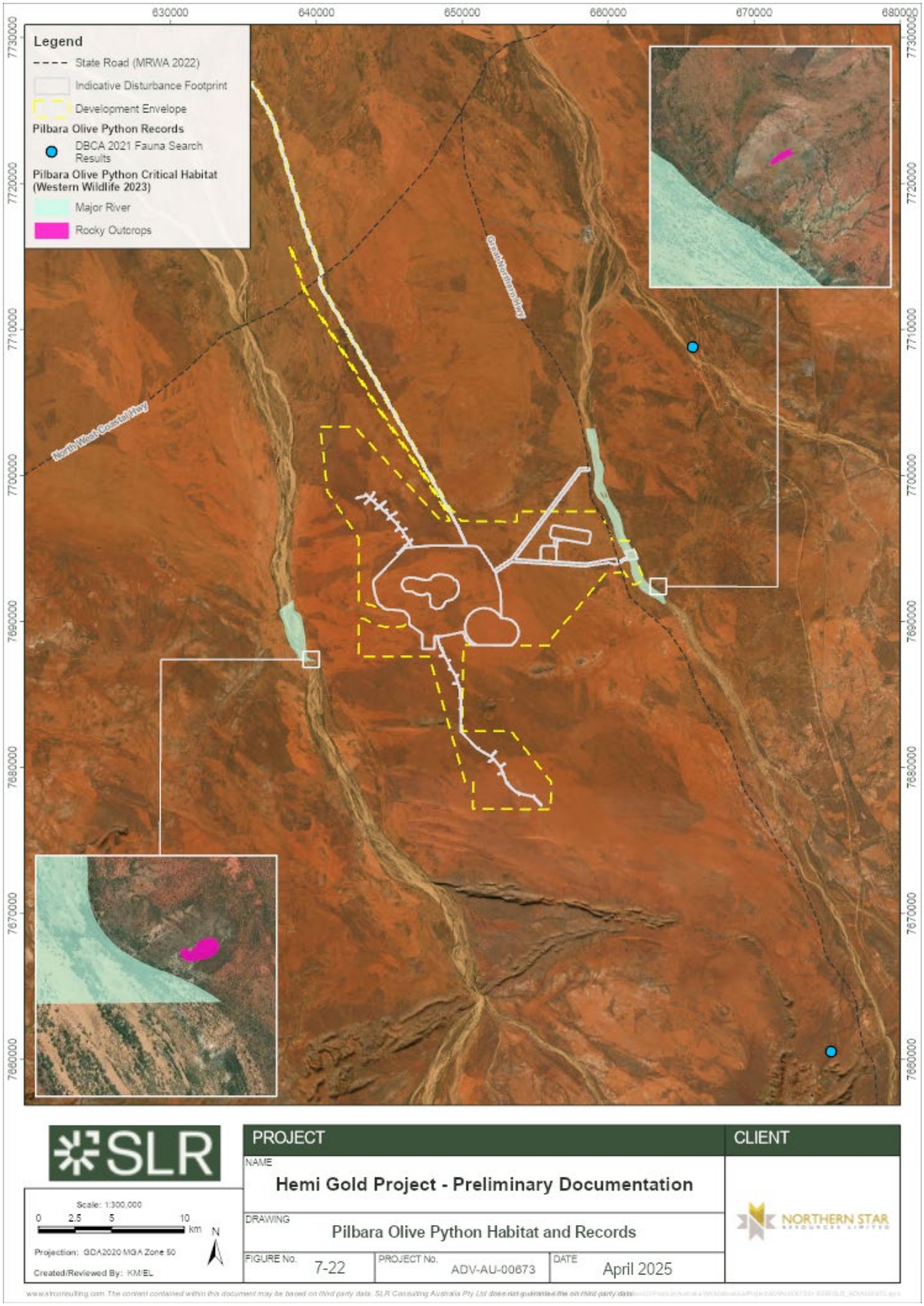
Habitats likely to be critical for the survival of the species include Major River and Rocky Outcrop habitats. However, the species potentially occurs in a variety of habitats when dispersing and looking for mates. Critical habitat is shown in Figure 7-22 and detailed in Table 7-27

Table 7-27: Pilbara Olive Python Critical Habitat

Critical Habitat	Mapped Survey Area (ha)	Area inside Development Envelope (ha)	Area inside Indicative Disturbance Footprint (ha)
Major River	1,231.9	181.2	10
Rocky Outcrops	1.5	0.0	0.0
Total	**1,233.4**	**181.2**	**10**

The cryptic habits of this species make it difficult to systematically survey, as even a large-scale survey may fail to record any individuals. However, it is considered likely to occur in the survey area due to the nearby records.

Figure 7-22: Pilbara Olive Python Habitat and Records



7.2.7.7 Potential Impacts and Management Measures

The potential impacts on Pilbara Olive Python and the proposed management Northern Star will implement are presented in Table 7-28.

Table 7-28: Pilbara Olive Python Potential Impacts and Management

Potential Impacts	Extent or Likelihood	Proposed Management
Major fire events	Unlikely	• Northern Star does not propose to change the existing fire regime in the Development Envelope. • Using a permit system for hot work. • Installation of fire breaks around critical infrastructure. • All mine vehicles fitted with firefighting equipment. • Emergency response as required. • Including fire education in the site induction.
Direct predation or predation of food sources by cats and foxes	Unlikely	• Implementing best practice waste management measures. • Limiting the creation of permanent water bodies. • Control measures as required. • Monitoring of predators through automated motion sensor cameras.
Destruction of habitat due to mining development	Unlikely	• Limiting clearing to the minimum required. • Using previously disturbed areas to the extent possible. • Exclusion of Rocky Outcrop habitat from clearing footprint. • Exclusion of the Yule River from the Development Envelope. • Limiting clearing in the Turner River to low-impact disturbance for the dewatering outfall. • Ensuring discharge meets quality criteria in the site environmental licence.
Accidental vehicle strikes	Unlikely	• Implement speed limits of 80 and 60 km/h on sealed and unsealed roads for mine vehicles within the Development Envelope. • Mine vehicles will be required to stay on existing roads and tracks. • Personnel hooning and misadventure will be prohibited. • Sightings and incidents will be reported. • Personnel will be educated on conservation significant fauna.
Changes in local hydrology due to surplus water discharge	Unlikely	• Water drawdown will not extend to the rivers. • No significant impact on pools due to surplus discharge.
Death from mistaken identification as a poisonous brown snake	Unlikely	• Deliberate harm to any native fauna is prohibited. • Snakes will be relocated by authorised and trained reptile handlers only. • Personnel will be educated on conservation significant fauna and species identification.
Disturbance caused by increasing tourist visitors	Unlikely	• Unauthorised personnel (including tourists) are excluded from mining tenements. • Any visitors will have to complete an environmental induction or be escorted by inducted staff.

7.2.7.8 Significance Test

An assessment of the proposed actions against the significance criteria for Vulnerable species in the Significant Impact Guidelines (Commonwealth of Australia (CoA), 2013) is presented in Table 7-29.

Table 7-29: Significance Impact Assessment for the Pilbara Olive Python

Significant Impact Criteria	Determination of Significance
Will the Project lead to a long-term decrease in the size of an important population of a species?	**Unlikely**. There is no advice provided that defines an important population for the Pilbara Olive Python. However, no individuals have been recorded within the Development Envelope through a variety of survey methods including eDNA analysis. With nearby DBCA records, and suitable habitat available (Rocky Outcrop and Major River) it is considered likely that Pilbara Olive Python are located within or surrounding the Development Envelope, most likely near the Turner and Yule Rivers. Mitigation measures to control feral fauna populations; prevent changes to the fire regime; and to avoid road kills will be implement across the Proposed Action which will assist in protecting the species.
Will the Project reduce the area of occupancy of an important population?	**Unlikely**. Critical habitats for the Pilbara Olive Python have been identified as Rocky Outcrop and Major River. The Rocky Outcrop habitat has been excluded from the Development Envelope. A small area of Major River habitat (10 ha) is proposed for disturbance for the surplus mine water discharge outfall, associated infrastructure and access roads. The disturbance will not reduce the area of occupancy by the species.
Will the Project fragment an existing important population into two or more populations?	**Unlikely.** Critical habitat for the Pilbara Olive Python is Rocky Outcrop and Major River habitat and direct disturbances to these have been avoided or minimised even though there are no recorded sightings within the Development Envelope or survey area. The Turner River's extent is approximately 220 km, and the Proposed Action will not significantly restrict movement along the river.
Will the Project adversely affect habitat critical to the survival of a species?	**Unlikely.** Critical habitat for the Pilbara Olive Python is Major River habitat and Rocky Outcrop. Rocky Outcrop has been excluded from the Development Envelope and will not be impacted by the Proposed Action. Approximately 10 ha of low impact clearing of Major River habitat is required for the surplus mine water dewatering discharge outfall in the Turner River. This clearing is not anticipated to have any effect on the overall habitat quality in the Turner River or result in a decline in the Pilbara Olive Python.
Will the Project disrupt the breeding cycle of an important population?	**Unlikely.** Pilbara Olive Pythons have low reproduction rates (mating every two to three years), one of the reasons the species is listed as Vulnerable under the EPBC Act. Approximately 10 ha of low impact clearing of Major River habitat is required for the surplus mine water dewatering discharge outfall in the Turner River with all Rocky Outcrop habitat excluded from the Development Envelope. Disruptions to the breeding cycle are not anticipated.
Will the Project modify, destroy, remove, or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	**Unlikely.** Approximately 10 ha of low impact clearing of Major River habitat is required for the surplus mine water dewatering discharge outfall in the Turner River with all Rocky Outcrop habitat excluded from the Development Envelope. The discharge of surplus water into the Turner River is not anticipated to affect the Pilbara Olive Python. The discharge volume has been minimised via aquifer reinjection and through reuse as process water after year three of the Proposed Action. Modelling indicates that the expected flow will be confined to the main channel of the river.

Significant Impact Criteria	Determination of Significance
Will the Project result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?	**Unlikely**. Northern Star will implement a feral cat and fox monitoring program and implement control measures when required. Northern Star will implement a feral cat and fox monitoring program and implement control measures when required across the Development Envelope to protect all MNES from being indirectly or directly impacted from the Proposed Action. Measures include implementing best practice waste management measures, limiting the creation of artificial water sources and prohibiting onsite personnel from feeding fauna species.
Will the Project introduce disease that may cause the species to decline?	**Unlikely.** Although disease is not recorded as threatening process for the Pilbara Olive Python, it could hinder the species' recovery. The Proposed Action is unlikely to introduce disease to the Pilbara Olive Python population with handling of individuals limited to trained personnel during relocations if required.
Will the Project interfere substantially with the recovery of the species?	**Unlikely.** Approximately 35 ha of low impact clearing of Major River habitat is required for the surplus mine water dewatering discharge outfall in the Turner River with all Rocky Outcrop habitat excluded from the Development Envelope. With standard environmental management measures in place, the Proposed Action is unlikely to have a significant impact on the Pilbara Olive Python.

7.2.7.9 Conclusion

The Proposed Action is not anticipated to have a significant impact on the local population or critical habitat of the Pilbara Olive Python. The low impact clearing of the Turner River for dewatering discharge is not anticipated to impact the overall habitat quality or result in a population decline. After three years, the surplus water in the Turner River's disposal volume will be minimised via aquifer reinjection and reused as processed water. Modelling indicated that the expected water flow would be confined to the main channels of the river.

Disruptions to the breeding cycle are not anticipated with the majority of the habitats within the Development Envelope not considered critical for the species. The Rocky Outcrop habitat and Yule River have been excluded from the Development Envelope.

The residual significant impact, after implementation of the mitigation hierarchy, is clearing of up to 10 ha of critical Major River habitat within the Development Envelope. Environmental offsets are proposed for this clearing and are discussed in Section 9.

7.3 Migratory Bird Species

No significant impact is anticipated on any migratory bird species as a result of the Proposed Action, as there is a lack of records within the Development Envelope, and there is abundant, more suitable habitat outside of the Development Envelope.

Only one migratory bird species was recorded during the Western Wildlife survey, a single Fork-tailed Swift sighted outside of the Development Envelope. Historical records from DBCA Threatened and Priority Fauna Database do not show any occurrences of migratory bird species within the Development Envelope. A search using DCCEEW's Protected Matters Search Tool undertaken by Western Wildlife (2023) returned the possibility for the species or species habitat to occur within 5 km of the Development Envelope for six of the twelve identified migratory bird species.

In addition, the COA (CoA, 2017) states that migratory species have a tendency for site fidelity, where they return to the same sites each consecutive year. As there have been no records within the Development Envelope, it is highly unlikely that species will utilise the area in the future.

7.3.1 Overview

Most migratory bird species breed in the northern hemisphere and migrate annually to southern non-breeding areas, including Australia. They are mostly present in Australia from as early as August and depart as late as May each year. Migratory bird species that visit Australia for this period utilise the East Asian-Australasian flyway (EAAF), a route that stretches from far eastern Russia and Alaska, south through east and southeast Asia, to Australian and New Zealand.

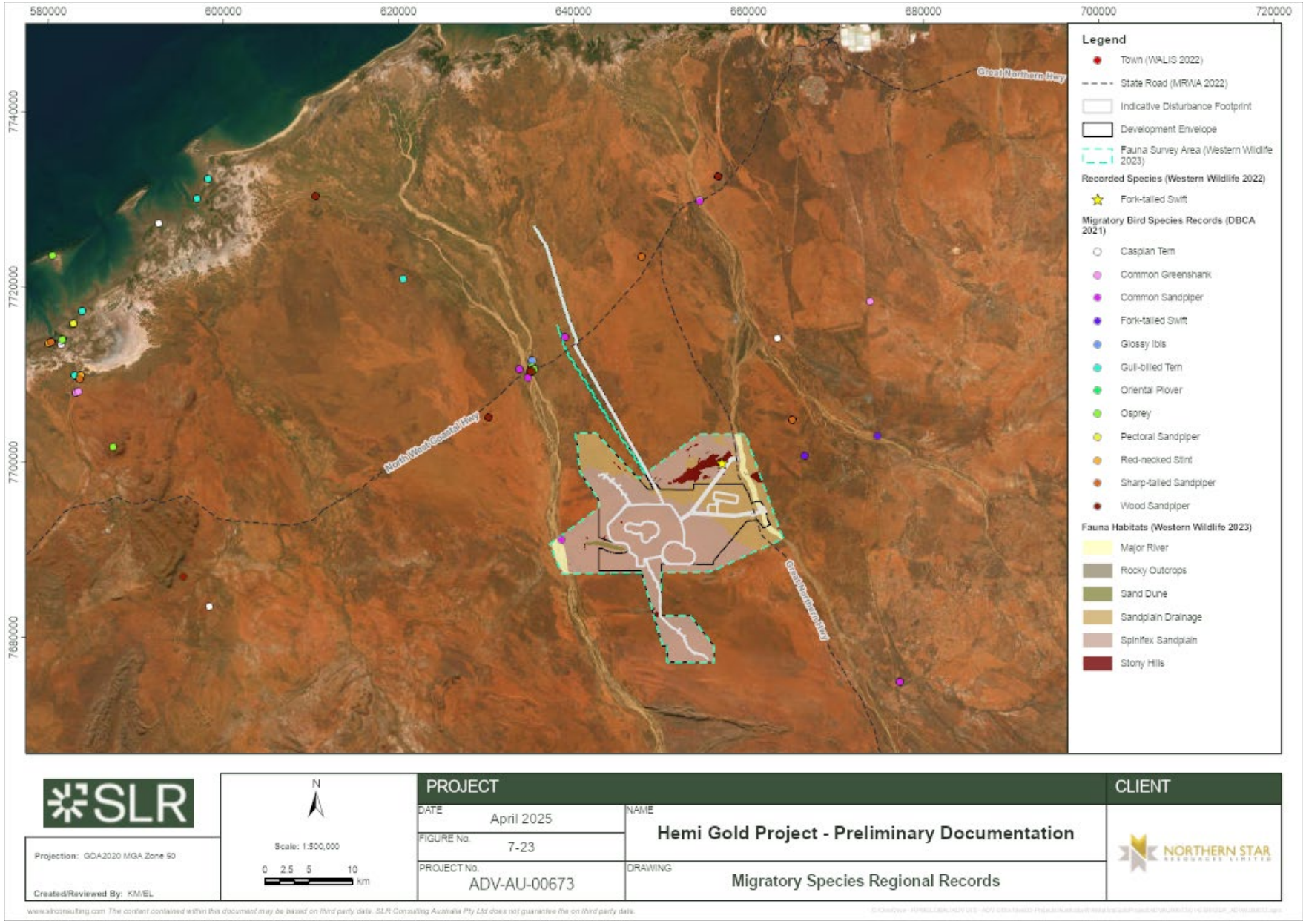
Areas used most by migratory shorebirds in Australia usually comprise networks of foraging and roosting habitats, mostly in coastal areas (DoEE, 2017).

Migratory species that potentially occur in the area of the Proposed Action and the subject of this assessment include:

- Common Sandpiper (*Actitis hypoleucos*)
- Common Greenshank (*Tringa nebularia*)
- Fork-tailed Swift (*Apus pacificus*)
- Oriental Plover (*Charadrius veredus*)
- Wood Sandpiper (*Tringa glareola*)
- Red-necked Stint (*Calidris ruficollis*)
- Sharp-tailed Sandpiper (*Calidris acuminata*)
- Osprey (*Pandion haliaetus*)
- Pectoral Sandpiper (*Calidris melanotos*)
- Gull-billed Tern (*Gelochelidon nilotica*)
- Caspian Tern (*Hydroprogne caspia*)
- Glossy Ibis (*Plegadis falcinellus*)

Regional records of these species are provided in Figure 7-23.

Figure 7-23: Migratory Species Regional Records



7.3.2 Relevant Policy and Guidance

Relevant Commonwealth policy and guidance for Migratory species, which have informed studies, planning and development of the Proposed Action are summarised in Table 7-30.

Table 7-30: Relevant Commonwealth Policy and Guidance for Migratory Species

Author	Year of Publication	Policy/ Guidance
CoA	2013	EPBC Act Significant Impact Guideline 1.1.
	2015	Draft referral guideline for 14 birds listed as migratory species under the EPBC Act
	2015	Wildlife Conservation Plan for Migratory Shorebirds
	2017	EPBC Act Policy Statement 3.2.1 – Industry Guidelines for avoiding, assessing, and mitigating impacts on EPBC Act listed migratory shorebird species

7.3.3 Habitat

The Matters of National Environmental Significance - Significant impact guidelines 1.1 – *Environment Protection and Biodiversity Conservation Act 1999* (CoA, 2013) states that important habitat for migratory species is:

- Habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, and/or
- Habitat that is of critical importance to the species at particular life-cycle stages, and/or
- Habitat utilised by a migratory species which is at the limit of the species range, and/or
- Habitat within an area where the species is declining.

Habitat preferences for each species are discussed in Table 7-31, and populations known or likely to occur in the Development Envelope are discussed in Table 7-33.

Coastal and inland habitats consist of:

- Coastal wetlands, estuaries, mudflats, rocky inlets, reefs and sandy beaches often supporting mangroves.
- Inland wetlands, floodplains and grassland areas, often with ephemeral water sources.

Based on the above criteria, potential habitats within the Development Envelope are not considered important for the listed migratory species.

Wetlands that are considered to be nationally important based on certain criteria, such as providing important habitat for animal taxa at a vulnerable stage in their life cycles, are listed in the Directory of Important Wetlands. The closest wetland included in this Directory to the Development Envelope is the Leslie (Port Hedland) Saltfields system and is situated approximately 50 km northeast of the Proposed Action (Figure 7-24). This wetland comprises a large saltfield with fringing coastal flats, tidal creeks and mudflats between the saltfield and the Indian Ocean (DCCEEW, 2019). The site is recognised as a major migration stopover for shorebirds in the EAAF.

The De Grey River is located approximately 18 km east of the Leslie (Port Hedland) Saltfields and is notable as it contains the largest number of permanent river pools (30), in addition to the largest shallow estuary, in north-western Australia. It is a significant drought refuge for nearby fauna, and an excellent inland wetland that contains preferred vegetation and habitat for non-coastal migratory species (DCCEEW, 2019).

Both the sites are nationally recognised wetlands of importance and provide favourable conditions for migratory species that are not present in the Turner or Yule Rivers.

Additional guidance on internationally and nationally important habitat is in the Shorebird Policy (DoEE, 2017). This identifies an area as internationally important if it supports:

- 1% of the population; or
- At least 20,000 water birds.

Nationally important habitat is defined as habitat that supports:

- 0.1% of the flyway population of a species.
- 2,000 migratory shorebirds; or
- 15 migratory shorebird species.

The flyway population estimates and criteria for seven of the 12 migratory bird species is shown in Table 7-32.

Figure 7-24: Regionally Significant Areas for Migratory Bird Species

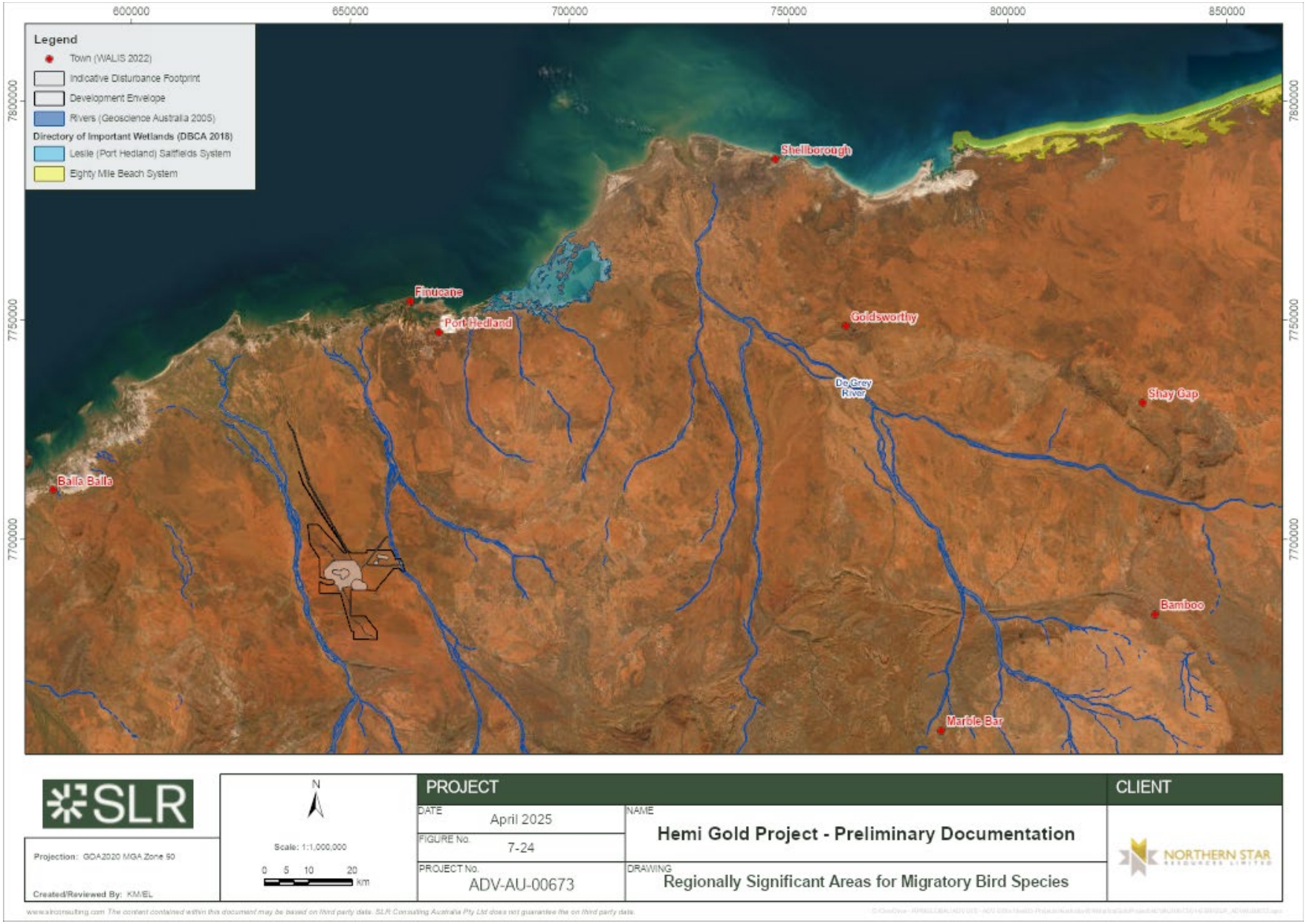


Table 7-31: Habitat Assessment

Species	Is Habitat Within the Development Envelope of Critical Importance to the Species?	Does Potential Habitat Within the Development Envelope Support an Ecologically Significant Proportion of the Population of the Species?	Is Potential Habitat within the Development Envelope at the Limit of the Species Range?	Is the Development Envelope within an Area Where the Species is Declining?
Fork-tailed Swift (*Apus pacificus*)	The species has a widespread distribution from coastal areas to inland plains, mostly occurring over dry or open habitats including riparian woodland, low scrub or saltmarsh. It may also be found in treeless grassland and sandplains with spinifex. Found in the north of the Pilbara region (DCCEEW, 2024b). Though the species was recorded in the Western Wildlife survey, it is predominantly aerial and has no particular foraging or roosting habitat, therefore terrestrial habitats in the area are unlikely to be of importance to this species. Habitat within the Development Envelope is not of critical importance to the species.	The species is a non-breeding visitor with a wide distribution and no particular foraging or roosting habitat. In addition, the species is almost exclusively aerial, therefore terrestrial habitats are unlikely to be utilised. The Development Envelope is also unlikely to support a nationally or internationally important population.	The species is widely distributed and almost exclusively aerial (DCCEEW, 2024b). The Development Envelope is not located at the limit of the species' range.	The species was recorded in the 2021-2022 Western Wildlife survey outside of the Development Envelope, and there are 11 records from the WA DBCA's Threatened and Priority Species Database. It can be concluded that the species does not regularly inhabit the Development Envelope, and an important population has not utilised the Development Envelope or surrounding area, and it is unlikely to do so in the future. The Development Envelope is not an area where the species is declining.
Oriental Plover (*Charadrius veredus*)	Preferred habitat for the Oriental Plover consists of dry grassland and open plains. Foraging habitat includes short grasses, hard stony bare ground, beaches and mudflats. Roosting habitat consists of dry, open areas and sometimes soft mud or shallow water of beaches and tidal mudflats. (DCCEEW, 2024f). These types of habitats are not found within the Development Envelope. Habitat within the Development Envelope is not of critical importance to the species.	The species is a non-breeding visitor to Australia There is no preferred habitat within the Development Envelope, and suitable habitat abundant outside of it. There has only been one other record of the species approximately 40 km from the area. An internationally or nationally important population of this species is also unlikely to occur (Western Wildlife, 2023). The species has not been recorded within the Development Envelope.	The species occurs in both coastal and inland areas, with most records along the northern and north-western coasts of Australia (DCCEEW, 2024f). The Development Envelope is not located at the limit of the species' range.	The species has not been recorded within the Development Envelope, and there is only one record from 40 km away in the WA DBCA's Threatened and Priority Species Database. It can be concluded that the species does not regularly inhabit the Development Envelope, and an important population has not utilised the Development Envelope or surrounding area, and it unlikely to do so in the future. The Development Envelope is not an area where the species is declining.
Sharp-tailed Sandpiper (*Calidris acuminata*)	Found mostly in coastal settings, the Sharp-tailed Sandpiper is likely to be a visitor to waterholes in the study area. The species utilises ephemeral wetlands during the wet season and occupy coastal mudflats during the dry season. Foraging occurs at the edge of the water of wetlands or intertidal mudflats, either on bare wet mud or sand, or in shallow water. Roosting habitat consists of edges of wetlands, on wet open mud or sand, grasses or saltmarsh (DCCEEW, 2024c). More suitable habitat is abundant outside of the Development Envelope. Habitat within the Development Envelope is not of critical importance to the species.	Habitats in the area are not likely to regularly support more than a few individuals and are unlikely to support a nationally or internationally important population. (Western Wildlife, 2023). Suitable habitat is abundant outside of the Development Envelope, and the Proposed Action is unlikely to impact a population of the species. The species has not been recorded within the Development Envelope.	Australian distribution is widespread across both inland and coastal, saline and freshwater areas (DCCEEW, 2024c). The Development Envelope is not located at the limit of the species' range.	The species has not been recorded within the Development Envelope, and there are only nine records within 20 km in the WA DBCA's Threatened and Priority Fauna Database. It can be concluded that the species does not regularly inhabit the Development Envelope, and an important population has not utilised the Development Envelope or surrounding area, and it unlikely to do so in the future. The Development Envelope is not an area where the species is declining.
Pectoral Sandpiper (*Calidris melanotos*)	The Pectoral Sandpiper prefers shallow fresh to saline wetlands. It is found in coastal and near coastal habitats and may occasionally occur further inland near river pools, wetlands and floodplains (DCCEEW, 2024d). Foraging occurs in shallow water or soft mud at the edge of wetlands. The species may be a visitor to waterholes on Major Rivers. More suitable habitat is abundant outside of the Development Envelope. Habitat within the Development Envelope is not of critical importance to the species.	It is unlikely for this habitat to be of importance to the Pectoral Sandpiper due to its preference for coastal habitats, lack of records from the study area, and distance from known distribution. Habitats in the area are not likely to regularly support more than a few individuals and are unlikely to support a nationally or internationally important population (Western Wildlife, 2023). The species has not been recorded within the Development Envelope.	Species distribution occurs across all Australian States and territories (DCCEEW, 2024d). The Development Envelope is not located at the limit of the species' range.	The species was not recorded within the Development Envelope, and there is only one record from 60 km away in the WA DBCA's Threatened and Priority Fauna Database. It can be concluded that the species does not regularly inhabit the Development Envelope, and an important population has not utilised the Development Envelope or surrounding area, and it unlikely to do so in the future. The Development Envelope is not an area where the species is declining.

Species	Is Habitat Within the Development Envelope of Critical Importance to the Species?	Does Potential Habitat Within the Development Envelope Support an Ecologically Significant Proportion of the Population of the Species?	Is Potential Habitat within the Development Envelope at the Limit of the Species Range?	Is the Development Envelope within an Area Where the Species is Declining?
Red-necked Stint (*Calidris ruficollis*)	Usually found in coastal habitats, though they can also occur in ephemeral or permanent wetlands (DCCEEW, 2024e). Likely to be a visitor to waterholes in the study area. Foraging habitat consists of bare wet mud on intertidal mudflats or sandflats, or in very shallow water. Away from coastal areas, roosting occurs on claypans, close-cropped grass, or muddy areas (DCCEEW, 2024e). Habitats are not likely to regularly support more than a few individuals, and there is abundant, more suitable, habitat outside of the Development Envelope. Therefore, the importance of this potential habitat is not high. Habitat within the Development Envelope is not of critical importance to the species.	The species prefers coastal habitats but is likely to be a non-breeding visitor to some habitats within the Development Envelope. Habitats in this area are unlikely to support a more than a few individuals at a time and are unlikely to support either a nationally or internationally important population (Western Wildlife, 2023). The species has not been recorded within the Development Envelope.	The species is distributed along most of the Australian coastline, with large occurrences on the Victorian and Tasmanian coasts (DCCEEW, 2024e). The Development Envelope is not located at the limit of the species' range.	The species has not been recorded within the Development Envelope, and there are 11 records of this species within 20 km of the study area in the WA DBCA's Threatened and Priority Fauna Database. It can be concluded that the species does not regularly inhabit the Development Envelope, and an important population has not utilised the Development Envelope or surrounding area, and it unlikely to do so in the future. The Development Envelope is not an area where the species is declining.
Wood Sandpiper (*Tringa glareola*)	In the Pilbara region, the species inhabits inland freshwater wetlands, with foraging occurring at the edges of wetlands, among open scattered aquatic vegetation, or in clear shallow water (DCCEEW, 2024k). The species is very likely to be a non-breeding summer visitor to waterholes on Major Rivers (Western Wildlife, 2023). There is abundant, more suitable, habitat outside of the Development Envelope, and habitats within the Development Envelope are unlikely to support more than a few individuals. Therefore, the importance of these habitats is low. Habitat within the Development Envelope is not of critical importance to the species.	Habitats are not likely to regularly support more than a few individuals and are unlikely to support either a nationally or internationally important population (Western Wildlife, 2023). The species has not been recorded within the Development Envelope.	Australian Distribution is scattered along the coastlines of all States and Territories (DCCEEW, 2024k). The Development Envelope is not located at the limit of the species' range.	The species has not been recorded within the Development Envelope, and there are six records of this species within 20 km of the study area in the WA DBCA's Threatened and Priority Fauna Database. It can be concluded that the species does not regularly inhabit the Development Envelope, and an important population has not utilised the Development Envelope or surrounding area, and it unlikely to do so in the future. The Development Envelope is not an area where the species is declining.
Common Greenshank (*Tringa nebularia*)	The species is found in sheltered coasts, mudflats, inland wetlands and saltmarshes. It can also be found in ephemeral wetlands, including waterholes and inundated claypans and salt flats. Foraging habitat consists of wetlands, soft mud on mudflats, in channels or in shallows around edges of water with mangroves or other sparse fringing vegetation. Roosting habitat consists of wetlands, shallow pools, sandbanks, muddy islets and slightly elevated rocks (DCCEEW, 2024l). Habitats are not likely to regularly support more than a few individuals, and there is abundant, more suitable, habitat outside of the Development Envelope. Therefore, the importance of this potential habitat is low. Habitat within the Development Envelope is not of critical importance to the species.	Habitats are not likely to regularly support more than a few individuals and are unlikely to support either a nationally or internationally important population (Western Wildlife, 2023), and there is abundant, more suitable, habitat outside of the Development Envelope. Therefore, the importance of this potential habitat is low. The species has not been recorded within the Development Envelope.	The Common Greenshank is a non-breeding visitor to Australia, with a wide distribution over all states and territories s (DCCEEW, 2024l). The Development Envelope is not located at the limit of the species' range.	The species has not been recorded within the Development Envelope, and there are 21 records of this species within 20 km of the study area in the WA DBCA's Threatened and Priority Fauna Database. It can be concluded that the species does not regularly inhabit the Development Envelope, and an important population has not utilised the Development Envelope or surrounding area, and it unlikely to do so in the future. The Development Envelope is not an area where the species is declining.

Species	Is Habitat Within the Development Envelope of Critical Importance to the Species?	Does Potential Habitat Within the Development Envelope Support an Ecologically Significant Proportion of the Population of the Species?	Is Potential Habitat within the Development Envelope at the Limit of the Species Range?	Is the Development Envelope within an Area Where the Species is Declining?
Common Sandpiper (*Actitis hypoleucos*)	The Common Sandpiper prefers coastal and inland wetlands, however, is likely to occur on waterholes along the Yule and Turner Rivers (Western Wildlife, 2023). Foraging habitat consists of shallow water and bare soft mud, while roosting occurs on rocks, or in roots or branches of vegetation, especially mangroves (DCCEEW, 2024a). Habitats are not likely to regularly support more than a few individuals, and there is abundant, more suitable, habitat outside of the Development Envelope. Therefore, the importance of this potential habitat is low. Habitat within the Development Envelope is not of critical importance to the species.	Habitats are not likely to regularly support more than a few individuals and are unlikely to support either a nationally or internationally important population (Western Wildlife, 2023). There is abundant, more suitable, habitat outside of the Development Envelope. Therefore, the importance of this potential habitat is low. The species has not been recorded within the Development Envelope.	The species has a broad distribution across all Australian coastlines (DCCEEW, 2024a). The Development Envelope is not located at the limit of the species' range	The species has not been recorded within the Development Envelope, and there are 16 records of this species within 20 km of the study area in the WA DBCA's Threatened and Priority Fauna Database. It can be concluded that the species does not regularly inhabit the Development Envelope, and an important population has not utilised the Development Envelope or surrounding area, and it is unlikely to do so in the future. The Development Envelope is not an area where the species is declining.
Eastern Osprey (*Pandion haliaetus*)	The Osprey mainly nests on offshore islands, foraging in sheltered seas and in the lower reaches of rivers. Though they prefer coastal habitats, they occasionally travel inland along major rivers (DCCEEW, 2024i). The species is likely to be a foraging visitor to waterholes on Major Rivers, however the pools along the rivers are not likely to be important foraging habitat. The study area lacks breeding habitat (Western Wildlife, 2023). There is abundant, more suitable, habitat outside of the Development Envelope. Therefore, the importance of this potential habitat is low. Habitat within the Development Envelope is not of critical importance to the species.	The Major Rivers habitat is not likely to regularly support more than a few individuals and is unlikely to support either a nationally or internationally important population (Western Wildlife, 2023).	The species has a very limited distribution along the coastline of Australia. Nesting occurs on offshore islands, and other preferred habitat consists of coastal or near coastal areas (DCCEEW, 2024i). The Development Envelope is not located at the limit of the species' range	The species has not been recorded within the Development Envelope, and there are 12 records of this species within 20 km of the study area in the WA DBCA's Threatened and Priority Fauna Database. It can be concluded that the species does not regularly inhabit the Development Envelope, and an important population has not utilised the Development Envelope or surrounding area, and it is unlikely to do so in the future. The Development Envelope is not an area where the species is declining.
Gull-billed Tern (*Gelochelidon nilotica*)	The species prefers sheltered seas and estuaries, as well as inundated inland claypans and salt lakes (Johnstone and Storr, 1998). It may be a foraging visitor to waterholes on Major Rivers. The Major Rivers habitat is not likely to regularly support more than a few individuals, and there is abundant, more suitable, habitat outside of the Development Envelope. Therefore, the importance of this potential habitat is low. Habitat within the Development Envelope is not of critical importance to the species.	The Major Rivers habitat is not likely to regularly support more than a few individuals and is unlikely to support either a nationally or internationally important population (Western Wildlife, 2023).	The species has a broad distribution across all Australian coastlines (DCCEEW, 2024g). The Development Envelope is not located at the limit of the species' range	The species has not been recorded within the Development Envelope, and there are 16 records of this species within 20 km of the study area in the WA DBCA's Threatened and Priority Fauna Database. It can be concluded that the species does not regularly inhabit the Development Envelope, and an important population has not utilised the Development Envelope or surrounding area, and it is unlikely to do so in the future. The Development Envelope is not an area where the species is declining.
Caspian Tern (*Hydroprogne caspia*)	The species is found on sheltered sandy and muddy shores, also occurring on near coastal or inland terrestrial wetlands that are either fresh or saline, especially lakes (including ephemeral lakes), waterholes, reservoirs, rivers and creeks (DCCEEW, 2024h). This species potentially occurs as a non-breeding visitor to waterholes on the Turner and Yule River on occasion. The Major Rivers habitat is not likely to regularly support more than a few individuals, and there is abundant, more suitable, habitat outside of the Development Envelope. Therefore, the importance of this potential habitat is low. Habitat within the Development Envelope is not of critical importance to the species.	The Major Rivers habitat is not likely to regularly support more than a few individuals, or a nationally or internationally important population of the species.	The species has a widespread occurrence across all Australian states and territories, both coastal and inland (DCCEEW, 2024h). The Development Envelope is not located at the limit of the species' range	The species has not been recorded within the Development Envelope, and there are 32 records of this species within 20 km of the study area in the WA DBCA's Threatened and Priority Fauna Database. It can be concluded that the species does not regularly inhabit the Development Envelope, and an important population has not utilised the Development Envelope or surrounding area, and it unlikely to do so in the future. The Development Envelope is not an area where the species is declining.

Species	Is Habitat Within the Development Envelope of Critical Importance to the Species?	Does Potential Habitat Within the Development Envelope Support an Ecologically Significant Proportion of the Population of the Species?	Is Potential Habitat within the Development Envelope at the Limit of the Species Range?	Is the Development Envelope within an Area Where the Species is Declining?
Glossy Ibis (*Plegadis falcinellus*)	The Glossy Ibis may be an occasional foraging visitor to waterholes on Yule and Turner Rivers. Preferred habitat for both foraging and breeding includes freshwater marshes, lagoons, floodplains, swamps, sewage ponds, cultivated areas under irrigation. Breeding habitat may also include mangroves. Roosting habitat consists of trees and shrubs, usually near water bodies. The Major Rivers habitat is not likely to regularly support more than a few individuals, and there is abundant, more suitable, habitat outside of the Development Envelope. Breeding and foraging habitat is not present within the Development Envelope. Habitat within the Development Envelope is not of critical importance to the species.	The Major Rivers habitat is not likely to regularly support more than a few individuals, or a nationally or internationally important population of the species.	Australian Distribution is limited to east of the Kimberley in Western Australia, including irregular distribution throughout the rest of the state, and Eyre Peninsula in South Australia (DCCEEW, 2024j). The Development Envelope is not located at the limit of the species' range	The species has not been recorded within the Development Envelope, and there is only one record of this species within 20 km of the study area in the WA DBCA's Threatened and Priority Fauna Database. It can be concluded that the species does not regularly inhabit the Development Envelope, and an important population has not utilised the Development Envelope or surrounding area, and it is unlikely to do so in the future. The Development Envelope is not an area where the species is declining.

Table 7-32: Flyway Population Estimates (Hansen et al., 2016)

Species	Flyway Population Estimate	1% Flyway Population Criterion	0.1% Population Criterion
Oriental Plover	230,000	2,300	230
Common Sandpiper	190,000	1,900	190
Sharp-tailed Sandpiper	85,000	850	85
Pectoral Sandpiper	1,220,000 – 1,930,000	12,200	1,220
Red-necked Stint	475,000	4,750	475
Wood Sandpiper	130,000	1,300	130
Common Greenshank	110,000	1,100	110
Osprey	Unknown	Unknown	Unknown
Fork-tailed Swift			
Gull-billed Tern			
Caspian Tern			
Glossy Ibis			

The habitat in the Development Envelope does not meet any of the above criteria as ecologically significant populations of migratory birds were not recorded during any of the fauna surveys.

7.3.4 Threats

The Wildlife Conservation Plan for Migratory Shorebirds (CoA, 2015) details the following threats to migratory birds:

- Habitat loss due to clearing.
- Habitat modification via pollution, invasive species and altered hydrological regimes.
- Anthropogenic disturbance due to aircraft over-flights, industrial operations, construction, artificial lighting, and recreational activities such as fishing, off-road driving, water traffic and domestic animals.
- Climate variability and change that is expected to result in increased temperatures, rising sea levels and a drying trend and more frequent, extreme climate events.
- Harvesting of shorebird prey, e.g. fish, molluscs, seaweed.
- Fisheries by-catch, i.e. birds drowning in fishing nets.
- Hunting – although prohibited in Australia, illegal hunting may still occur.

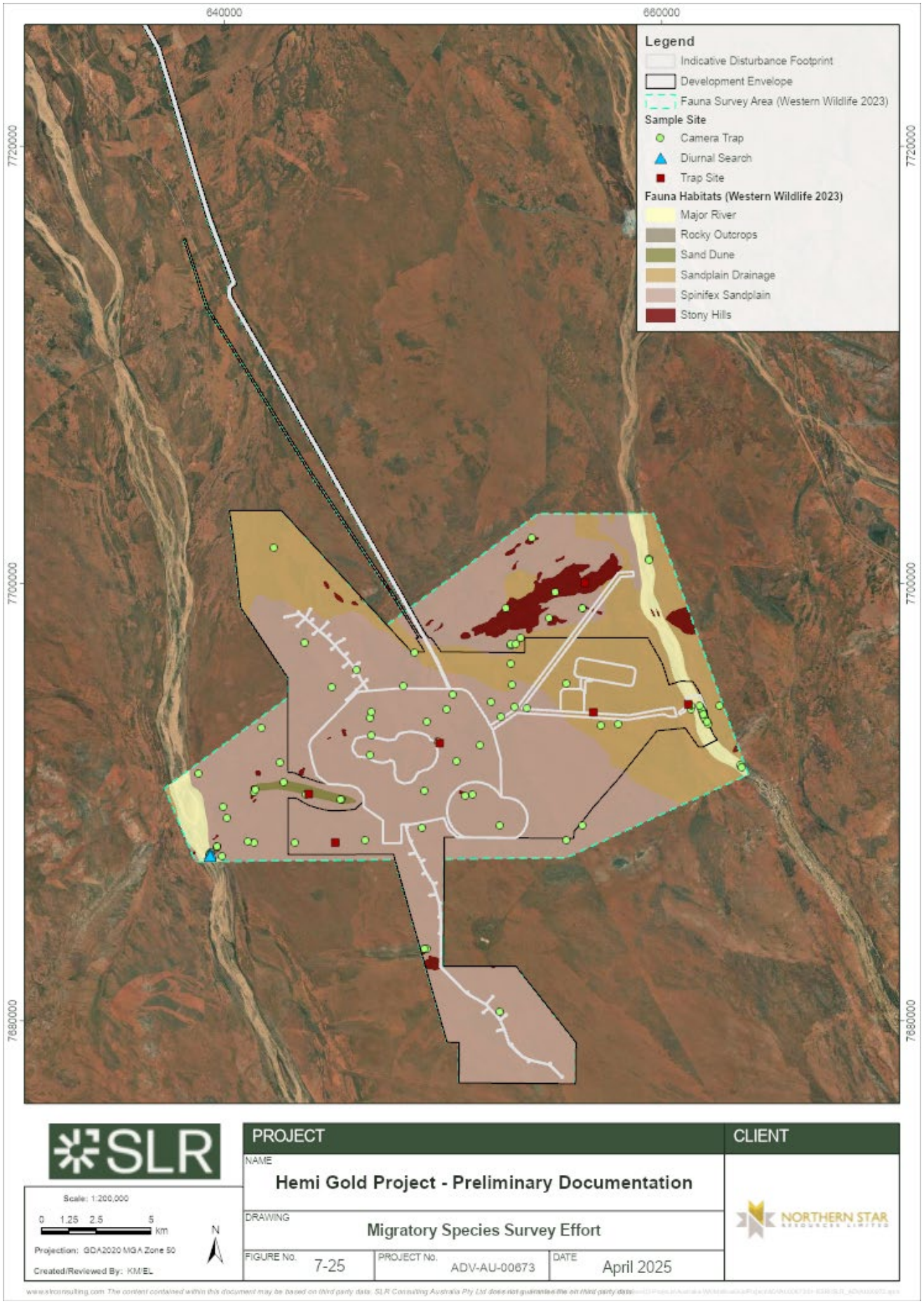
7.3.5 Survey Effort

Detailed fauna surveys for the Development Envelope were undertaken in September 2021 and March 2022 in accordance with appropriate guidelines for migratory species. Though the Western Wildlife fauna survey was not targeted for migratory species, it did follow the Survey Guidelines for Australia's Threatened Birds (DEWHA, 2010). An extensive literature review was undertaken for migratory species in the surrounding area, utilising publications, database searches, and results of fauna survey reports from Projects within 50 km of the study area.

Western Wildlife undertook bird surveys at each trapping site during the September and March phases of the survey. Surveys were undertaken within 300 m of each site and concurrently with morning trap checks between sunrise and 9 AM. Birds were recorded if seen or heard, and opportunistically throughout the study area. The survey effort across the survey area for birds is provided in Figure 7-25.

The survey guideline used for migratory shorebird species was EPBC Act Policy Statement 3.21 - Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species (DoEE, 2017).

Figure 7-25: Migratory Species Survey Effort



7.3.6 Local Population

The migratory species that are known to occur or likely to occur in the Development Envelope are discussed in Table 7-33.

Table 7-33: Local Population Assessment

Species	Species Abundance and Distribution	Likelihood of Occurrence
Fork-tailed Swift (*Apus pacificus*)	This species is a non-breeding visitor to all states and territories in Australia (DCCEEW, 2024b). It was recorded in the 2021-2022 Western Wildlife survey, outside of the Development Envelope. There are 11 records from the surrounding area on the WA DBCA's Threatened and Priority Species Database. It is a largely aerial species utilising a variety of habitats (Western Wildlife, 2023). A search using DCCEEW's Protected Matters Search Tool by Western Wildlife (2023) states that the species or species habitat is likely to occur within a 5 km buffer zone of the Development Envelope.	**Recorded** Likely to be a regular summer visitor in small numbers, but as it is a largely aerial species in Australia it is unlikely to be affected by changes to the Development Envelope.
Oriental Plover (*Charadrius veredus*)	This species is a non-breeding visitor to both coastal and inland areas of Australia. Most records have been in northern and north-western Australia (DCCEEW, 2024f). There is only one WA DBCA record of this species in the vicinity of the study area, approximately 40 km southeast of the Proposed Action, from 1999. A search using DCCEEW's Protected Matters Search Tool by Western Wildlife (2023) states that the species or species habitat may occur within a 5 km buffer zone of the Development Envelope.	**Possible Occurrence** May be a non-breeding summer visitor to open plains and recently burnt areas. There are very few records of this species in the region. An ecologically important proportion of the population is not likely to be affected by the Proposed Action.
Sharp-tailed Sandpiper (*Calidris acuminata*)	This species is a non-breeding visitor to the entirety of Australia including offshore islands. It is estimated that 85,000 individuals occupy the East Asian-Australasian Flyway, with 91% of this population occurring in Australia and New Zealand during the non-breeding season (DCCEEW, 2024c). There are nine records of this species within 20 km of the study area on the WA DBCA's Threatened and Priority Fauna Database, including one record from the Yule River in 2007 (Western Wildlife, 2023). A search using DCCEEW's Protected Matters Search Tool by Western Wildlife (2023) states that the species or species habitat may occur within a 5 km buffer zone of the Development Envelope.	**Potential Occurrence** Non-breeding summer visitor to waterholes on Major Rivers, possibly also to claypans in the Sandplain Drainage habitat. These habitats are not likely to regularly support more than a few individuals.

Species	Species Abundance and Distribution	Likelihood of Occurrence
Pectoral Sandpiper (*Calidris melanotos*)	This species is a non-breeding visitor. Australian distribution mainly occurs along the east coast, with some slightly inland records. The species is sparsely recorded in WA and Tasmania (DCCEEW, 2024d). There is a single record of this species on the WA DBCA's Threatened and Priority Fauna Database, from Forestier Bay (approximately 60 km to the west of the Development Envelope) in 2013 (Western Wildlife, 2023). A search using DCCEEW's Protected Matters Search Tool by Western Wildlife (2023) states that the species or species habitat may occur within a 5 km buffer zone of the Development Envelope.	**Possible Occurrence** May be a non-breeding summer visitor to waterholes on Major Rivers, possibly also to claypans in the Sandplain Drainage habitat. These habitats are not likely to regularly support more than a few individuals.
Red-necked Stint (*Calidris ruficollis*)	This species is distributed along most of the Australian coastline with large densities on the Victorian and Tasmanian coasts. It has been recorded in all coastal regions and found inland in all states when conditions are suitable (DCCEEW, 2024e). The Australian non-breeding population was estimated at 475,000 (Hansesn et al., 2016). There are eleven records of this species within 20 km of the study area on the WA DBCA's Threatened and Priority Fauna Database including on the Yule River in 2005 (Western Wildlife, 2023) . However, the search using the Protected Matters Search Tool undertaken by Western Wildlife (2023) did not yield results for neither the species nor species habitat to occur within a 5 km radius of the Development Envelope.	**Potential Occurrence** Non-breeding summer visitor to waterholes on Major Rivers, possibly also to claypans in the Sandplain Drainage habitat. These habitats are not likely to regularly support more than a few individuals.
Wood Sandpiper (*Tringa glareola*)	The Australian distribution of the Wood Sandpiper is very sparse, with the majority of records having occurred in north-western Australia. It is estimated that 130,000 individuals occupy the East Asian-Australasian Flyway (DCCEEW, 2024k). There are six records of this species within 20 km of the study area on the WA DBCA's Threatened and Priority Fauna Database including from the Yule River in 2005 (Western Wildlife, 2023). However, the search using the Protected Matters Search Tool undertaken by Western Wildlife (2023) did not yield results for neither the species nor species habitat to occur within a 5 km radius of the Development Envelope.	**Likely Occurrence** Non-breeding summer visitor to waterholes on Major Rivers, possibly also to claypans in the Sandplain Drainage habitat. These habitats are not likely to regularly support more than a few individuals.
Common Greenshank (*Tringa nebularia*)	The Common Greenshank is a non-breeding visitor to Australia, with a wide distribution over all states and territories. The East Asian-Australasian Flyway population is estimated to be at 110,000 of which 18,000 – 19,000 spend the non-breeding season in Australia (DCCEEW, 2024l). There are 21 records of this species within 20 km of the study area on the WA DBCA's Threatened and Priority Fauna Database, including records on the Yule River from 2005 (Western Wildlife, 2023). However, the search using the Protected Matters Search Tool undertaken by Western Wildlife (2023) did not yield results for either the species or the species' habitat to occur within a 5 km radius of the Development Envelope.	**Likely Occurrence** Non-breeding summer visitor to waterholes on Major Rivers, possibly also to claypans in the Sandplain Drainage habitat. These habitats are not likely to regularly support more than a few individuals.

Species	Species Abundance and Distribution	Likelihood of Occurrence
Common Sandpiper (*Actitis hypoleucos*)	Found along all coastlines of Australia and in many areas inland, the Common Sandpiper is widespread in small numbers. The population when in Australia is concentrated in northern and western Australia (DCCEEW, 2024a). There are 16 records of this species within 20 km of the study area on DBCA's Threatened and Priority Fauna Database, with many of these records from the Yule River, including one record from Jelliabidina Pool in 2002. The species is likely to be a regular visitor in small numbers, but the area is unlikely to support an ecologically important population (Western Wildlife, 2023). A search using DCCEEW's Protected Matters Search Tool by Western Wildlife (2023)states that the species or species habitat may occur within a 5 km buffer zone of the Development Envelope.	**Likely Occurrence** Non-breeding summer visitor to waterholes on Major Rivers, possibly also to claypans in the Sandplain Drainage habitat. These habitats are not likely to regularly support more than a few individuals.
Eastern Osprey (*Pandion haliaetus*)	The Eastern Osprey has a limited distribution within Australia, only found within a small stretch of habitat along all coastlines with the exception of Victoria and Tasmania (Australian Geographic, 2024a). There are 12 records of this species within 20 km of the study area on DBCA's Threatened and Priority Fauna Database including records on the Yule River from 1999 and 2000 (Western Wildlife, 2023). A search using DCCEEW's Protected Matters Search Tool by Western Wildlife (2023) states that the species or species habitat is likely to occur within a 5 km buffer zone of the Development Envelope.	**Potential Occurrence** Foraging visitor to waterholes on Major Rivers. The study area lacks breeding habitat and river pools are not likely to be important foraging habitat for this species.
Gull-billed Tern (*Gelochelidon nilotica*)	The distribution of Gull-billed Tern is poorly known. There are 16 records of this species within 20 km of the study area on DBCA's Threatened and Priority Fauna Database including a record from the Yule River in 2004. Habitat is unlikely to be important for this species (Western Wildlife, 2023). However, the search using the Protected Matters Search Tool undertaken by Western Wildlife (2023) did not yield results for either the species or the species' habitat to occur within a 5 km radius of the Development Envelope.	**Potential Occurrence** Foraging visitor to waterholes on Major Rivers. No breeding habitat present. The habitats in the study area are unlikely to be important for the Gull-billed Tern.
Caspian Tern (*Hydroprogne caspia*)	The Caspian Tern is a non-breeding visitor to Australia. It is widespread around the coast of Australia, with varying distribution in inland areas (DCCEEW, 2024h). There are 32 records of this species within 20 km of the study area on DBCA's Threatened and Priority Fauna Database, including records from the Yule River in 1999, 2004 and 2007 (Western Wildlife, 2023). However, the search using the Protected Matters Search Tool undertaken by Western Wildlife (2023) did not yield results for either the species or the species' habitat to occur within a 5 km radius of the Development Envelope.	**Likely Occurrence** Foraging visitor to waterholes on Major Rivers. No breeding habitat present.

Species	Species Abundance and Distribution	Likelihood of Occurrence
Glossy Ibis (*Plegadis falcinellus*)	Australian distribution of the Glossy Ibis is limited, with the species generally found east of the Kimberley in Western Australia, and at the Eyre Peninsula in South Australia (DCCEEW, 2024j). There is a single record of this species within 20 km of the study area on DBCA's Threatened and Priority Fauna Database, from the Yule River in 2004 (Western Wildlife, 2023). However, the search using the Protected Matters Search Tool undertaken by Western Wildlife (2023) did not yield results for either the species or the species' habitat to occur within a 50 km radius of the Development Envelope.	**Potential Occurrence** Occasional foraging visitor to waterholes on Major Rivers. No breeding habitat present.

7.3.7 Potential Impacts and Management

The potential impacts on migratory bird species and the management measures Northern Star will implement are presented in Table 7-34.

Table 7-34: Migratory Bird Species Potential Impacts and Management Measures

Potential Impact	Potentially Impacted Migratory Species	Extent or Likelihood	Mitigation Measures
Habitat Loss.	• Fork-tailed Swift • Oriental Plover • Sharp-tailed Sandpiper • Pectoral Sandpiper • Red-necked Stint • Wood Sandpiper • Common Greenshank • Common Sandpiper • Gull-billed Tern	• 800 ha (Sandplain Drainage) • 10 ha (Major River)	• Limiting clearing to the minimum required. • Using previously disturbed areas to the extent possible. • Exclusion of the Yule River from the Development Envelope. • Limiting clearing in the Turner River to low-impact disturbance for the dewatering outfall.
Increase in predator species.	• Fork-tailed Swift • Oriental Plover • Sharp-tailed Sandpiper • Pectoral Sandpiper • Red-necked Stint • Wood Sandpiper • Common Greenshank • Common Sandpiper • Eastern Osprey • Gull-billed Tern • Caspian Tern • Glossy Ibis	Unlikely	• Implementing best practice waste management measures. • Limiting the creation of permanent water bodies. • Implementing best practice waste management measures. • Ongoing feral fauna monitoring. • Control measures as required. • Personnel prohibited from feeding of feral fauna. • Prohibit pets on site.

Potential Impact	Potentially Impacted Migratory Species	Extent or Likelihood	Mitigation Measures
Direct mortality from vehicle strikes.	• Fork-tailed Swift • Oriental Plover • Sharp-tailed Sandpiper • Pectoral Sandpiper • Red-necked Stint • Wood Sandpiper • Common Greenshank • Common Sandpiper • Eastern Osprey • Gull-billed Tern • Caspian Tern • Glossy Ibis	Unlikely	• Implement speed limits of 80 and 60 km/h on sealed and unsealed roads for mine vehicles within the Development Envelope. • Mine vehicles will be required to stay on existing roads and tracks. • Personnel hooning and misadventure will be prohibited. • Sightings and incidents will be reported. • Personnel will be educated on conservation significant fauna.
Introduction and spread of weed species.	• Oriental Plover	Unlikely	• Weed control measures. • Progressive rehabilitation of disturbed areas where feasible.
Surplus mine water discharge causing a temporal change in flow characteristics of the Turner River.	• Sharp-tailed Sandpiper • Pectoral Sandpiper • Red-necked Stint • Wood Sandpiper • Common Greenshank • Common Sandpiper • Eastern Osprey • Gull-billed Tern • Caspian Tern • Glossy Ibis	Modelled wetting front	• Increase in productive available habitat during first three years of discharge. • Quality of water discharged only within approved limits. • Monitoring of vegetation health.

7.3.8 Significance Test

An assessment of the Proposed Action against the significance impact criteria for listed migratory species in the 'Significant Impact Guidelines 1.1' (DoE, 2013) is presented in Table 7-35.

Table 7-35: Significant Impact Assessment for Migratory Species

Significance Impact Criteria	Determination of Significance
Will the Project substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species?	**Unlikely**. Sandplain Drainage and Major River habitats may be used occasionally by the various migratory species; however they do not meet the criteria for it to be considered 'important' or ecologically significant (Table 7-31). Within the Development Envelope, 800 ha of Sandplain Drainage and 10 ha of Major River habitat is proposed to be disturbed. This habitat is common and widespread in the Pilbara bioregion and extends beyond the area of the Proposed Action.

Significance Impact Criteria	Determination of Significance
	The discharge of mine surplus water is modelled to extend up to 50 km downstream of the outfall in the Turner River in the first three years of dewatering (Geowater, 2023b). It is expected that a continuous flow will occur for the first three years before reducing to an intermittent flow as the water will be directed to the processing plant. The continual flow will increase the productivity of the Turner River and provide migratory species with additional habitat, prior to returning to the normal wet-dry cycle.
Will the Project result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species?	**Unlikely**. The habitat in the Development Envelope does not meet the criteria for it to be considered 'important', or ecologically significant (Table 7-31). Northern Star will implement measures to control feral fauna populations and to manage weeds. Northern Star will implement a feral cat and fox monitoring program and implement control measures when required across the Development Envelope to protect all MNES from being indirectly or directly impacted from the Proposed Action. Measures include implementing best practice waste management measures, limiting the creation of artificial water sources and prohibiting onsite personnel from feeding fauna species.
Will the Project seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species?	**No**. The Development Envelope does not host an ecologically significant population of any migratory species as defined in the guidelines (Table 7-34). The Migratory species that may possibly occur in the Development Envelope are non-breeding. Suitable roosting and foraging habitat are abundant outside the Development Envelope.

7.3.9 Conclusion

Only one migratory bird species was recorded during the Western Wildlife survey, a single Fork-tailed Swift sighted outside of the Development Envelope. Historical records from DBCA Threatened and Priority Fauna Database do not show any occurrences of migratory bird species within the Development Envelope. In addition, the COA states that migratory species have a tendency for site fidelity, where they return to the same sites each consecutive year. As there have been no records within the Development Envelope, it is highly unlikely that species will utilise the area in the future.

8 Risk Assessment

The risk assessment was produced through an analysis of potential risks and their impact. Mitigation measures were then outlined and evaluated for their effectiveness.

The methods used in the risk assessment included:

- **Risk identification** – potential risk pathways are systematically listed with a description of the event and potential impact.
- **Risks regulated by other Agencies** have been identified to avoid regulatory duplication. If the other agency can only regulate during certain stages of the Proposed Action, this is also identified.
- **Risk Analysis** – risks are analysed according to the consequence criteria, frequency, and uncertainty criteria.
- **Risk evaluation** – inherent and residual risks are analysed to determine whether they are acceptable. The higher the inherent risk, the more specific the management measures to reduce the residual risk.
- **Risk Treatment** – Measures to reduce the inherent risk are applied according to the following hierarchy:
  - Avoidance
  - Substitution
  - Control
  - Mitigation

The risk assessment was produced using the following definitions and criteria. Table 8-1 outlines the likelihood and frequency definitions, Table 8-2 describes the consequence criteria,

Table 8-3 displays the risk matrix, Table 8-4 demonstrates the risk acceptability criteria used for the risk ratings, and the risk assessment for the potential impacts is presented in Table 8-5.

Table 8-1: Likelihood Definitions

Likelihood	Frequency	Description
Almost Certain	Twice or more per year	• Event will occur during the Proposed Action / period under review. • High number of known incidents.
Likely	Once per year	• Event likely to occur during the Proposed Action / period under review. • Regular incidents known.
Possible	Once in 5 years	• Event may occur in some instances during the Proposed Action / period under review. • Occasional incidents known.
Unlikely	Once in 10 years	• Event is not likely to occur during the Proposed Action / period under review. • Some occurrences known.
Rare	Once in 20 years	• Event will occur in exceptional circumstances during the Proposed Action / period under review. • Very few or no known occurrences.

Table 8-2: Consequence Criteria

Consequence	Description
Insignificant	No detectable impact to MNES. Requires very little or no management.
Minor	Detectable impact to MNES, but within limits of natural variation. Requires specific management measures.
Moderate	Impact to MNES that exceeds natural variation. Requires a management plan.
Major	Impact exceeds natural variation with evidence of degradation of MNES. Requires a management plan with rehabilitation commitments and possibly offsets.
Severe	Irreversible impact on MNES. Serious, irreversible long-term impact on valued ecosystem and its function at a regional level. Requires offsetting or may be deemed unacceptable.

Table 8-3: Risk Matrix

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

Table 8-4: Risk Acceptability Criteria

Risk Rating	Status
Low	**Acceptable**. Specific treatment is not required if the inherent risk is low, however best practice environmental management measures are still to be implemented
Medium	**Requires standard mitigation to be acceptable**. Industry-standard best practice measures are suitable and specific risk treatment is not required if the inherent risk is medium. Monitoring may be required in some circumstances.
High	**Requires specific risk treatment to be acceptable**. Specific management measures are required to address high inherent and residual risks.
Extreme	**Unacceptable**. Specific environmental management measures are required to reduce environmental risk if the inherent risk is extreme. An extreme residual risk is unacceptable.

Table 8-5: Risk Assessment

Activity	Risk Impact	Likelihood	Consequence	Inherent Risk	Actions to be Implemented/ Mitigation Measures	Likelihood	Consequence	Residual Risk	Justification for Residual Risk Ranking
Flora and Vegetation									
Clearing	Loss of Threatened species. Loss of critical habitat to MNES	Almost Certain	Moderate	High	• Limiting clearing to the amount required. • Clearing of no more than 5,759 ha of sandplains habitats (Sandplain Drainage and Spinifex Sandplain) within the Development Envelope (considered as critical habitat for the Greater Bilby). • Clearing of no more than 10 ha of Major River habitat within the Development Envelope (considered critical habitat for the Northern Quoll). • Using previously disturbed areas to the extent possible. • Implementation of an internal permitting system for clearing. • Stripping and stockpiling of topsoil for subsequent rehabilitation to preserve seed bank. • Offsets are proposed for clearing of critical habitat for Northern Quoll and Greater Bilby.	Almost Certain	Minor	High	• One Threatened species identified in flora studies, *Seringia exastia*, waiting for delisting by DCCEEW after taxonomic review. • *Seringia exastia* extends over northern and central Western Australia, Northern Territory and South Australia. • The Proposed Action will not fragment important populations of Threatened species. • The native vegetation types are regionally common and extend beyond the Development Envelope.
Fauna									
Vehicle movement	Individual injury or death of listed MNES	Possible	Minor	Medium	• Implement speed limits of 80 and 60 km/h on sealed and unsealed roads for mine vehicles within the Development Envelope. • Mine vehicles will be required to stay on designated roads and tracks. • Personnel hooning and misadventure will be prohibited. • Sightings and incidents will be reported. • Personnel will be educated on conservation significant fauna.	Unlikely	Insignificant	Low	With suitable controls, the impact of vehicle collisions will be reduced.
Uncontrolled fire as a result of activities from the Proposed Action	• Individual injury or death of listed MNES • Reduction in available critical habitat for MNES species	Possible	Major	High	• Maintain fire breaks and implementation of management procedures. • Firefighting and suppression equipment located on site and on equipment and mine vehicles. • All equipment and mine vehicles restricted to designated cleared access tracks/roads. • Staff training and awareness in the prevention and management of fires. • Consultation with relevant agencies in relation to prescribed burns and fire management. • Implementation of Hot Work Permit System. • All mine vehicles fitted with firefighting equipment.	Unlikely	Moderate	Medium	Bushfires are becoming more prevalent across the arid region, so there will be a risk remaining. Critical habitat for all species listed as MNES is common and widespread throughout the Pilbara bioregion, of which a bushfire will only affect a portion of. The Project will also provide for additional firefighting capabilities in a largely unpopulated region.
Dust suppression methods are not used	Reduction in health of vegetation within areas of critical habitat for MNES species	Possible	Minor	Medium	• Dust suppression via water cart as required during clearing, construction and operation. • Clearing not undertaken during strong wind events as described by BoM as winds with a sustained average speed of over 50 km per hour. • Dust suppression built into infrastructure designs.	Rare	Minor	Low	Dust suppression, once applied, is extremely effective. Dust suppression forms a crust over the watered areas, therefore minimising dust generation to an acceptable standard. Vegetation in arid regions have a high tolerant to dust levels.
Introduction and spread of weeds	Reduction in health of critical habitat	Possible	Minor	Medium	• Implementation of weed management procedures including the recording and mapping of weed infestations. • All vehicles entering site must be cleaned prior to arrival. Weed hygiene certificate issue.	Rare	Minor	Low	Weed management will reduce weed populations as far as reasonably practical.

Activity	Risk Impact	Likelihood	Consequence	Inherent Risk	Actions to be Implemented/ Mitigation Measures	Likelihood	Consequence	Residual Risk	Justification for Residual Risk Ranking
Increase in feral predator species	Loss of conservation significant species	Likely	Moderate	High	• Predator control program. • Monitoring of feral fauna activity. • Site induction. • Implementing best practice waste management measures. • Limiting creation of permanent water bodies. • Fencing of artificial water sources where practicable and any putrescible landfills.	Unlikely	Moderate	Medium	Feral fauna such as foxes and cats are already present in the Development Envelope. Implementation of monitoring and management measures are sufficient to reduce significant impact to fauna. The environmental integrity will be maintained.
Collision with fences and powerlines	Loss of conservation significant species	Possible	Moderate	Medium	• Limiting use of fencing to amount required. • Not using barbed wire fencing where practicable. • If barbed wire fencing is required (due to legislative, safety or pastoral requirements) the top strands will be plain wire, and 10 cm disc bat reflectors will be used. • Inspection of areas requiring barbed wire fencing due to legislative, safety or pastoral requirements. • Reporting of all fauna related incidents. Limiting extent of power corridor to minimum required. • Use of bat reflectors where required.	Unlikely	Minor	Low	Collision with fences and powerlines are unlikely and will not significantly reduce populations of listed MNES.
Introduction and increases of invasive animal species i.e. cane toads	Loss of conservation significant species	Unlikely	Moderate	Medium	• Implementing best practice waste management measures. • Limiting the creation of permanent water bodies. • Fencing of artificial water bodies, • Fencing of artificial water sources where practicable and any putrescible landfills. • Personnel feeding of feral fauna is prohibited. • Vehicle hygiene measures for vehicles arriving to site. • Prohibit pets on site. • Vehicle hygiene inspections from all transport vehicles from Kimberley and Northern Territory inspected for Cane Toad.	Unlikely	Minor	Low	With the implementation of management and monitoring procedures, introduction of invasive species is unlikely.
Clearing	Fragmentation of critical habitat. Isolation or fragmentation of important populations.	Possible	Minor	Medium	• Undertake progressive one directional clearing to allow terrestrial fauna to move into adjacent habitat ahead of the clearing activity. Avoidance of Rocky Outcrop, Sand Dune and Major River habitat associated with the Yule River has been excluded from the Development Envelope. • Upper clearing limits applied to Northern Quoll and Greater Bilby critical habitat. • Progressive rehabilitation of disturbed areas.	Unlikely	Minor	Low	Clearing is limited to the maximum extent required, and disturbed areas are used where possible. Fauna habitats are widespread and common extending beyond the Development Envelope boundaries.
Altered surface water flow	Reduction in health of critical habitat.	Unlikely	Moderate	Medium	• Studies have been conducted, and water management infrastructure has been designed to ensure altered surface water flows do not negatively impact on vegetation suitable for fauna. • Mining areas avoid creeks or drainage, where possible. • Diversions designed to return surface water to natural flow paths, where possible. •	Rare	Minor	Low	Surface water risks have been assessed, and appropriate controls put into place through the design phase to ensure no issues occur during and after construction.
Surplus water discharge to the Turner River	Increased surface flows and mounding of the underlying alluvial aquifer associated with the Turner River results in water logging of the root zone which may be detrimental to trees in the saturated zone.	Likely	Moderate	High	• Modelling of the maximum and minimum low flow (Figure 6-9 and Figure 6-10) shows discharge to Turner River reaches a maximum of 50 km for the first three years (continuous flow), reducing to approximately 30 km thereafter (intermittent flow). • Staged reduction in discharge to ensure the system returns to baseline levels over time.	Possible	Minor	Medium	Northern Star has proposed the following outcomes based provision in the CSSMP: • Discharge of surplus mine water to the Turner River does not cause significant long-term impact to the Turner River riparian vegetation health.

Activity	Risk Impact	Likelihood	Consequence	Inherent Risk	Actions to be Implemented/ Mitigation Measures	Likelihood	Consequence	Residual Risk	Justification for Residual Risk Ranking
	Increased water availability may result in vegetative adaptations which may be detrimental to vegetation once surplus water discharge reduces or stops.				• Implementation of the CSSMP that includes trigger and threshold criteria with regards to riparian vegetation (potential MNES habitat).				• Discharge of surplus mine water to the Turner River does not cause a significant long-term impact on Turner River riparian (understory) health. The outcomes are monitored by early response, trigger and threshold criteria with appropriate response actions and monitoring, timing and reporting (Appendix 2)
	Localised erosion and scouring of the Turner River, particularly at the point of discharge.	Likely	Minor	Medium	• Pipelines fitted with flow meters and flow limitation device (maric valve) for monitoring and control of flow control, discharging through an energy dissipation and flow dispersion pad sitting on the riverbed. • Pads to consist of a reno mattress approximately 2 x 2 m which has the discharge pipe embedded centrally with geofabric silt bag encapsulating the pad. • Silt bag provides flow dispersion evenly through the area of the reno mattress reducing water velocity to below 0.4 m/s suitable for sand discharge. • Reno mattress protects the pipe from displacement, fauna or malicious damage. • Header pipe and flow monitoring located outside of the 1% AEP flood level allowing for operator access and security. • No permanent infrastructure proposed.	Unlikely	Minor	Low	Site investigation of the Turner River identified visible scour lines from natural runoff on the embankments indicating susceptibility to erosion of discharge flows without control to the riverbed. Erosion control measures to the embankment were considered however discharge directly to the riverbed is considered far more reliable and least disruptive to the predominantly dry river environment. Pipeline flows therefore have been designed to be distributed by a header manifold to multiple overland pipes for water discharge direct to the riverbed.
Reinjection of surplus mine water in critical habitat	Reduction in health of critical habitat in area of mounding	Likely	Moderate	High	• Reinjection rates limit such that mounding remains >2 m below ground level. • Use of multiple reinjection bores sufficiently spaced to control mounding to acceptable level. • Reinjection bores will target the thickest and most permeable sections of the upper and lower alluvium/paleochannel aquifers. • Use of mine water as process water from year three to minimise reinjection volumes. • Reinjection and monitoring of water levels in accordance with Environmental Licence.	Unlikely	Minor	Low	Significant impacts on vegetation within the mounding footprint are not anticipated. The vegetation is anticipated to be largely unaffected and adapt to changing conditions.
Groundwater abstraction	Reduction in health of critical habitat	Possible	Major	High	• Dewatering undertaken in accordance with RIWI Act Licence to take groundwater. • Re-injection of surplus water to reduce extent of drawdown. • Monitoring of groundwater drawdown throughout life of mine and mitigation measures applied from State approved EMP.	Unlikely	Moderate	Medium	Significant impacts on critical habitat for MNES are not predicted. Groundwater drawdown will be monitored throughout life of mine with mitigation measures applied from State approved EMP.
Excess water from dewatering requires discharge to Turner River system.	Changes in Turner River water quality reduce the health of the critical habitat.	Possible	Major	High	• Application of discharge criteria in environmental Licence. • Reinjection or reuse of water that does not meet the discharge criteria. • The turbidity of the surplus mine water into the Turner River will not exceed approved quality limits.	Unlikely	Moderate	Medium	The management measures implemented will ensure water quality is maintained. No significant impacts on the environmental values of the Turner River are anticipated.
Excess water from dewatering requires discharge to Turner River system.	Reduction in the health of critical habitat due to changes in wet/dry cycle of the Turner River system.	Possible	Major	High	• Phased reduction in discharge volumes after year three of the Proposed Action to allow for the ecosystem to adjust. • Reuse of surplus water in the processing facility once this becomes operational in year three of the Proposed Action to reduce disposal volumes.	Unlikely	Moderate	Medium	Aquatic habitats are unlikely to be impacted by the proposed discharge of surplus water into the Turner River. Vegetation along the Turner River is adapted to rapidly changing conditions and is expected to persist during and after the dewatering. The staged reduction in discharge will help with no anticipated impacts.

Activity	Risk Impact	Likelihood	Consequence	Inherent Risk	Actions to be Implemented/ Mitigation Measures	Likelihood	Consequence	Residual Risk	Justification for Residual Risk Ranking
Noise	Interruptions in feeding and resting behaviour, reducing reproductive success and complete displacement/ abandonment of an area.	Possible	Minor	Low	• Equipment design would be specified to be within Australian standard noise limits.	Unlikely	Minor	Low	No anticipated impacts. Surveys have not identified caves that support the roosting of the Pilbara Leaf-nosed Bat, nor the Ghost Bat within the Development Envelope. Critical habitat for the Northern Quoll, Grey Falcon and Pilbara Olive Python is more than 5 km from the main mining area where most noise will be created. The Greater Bilby is a mobile animal, with sufficient interconnected habitat available in the surrounding areas.
Flight impacts	Direct impact to MNES species, particularly Migratory birds and bats from increased flights.	Possible	Minor	Low	• Flight frequency would be 4 – 5 flights per week during construction, reducing to 3 – 4 flights during operations. • The airstrip will be driven prior to aircrafts taking off or landing to remove any native fauna from the area.	Unlikely	Minor	Low	Only one migratory bird species was recorded during the Western Wildlife survey, a single Fork-tailed Swift sighted outside of the Development Envelope. No significant impact is anticipated on any migratory bird species as a result of the Proposed Action, as there is a lack of records within the Development Envelope, and there is abundant, more suitable habitat outside of the Development Envelope. No significant impact is anticipated on listed Bat species as no roosts have been identified within, or close to the Development Envelope. No significant impact is anticipated on listed fauna species as the airstrip will be driven prior to flights landing or taking off to remove any native fauna.
Chemical spills, water treatment from WWTP, runoff from airstrip and other site related activities.	Contamination of surface or groundwater due to hydrocarbon and chemical spills.	Likely	Moderate	High	• Chemicals, diesel, oil and waste oil stored in accordance with Australian Standards. Facilities containing hydrocarbons and/or chemicals will be designed within bunds to contain at least 110% of the contents of the material stored. • Refuelling and fuel delivery inlets will be located on concrete or HDPE-lined pads to contain any drips or spills. The pads will drain to a sump to allow removal of collected material. • Overland pipes containing hazardous materials will be installed within bunds with catchment sumps constructed at low elevations points as required to provide containment capacity in the case of a pipeline leak. • Flow sensors would be fitted along pipelines to allow detection of loss of contents. • Isolation valves will be installed at appropriate intervals along pipelines. • Spill kits will be located at strategic locations throughout the project area and employees trained in their use. • Hazardous spills will be cleaned up, and contaminated soils will either be remediated or removed from site by a licensed third party. • Incident investigation would be undertaken as required to determine the cause of environmentally harmful spills/leaks and control measures identified to prevent future incidents. As required, spills would be reported to the relevant authorities. • Decommissioning and removal of all hazardous storages and hazardous materials pipelines.	Possible	Moderate	Medium	Standard practices for mining operations which are effective in managing potential impacts

9 Offsets

9.1 Offsets Summary

The Environmental Offsets Policy outlines the Commonwealth government's approach to offsetting residual environmental impacts under the EPBC Act. This policy defines offsets as "measures that compensate for the residual adverse impacts of an action on the environment" (DSEWPaC, 2012). The policy emphasises that avoidance and mitigation measures must be the primary strategy for managing significant impacts. Offsets are not intended to reduce likely impacts but rather compensate for unavoidable residual impacts that remain after all reasonable mitigation efforts have been implemented.

In the context of the Proposed Action, offsets will be required to compensate for residual significant impacts on the following environmental values:

- Clearing of critical habitat:
  - Clearing of up to 10 ha of Major River habitat, considered critical habitat for the Northern Quoll (*Dasyurus hallucatus*).
  - Clearing of up to 41 ha of Sandplain Drainage habitat, considered supporting habitat for the Northern Quoll (*Dasyurus hallucatus*).
  - Clearing of up to 10 ha of Major River habitat, considered critical habitat for the Pilbara Olive Python (*Liasis olivaceus barroni*).
  - Clearing of up to 5,759 ha of sandplain habitats (Spinifex Sandplain and Sandplain Drainage) considered critical habitat for the Greater Bilby (*Macrotis lagotis*).

The total offset liability will be calculated by multiplying the area of each species' critical habitat impacted by the Proposed Action by the corresponding offset rate specified by the Pilbara Environmental Offset Fund (PEOF) for the relevant IBRA subregion. Where a habitat type provides critical habitat for more than one species, the offset liability will be calculated separately for each species. Further details are presented in the Impact Reconciliation Program (IRP) provided as Appendix 26.

9.2 Proposed Offset Strategy

On 19 November 2020, the State and Commonwealth governments established a memorandum of understanding to enable achievement of landscape-scale biodiversity outcomes for MNES via the Pilbara Environmental Offset Fund (PEOF). The agreement means that the PEOF now collects and deploys the environmental offset monies paid by industry under State and Commonwealth (as a condition under Part 9 or 10 of the EPBC Act environmental legislation.

Northern Star proposes to achieve the required biodiversity offsets for the Proposed Action through the PEOF. The primary mechanism for offsetting residual significant impacts will be contributing financially to the PEOF. This established fund supports conservation activities within the Pilbara region, targeting areas that benefit the threatened fauna species impacted by the project, such as habitat restoration, fauna management plans, and weed control.

The specific offset liability will be determined by finalising the clearing area for each impacted value and applying the corresponding PEOF offset rates as per Table 9-1. To ensure ongoing compensation for residual significant impacts, Northern Star will make offset payments progressively throughout the project life. The initial payment will be calculated based on the area cleared during the first reporting period (which ends by the second financial year after project approval). Subsequent payments will be made every 24 months, informed by the findings of the Impact Reconciliation Report (IRR).

Table 9-1: PEOF Offset Rates

Species	Habitat Type	Site Layout (ha)	Federal Offset Rate ($)	Total Offset Payable ($)
Northern Quoll	Critical (Major River)	10	3,306	~ 33,060
	Foraging and dispersal (Sandplain Drainage)	41	1,653	~ 67,773
Pilbara Olive Python	Major River	10	3,306	~ 33,060
Greater Bilby	Critical (Spinifex Sandplain and Sandplain Drainage)	5,759	3,306	~ 19,039,254
Grand Total		-	-	~ 19,173,147

9.3 Summary of EPBC Act Offset Commitments

Northern Star is committed to complying with the offset requirements outlined in the EPBC Act. The specific offset commitments will be finalised in consultation with DCCEEW and formalised through the Decision Notice. Northern Star proposes the following key elements for its offset strategy to comply with the requirements outlined in the EPBC Act:

- Offsetting residual significant impacts on:
  - Northern Quoll – critical habitat (Major River) and foraging and dispersal habitat (1 km from critical habitat being Sandplain Drainage)
  - Pilbara Olive Python – critical habitat (Major River).
  - Greater Bilby critical habitat (Sandplain Drainage and Spinifex Sandplain).
- Utilising the Pilbara Environmental Offset Fund (PEOF) as the primary offset mechanism.
- Calculating the offset liability based on the Commonwealth rate for the relevant species.
- Making progressive offset payments aligned with clearing activities.

10 Environmental Record of Northern Star

Northern Star is not currently or has previously been subject to any proceeding under Commonwealth, State or Territory legislation. Northern Star is currently undertaking exploration activities in accordance with approved programs of work and in accordance with tenement conditions for exploration licences; and mining and miscellaneous leases issued under the WA *Mining Act 1978*.

No member of Northern Star's Board of Directors has been subject to proceedings under Commonwealth, State or Territory environmental legislation. Each member has a satisfactory record of responsible environmental management.

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APPENDICES

APPENDIX 1: ADDITIONAL INFORMATION REQUESTED BY DCCEEW

Requirement	Additional Information Requested by the Department	Section/Comment
Table A: Request for further information		
1. Description of the action		
1.1 Description of the action	a. This should include the location of all works to be undertaken (including plans and maps) and elements of the action that may have impacts on Matters of National Environmental Significance (MNES). The description of the action must also include details on how the works are to be undertaken (including stages of development and their timing) and design parameters for any structural elements of the action that may have impacts on MNES. Please highlight changes that have been made to the Project since referral documentation was submitted.	Section 2
	b. A description of the proposed action must include: i. A summary of all components of the proposed action. ii. The activities associated with the proposed action iii. The location, boundaries, and size (in hectares) of the proposed action area, any discrete disturbance areas, and any adjoining areas which may be directly or indirectly impacted by the proposed action, including nearby habitat and areas for stockpiles, laydowns/storage, construction camps, substations, temporary transmission lines, vehicle access and associated activities. iv. A layout plan (or plans) for the Project, including but not limited to key infrastructure, laydown areas and construction camps, new access tracks, conservation areas and any heritage agreements the Development Envelope passes through. v. The anticipated timing and duration (including start and completion dates) for construction and operation of the proposed action vi. A description of operational requirements of the action including any anticipated maintenance works vii. A description and likely timing of rehabilitation activities associated with the proposed action.	Section 2 and Appendix 7
2. Baseline information		
2.1 Description of the environment and Matters of National Environmental Significance (MNES)	a. At the referral decision stage, the proposed action was determined as likely to have a significant impact on the following threatened terrestrial species: i. Ghost Bat (*Macroderma gigas*), ii. Pilbara Olive Python (*Liasis olivaceus barroni*), iii. Northern Quoll (*Dasyurus hallucatus*), iv. Pilbara Leaf-Nosed Bat (*Rhinonicteris aurantia*), v. Greater Bilby (*Macrotis lagotis*), vi. Grey Falcon (*Falco hypoleucos*), vii. Night parrot (*Pezoporus occidentalis*).	Section 6.6 and 7
	b. The preliminary documentation must provide a general description of the environment impacted by and surrounding the proposed action area, in both the short and long-term. The preliminary documentation should include all potential impacts to MNES, and associated avoidance and mitigation measures outlined in the referral information plus the additional information listed in this document. For the above listed	Section 6 and 7

Requirement	Additional Information Requested by the Department	Section/Comment
	threatened species, specific matters this section must address include, but are not limited to: i. Information on the abundance, distribution, ecology and habitat preferences for each listed species or community. ii. Quantification of the extent of habitat and the number of individuals likely to be impacted, or historical patterns of use by those species, within the proposed action area and surrounds (including mapping identifying known and/or potential habitat). iii. Assessment of the quality and importance of known or potential habitat for the relevant listed species or communities within the proposed action area and surrounds. iv. An assessment of the adequacy of any surveys undertaken (including survey effort and timing). In particular, the extent to which these surveys were appropriate for the listed species or community and undertaken in accordance with relevant departmental survey guidelines. v. An assessment of the impacts of habitat fragmentation in the Project area and surrounding areas, including considerations of species/ movement patterns.	
2.2 Targeted Surveys	a. The referral documentation notes that targeted surveys were only undertaken for the Northern Quoll, Bilby, and the Night Parrot (where there was habitat identified that potentially supported these species). i. Please provide a discussion on the reasoning for not undertaking targeted surveys for the other species identified above at comment 2.1. Include reasoning of the sufficiency of survey work that was undertaken to adequately determine the presence of these species. ii. For the Northern Quoll, Bilby, and Night Parrot, the preliminary documentation should include a discussion on the adequacy of the surveys in determining local population size, distribution, and habitat for the species, including how the surveys met the requirements under relevant departmental survey guidelines.	Section 7.2
2.3 Ghost Bat (*Macroderma gigas*)	a. The referral documentation asserts that there is no diurnal roosting habitat present for the Ghost Bat. Please provide discussion to support this conclusion, including details on survey efforts to identify any such habitat. The discussion should include an assessment of the adequacy of any surveys undertaken (including survey effort and timing). In particular, the extent to which these surveys were appropriate for the listed species and undertaken in accordance with relevant departmental survey guidelines.	Section 7.2.1
	b. Provide a figure/map displaying the survey records and habitat for the species, similar to that provided for other species in the referral document Assessment of Impacts to MNES.	Section 7.2.1
2.4 Night Parrot (*Pezoporus occidentalis*)	a. The department requests further information detailing the location and size of potential habitat for the Night Parrot (*Pezoporous occidentalis*) that may be impacted by the proposed action. This should be done giving consideration to: i. Additional survey work to identify and quantify habitat. ii. Details of the direct and indirect loss and/or disturbance of protected matters and their habitat as a result of the proposed action. This must include the area (in hectares) and quality of the habitat to be impacted and quantification of the individuals to be impacted.	Section 7.2.4

Requirement	Additional Information Requested by the Department	Section/Comment
	iii. Identification of possible breeding and roosting habitat iv. Provide a map/s detailing the location of relevant habitat, survey efforts and any identified individuals	
2.5 Fringed Fire-bush (*Seringia exastia*)	a. The department acknowledges the delisting of *Seringia exastia* as a Threatened species at a state level, and the advice received by the proponent from the Department of Biodiversity Conservation and Attractions that targeted surveys for the taxon were not required.	Section 7.1.1
	b. The department also notes the work done by Ecoscape (Australia) Pty Ltd on behalf of the proponent in 2021 which identified approximately 200 individuals of *Seringia exastia* at the Project site, which was confirmed by Umwelt (Australia) Pty Ltd in 2022.	Section 7.1.1 (Local Population)
	c. However, the species remains listed as Threatened (Critically Endangered) under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) and as such any impacts from the proposed action to *Seringia exastia* requires full impact assessment. In order to inform the assessment, the department requests the provision of the following: i. Targeted surveys for the taxon to identify individuals within the development envelop and surrounding area. ii. A revised assessment and description of the potential impact of the proposed action on the *Seringia exastia* informed by the survey work and current listing status under the EPBC Act.	Section 7.1.1 (Significance Test)
2.6 Listed migratory species	a. At the referral decision stage, the proposed action was determined as likely to have a significant impact on the following listed migratory species: i. Common Sandpiper (*Actitis hypoleucos*) – Migratory ii. Common Greenshank (*Tringa nebularia*) – Migratory iii. Fork-tailed Swift (*Apus pacificus*) – Migratory iv. Oriental Plover (*Charadrius veredus*) – Migratory v. Wood Sandpiper (*Tringa glareola*) – Migratory vi. Red-necked Stint (*Calidris ruficollis*) – Migratory vii. Sharp-tailed Sandpiper (*Calidris acuminata*) – Migratory viii. Osprey (*Pandion haliaetus*) – Migratory ix. Pectoral Sandpiper (*Calidris melanotos*) – Migratory x. Gull-billed Tern (*Gelochelidon nilotica*) – Migratory xi. Caspian Tern (*Hydroprogne caspia*) – Migratory xii. Glossy Ibis (*Plegadis falcinellus*) – Migratory	Section 7.3
	b. The department requests: i. Vegetation mapping detailing the relevant survey efforts, habitat types, and any identified locations of migratory species identified during surveys. ii. Quantification of the extent of habitat and the number of individuals likely to be impacted, within the proposed action area and surrounds (including mapping identifying known and/or potential habitat). iii. A discussion of habitat connectivity, dispersal, and migration behaviours. Provide a summary of habitat usage in the area with consideration to breeding, roosting, and foraging. This may also include identification and description of known and potential migratory bird	Section 7.3

Requirement	Additional Information Requested by the Department	Section/Comment
	foraging, roosting, and breeding habitat in the broader area with a discussion of their connectivity, current usage and future use. iv. Please ensure that this section includes the information required by section 2.1 as relevant for the listed migratory bird species.	
3. Avoidance, mitigation and management measures		
3.1 Avoidance, mitigation and management measures	a. The preliminary documentation must provide information on specific measures proposed to avoid, mitigate, and manage impacts to the relevant protected matters from the proposed action. Documentation should clearly set out the following measures for each environmental issue and protected matter likely to be impacted by the proposed action. Measures including, but not limited to, the following items must be outlined in the documentation: A consolidated list of impact avoidance and mitigation measures based on best available practices that will be implemented to reduce impacts on protected matters (including any additional to those proposed in the original referral). This must include a description of each measure proposed, relevant protocols, the name of the agency responsible for each measure, as well as the location and timing for each measure. The following measures should be included but are not limited to: Project specific details such as hours of operation and activity schedules. Details of pre-clearance and clearance procedures. Measures to minimise risk of injury and death, such as during construction and from vehicle strike. Measures to minimise impacts on surrounding areas used by the listed threatened species identified as likely occur at the site. This may include noise, dust, light pollution etc. Measures to manage unexpected finds (e.g. active denning site) or injuries / death of fauna. Measures to prevent impacts to Bat and bird species via collision with fences (including those temporarily erected during construction). Measures to mitigate impacts from disturbance at all stages of the Project. Measures to avoid or mitigate likelihood of impacts on water resources. Details of training to be provided to those onsite.	Section 8 and Appendix 2
	b. Describe contingencies for events, such as the identification of protected matters during construction searches (e.g. translocation management protocols for specific species).	Section 8
	c. Details of any rehabilitation or revegetation measures to be implemented, including objectives, target species, timing of relevant stages, methodology, maintenance, and monitoring.	Section 8
	d. For each proposed mitigation measure, please also include: i. Performance and completion criteria ii. Monitoring and reporting arrangements iii. Potential risks/threats, including residual risks, and any measures that would be implemented to mitigate against these risks, and any proposed monitoring to confirm the effectiveness of these measures.	Section 8

Requirement	Additional Information Requested by the Department	Section/Comment
	e. Discussion of the likely residual impacts to the protected matter after proposed avoidance and/or mitigation measures are taken into account.	Section 8 and 9.1
	f. Management commitments by the person proposing to take the action must be clearly distinguished from recommendations or statements of best practice made by the document author or other technical expert. It is preferable to provide a consolidated table of management commitments, including details on funding, roles and responsibilities and measurable performance criteria. Commitments should be made using unambiguous language, i.e. use 'will' and 'must' when committing to actions instead of 'where possible', 'where practicable', 'as required', 'to the greatest extent possible', and 'should' or 'may'. This information should also be included in an Environmental Management Plan (EMP) which is to be EPBC Act specific and details the management of potential environmental impacts to the listed threatened and migratory species associated with the proposed action. The EMP provided should be consistent with the department's Environmental Management Plan Guidelines (2014) (See Table C 2.4b).	Section 8
4. Management Plans		
4.1 Fauna Management Plan and general environmental management measures	a. Further to comments above (2.1) the department requests that the Fauna Management Plan Hemi Gold Project 2023 is updated to include all listed threatened species and listed migratory species, and all relevant management and mitigation measures identified by the proponent. Please refer to the Environmental Management Plan Guidelines for further information on the development of management plans for projects referred under the EPBC Act. b. Where there are management measures common across species and/or operational activities, the proponent may choose to include these in additional management plans instead (with reference to them in relevant sections in the Fauna Management Plan), for example an Artificial Light Management Plan, a Weed Control Management Plan, or a Vehicle Management Plan.	Section 7 and Appendix 2
4.2 Greater Bilby Recovery Plan	a. The Fauna Management Plan currently refers to the Draft Recovery Plan for the Greater Bilby (Macrotis lagotis) (2019), please update any references and content within the management plan to reflect to the current version, Recovery Plan for the Greater Bilby (Macrotis lagotis) (2023).	Appendix 2
5. Inland Waters		
5.1 Inland Waters Subterranean fauna	a. The referral documentation noted that the sampling bores were constructed such that sampling of subterranean stygofauna is possible, please provide the results of this sampling for review.	Section 6.7
5.2 Turner River	a. The department acknowledges the provision of the discharge model. To enable assessment of the impact of continuous inundation on riverine ecology, the maximum and minimum periods of no flow, and continuous low flow, should also be provided.	Section 6.3.5 and 8
	b. Additionally, please provide the water quality objectives for surplus water being discharged to the Turner River.	Appendix 2

Requirement	Additional Information Requested by the Department	Section/Comment
	c. Provide any erosion control measures, including those to prevent localised erosion and scouring from any development near the river (such as the outflow pipe and associated infrastructure)	Section 2.3 and 8
	d. While the Turner River is not considered to be connected to the shallow alluvial aquifer or palaeochannel that extends from Hemi to the Yule River (Geowater 2023, p. ES-ii), the department requests drawdown estimations for all aquifers to better assess potential impacts from drawdown associated with the Project. Only one river pool has been identified on the Turner River in the study area, and this is located 8.5 km beyond the maximum 0.5 m drawdown extent (Geowater 2023, p. 88).	Section 6.3 and Appendix 11
5.3 Yule River	a. The Yule River has 13 semi-permanent pools and one permanent pool (Jelliabidina Pool) that are likely to have a connection to the shallow alluvial aquifer (Geowater 2023, pp. 39 and 73). The proponent has stated that there is unlikely to be any adverse impacts from mine dewatering as the modelled final drawdown cone is around 2000 m to 3000 m from the closest pools (Geowater 2023, Figure 5-11, p.89). However, due to concerns regarding the modelling (see comments at 5.6 and 5.7), the department is unable to determine the likelihood and extent of impacts to these pools from mine dewatering. It is noted that continuous surface water level monitoring in several pools as well as two monitoring bores between Hemi and the Yule River are proposed (Geowater 2023, p. 88).	Section 6.4.2, Appendix 2, Appendix 10 and Appendix 11
	b. The proponent has conceptualised the catchment as having greater groundwater outflows (to the north-west) than inflows (Geowater 2023, Figure 2-27, p. 36). Given the noted connectivity between surface water features and the water table (Geowater 2023, p. 39), the department considers that further information regarding the modelling should be provided (see comments at 5.6 and 5.7) to increase confidence that baseflows in the Yule River and persistence of the instream pools will not be impacted. Further clarification regarding the connection between the Yule River and the surficial aquifer (including the underlying palaeochannel) would be beneficial in this analysis.	Section 6.3.1, Section 6.4.2, Appendix 2 and Appendix 11
5.4 Internal surface water catchment	a. Based on post-closure flood modelling (SWS 2022, pp. 23 – 32) the impacts on surface water flow across the local catchment from proposed bunds and diversions appear to be minimal from initial assessments but these should be fully modelled and provided to the department.	Section 6.4.1, Appendix 3 and Appendix 7
	b. Please provide information on the potential impacts from chemical spills, water treatment, runoff from the proposed airstrip, or other site-related impacts and how these will be managed to prevent infiltration to groundwater.	Section 8
5.5 Water related impacts on vegetation	a. The dominant vegetation of the river channels includes the river redgum (*Eucalyptus camaldulensis*) and silver-leaved paperbark (*Melaleuca argentea*) (Geowater 2023, p. 73). The distribution of these species in the Yule River coincides with areas inundated during flooding and where the depth to groundwater is shallow (Braimbridge M & Loomes R. 2013, p. 9) and this could be expected to be similar in the Turner River. In the Turner River, M. argentea and E. camaldulensis subsp. refulgens are considered to be obligate and potentially facultative phreatophytes (Umwelt 2023, p. 56). These species have adaptations and responses that allow some capacity to cope with periods of low water availability and to respond to high water availability to maintain resilience of established vegetation and allow establishment of new vegetation (Braimbridge & Loomes 2013, p. 16). Other potential facultative phreatophytes found in the Turner River included *Acacia*	Section 6.3, 6.5.3, 8 and Appendix 2

Requirement	Additional Information Requested by the Department	Section/Comment
	ampliceps, E. victrix, M. glomerata and M. linophylla (Umwelt 2023, p. 122). i. Increased surface flows and mounding of the underlying alluvial aquifer due to surplus water discharge in Turner River may cause continual waterlogging of the root zone for over 2 years that may be detrimental to trees in this saturated zone. This may therefore impact on vegetation for the area with continual surface water flows and for the areas where alluvial groundwater is mounded under, and adjacent to, the river. ii. According to the referral documentation, only M. argentea was found in areas where high water flow volumes appear to occur regularly (Umwelt 2023 p. 106), and this species is highly tolerant of flooding with no signs of water stress during 8 weeks of continual waterlogging (McLean 2014 p. ii). However, it is unclear if mature trees will survive over 2 years of continual waterlogging and if any adaptation occur during this prolonged period such that the subsequent return to 'natural' conditions may cause additional water stress. E. camaldulensis subsp. refulgens has been found to be moderately flood tolerant, although the study only extended for 88 days, and recovery of root mass after flooding ceased was poor (Argus 2015).	
	b. Vegetation located further from this saturated zone (i.e. where the root zone is not waterlogged continuously) may benefit from increased water availability. However, this benefit will only extend for the duration of the surplus flow discharges until the system returns to equilibrium. There is also a possibility that adaptations to increased water availability, such as described by McLean (2014) and Argus, Colmer & Grierson (2015), may then be detrimental when surplus flows stop, and water availability returns to more natural conditions. Please provide a discussion on the likelihood of such impacts and consideration given to this in Project design	Section 6.3, 8 and Appendix 2
	c. Reduced groundwater levels (i.e. through water drawdown associated with mine dewatering and/or during droughts) is likely to cause tree water stress (and has been identified downstream in Braimbridge & Loomes (2013, pp. 26 – 27)) and negative responses in species that are obligate and/or potentially facultative phreatophytes. Provide a discussion on the likelihood of such impacts and consideration given in Project design to mitigate.	Section 6.3.4, 6.5.3 and Appendix 2
5.6 Impacts from extraction of groundwater, reinjection, and surplus water discharge	a. The water management system presented in Figure 4-2 (Geowater 2023, pp. 71 – 72) does not include information regarding metal concentration trigger levels for the two piping manifolds, the transfer ponds (including capacities, usage within the system and locations), nor an explanation regarding the points and connections represented in the figure. Further, the "detailed spreadsheet model" which is used to determine which pipeline system the groundwater would be directed to was also not provided. Such information is necessary to determine the effectiveness and potential impacts of this management strategy	Section 6.3.2, Appendix 2 and Appendix 11
	b. The department notes that reinjection of the elevated arsenic water stream would be into the main palaeochannel aquifer (Geowater 2023, p. 70). Minimal information regarding particle tracking within the groundwater model has been provided and the potential changes to chemical properties of groundwater from extraction have not been considered. The department is therefore unable to determine with confidence the potential impacts associated with the reinjection of water with elevated arsenic. It is also noted that it is assumed that the soluble arsenic will remain soluble and not precipitate or accumulate within the alluvial aquifer system, and that geochemical assessments are underway to confirm this (Geowater 2023, p. 93). The department	Section 6.3.2, Appendix 10 and Appendix 13

Requirement	Additional Information Requested by the Department	Section/Comment
	considers that the other soluble metals that may be elevated should also be considered in this investigation (see Geowater 2023, p. 31).	
	c. The proponent has not outlined the treatment intended for processing water with elevated metals. The department requests a detailed discussion is provided regarding the "pressure oxidation stage" (Geowater 2023, p. 69) to be provided, as well as estimations of groundwater quality resulting from the intended treatment. i. The department notes that the water management system includes transfer ponds that will allow "natural chemical processes resulting from exposure to the atmosphere to occur, which further assists in improving water quality prior to redirection" (Geowater 2023, p. 71). Further information regarding this claim should be provided. ii. Should the processing of extracted water result in the precipitation of any contaminants (such as arsenic), the proponent should provide information regarding the management and disposal of such waste material.	i) Section 2.1.2, Appendix 15 and Appendix 16 ii.) Section 2.1.4 and Appendix 5 Pond sediments will be deposited into the TSF, and seepage will return to the pit for reuse in processing, forming a closed loop.
	d. Groundwater users within the broader region include pastoral leases, Atlas Iron Pty Ltd, and the Yule River Borefield, which is protected by the Yule River Water Reserve water source protection plan due to being a public drinking water source (Geowater 2023, p. 76). The southeastern edge of the reserve is located 5 km from Hemi (Geowater 2023, Figure 5-3, p. 77). i. The proponent does not anticipate there to be adverse impacts to the Yule River borefield from groundwater abstraction and aquifer reinjection from the Project (Geowater 2023, p. 82). Three pastoral bores are anticipated to become inoperable due to being within the drawdown cone of the Project (Geowater 2023, p. 81). ii. Given the concerns regarding the groundwater model (see comments at 5.7 and 5.8), the department is unable to determine whether contamination of aquifers or drawdown associated with the Project will result in unforeseen impacts to these other groundwater users. iii. The monitoring bores established by the proponent are either located within a 7 km radius of Hemi or near the Turner River or proposed tailings storage facility (Geowater 2023, Figure 2-1, p. 9). It is noted that there are no monitoring bores located on the Yule River. Given the uncertainty associated with the adequacy of the groundwater model (see comments at 5.7 and 5.8), the department considers that the addition of a monitoring bore within the alluvial aquifer of the Yule River would be appropriate.	Section 8 and Appendix 11
	e. The proponent has not provided a closure plan for Hemi. As the completed pits are intended to remain dewatered and there will be pit voids at the end of mining (Geowater 2023, p. 3), the department considers that a closure plan that discusses legacy impacts should be provided, as well as modelling results that consider end of mining and longterm scenarios. This should include consideration of residual contaminants in pits and rehabilitation or long-term management of pit voids.	Section 6.3.4 and 6.3.6 and Appendix 7 Response to later DCCEEW comments: i) Appendix 5 and Appendix 6 ii) Appendix 6 and Appendix 7
5.7 Modelling	a. To aid in determining the adequacy of the groundwater modelling, the department requests further information to inform the assessment. With the Project including aquifer reinjection for mitigation and management purposes, discharge, a broad highly permeable aquifer and a large palaeochannel, the department considers that a more in	i) Section 6.3.4 and Appendix 11

Requirement	Additional Information Requested by the Department	Section/Comment
	depth report on the groundwater model is required to assess the suitability of the model in reflecting the complex activities and regional hydrogeology associated with the Project. To assist in this assessment, the report should include, but not be limited to, provision of the following information: i. Staged drawdown results that display base case scenarios and reinjection scenarios throughout the Project life and post closure. ii. Uncertainty and sensitivity analysis on parametrisation. iii. Clarification regarding whether reinjections are intended in base case scenarios (Geowater 2023, p. 52).	ii) Appendix 2, Appendix 10 and Appendix 11 iii) Appendix 11
	b. Minimal information regarding the particle tracking model utilised within the groundwater model has been provided. More detail on the design and scenarios used for the particle tracking model should be provided to assess potential impacts associated with reinjection of water with elevated levels of arsenic.	Section 6.3.6, Appendix 10, Appendix 11 and Appendix 13
	c. It is noted that model uncertainty has been identified regarding the amount and degree of fractured zone permeability, location of the palaeochannel, and recharge of the alluvial aquifer (Geowater 2023, pp. 96 – 97). While the proponent has proposed additional fractured rock production bores to test the conceptual model, the department considers that further investigations that explore the location of the palaeochannel at its north-western extent near the Yule River and the permeability of fracture zones is essential to determine the adequacy of the model to predict potential impacts	Appendix 2, Appendix 10 and Appendix 11
5.8 Modelling continued	a. Overall, the department is satisfied that the model and data used to assess impacts of Turner River discharge scenarios are adequate however the department requests further information on the natural discharge and inundation patterns of the Turner River for comparison. In particular: i. The longest period (in days) of continuous flow greater than or equal to the proposed discharge flow (i.e. 24 ML/day) in the Turner River both modelled at the discharge location and downstream, and for the observed record and the gauge. ii. The alluvial connectivity and mounding in Turner River due to surplus water discharge is well described (Geowater 2023, pp. 86 – 88). It would be useful to also include the behaviour (observed and/or modelled) of the groundwater mounding under Turner River in relation to the longest period of continuous flow greater than or equal to 24 ML/day or similar.	i) Section 6.4 and 8 ii) Section 6.4 and Appendix 10
	b. It is noted that no water quality objectives have been included for the discharge water to Turner River; however, baseline data has been collected and ongoing monitoring is proposed. While it is stated that discharge water quality is similar to the baseline groundwater quality (Geowater 2023, p. 87), water quality objectives should be established with appropriate triggers and management actions to ensure no water quality impacts to Turner River.	Section 6.4.3 and Appendix 2
6. Offsets		
6.1 Offsets	a. An offset is required to compensate for all predicted or potential residual significant impacts to EPBC Act listed threatened species and communities. This residual significant impact includes the total area of habitat lost and/or degraded for each MNES species. Offsets must meet the principles of the EPBC Act Environmental Offsets Policy (2012) (see Table C item 2.4c).	Section 9 and Appendix 26

Requirement	Additional Information Requested by the Department	Section/Comment
	i. Offsets must be built around direct offsets, which should form a minimum of 90% of the total offset requirement. Other compensatory measures may satisfy up to 10% of the offset requirement. Offsets must meet the principles of the Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy (2012) (see Table C item 2.4d). The proponent must provide an offset proposal that compensates for the residual significant impacts of the proposed action. Note that where more than one offset is proposed, each offset requires an individual Offset Management Plan. Offset Management Plans should be consistent with the Environmental Management Plan Guidelines (2014) (see Table C item 2.4b and the department's Draft Offset Management Plan Template). ii. Alternatively, where financial contributions to the Pilbara Environmental Offsets Fund are made to compensate for the residual significant impacts of the proposed action, the proponent must develop an Impact Reconciliation Procedure as required by the Western Australian Environmental Protection Authority. Further guidance is available at: https://www.epa.wa.gov.au/forms-templates/instructions-preparing-impact-reconciliation-procedures-and-impact-reconciliation	
7. Economic and Social Impacts		
7.1 Economic and social impacts	a. Please provide further detail on the social and economic costs and/or benefits of undertaking the proposed action, including: i. An estimate of any anticipated economic costs and/or benefits (in AUD) ii. The basis for any estimation of costs and /or benefits iii. Any potential employment opportunities expected to be generated at each phase of the proposed action, including any potential opportunities for local Indigenous people. Such opportunities on this Project might relate to construction and operational activities, environmental management and monitoring, and apprenticeships.	Section 4 Additional information (confidential) on the social and economic aspects of the Proposed Action has been provided directly to DCCEEW for the Delegate's consideration.
	b. The department recommends the proponent incorporate the following recommendations provided by the NIAA: i. The NIAA encourages the engagement of First Nations employees and businesses to help realise the economic benefit of Projects for the local First Nations community. We encourage De Grey Mining to discuss opportunities for local First Nations people and businesses with Kariyarra Aboriginal Corporation (KAC) and the regional Community Development Program provider, Ashburton Aboriginal Corporation (AAC). This might include opportunities in environmental and cultural heritage management, Project management, construction and operational activities, and apprenticeships for First Nations people. ii. To support First Nations economic participation in this Project, we encourage De Grey Mining to develop a First Nations employment, training and procurement plan incorporating participation targets. The Department of Infrastructure, Transport, Regional Development, Communications and the Arts' Indigenous Employment and Supplier-use Infrastructure Framework and the Australian Government's Indigenous Procurement Policy contain useful tools for setting employment and business procurement targets, respectively. iii. The NIAA encourages De Grey Mining to pursue opportunities for long-term energy use benefits for local First Nations communities. Opportunities could include improvements to local First Nations community energy access, security and affordability through measures such as infrastructure upgrades; provision of community shares and	Section 4 Additional information (confidential) on the social and economic aspects of the Proposed Action has been provided directly to DCCEEW for the Delegate's consideration.

Requirement	Additional Information Requested by the Department	Section/Comment
	equity stakes in the Project; and community grants funded through a social contribution action plan.	
Table B: Information from the referral		
1. Description of the action	A description of all components of the action, as described in the referral documentation.	Section 2
2. Description of the environments	A description of all environments, as it relates to the proposed action, as described in the referral documentation.	Section 6
3. Relevant matters of National environmental significance	Details of the relevant MNES, as described in the referral.	Section 7
4. Baseline information	Description of the baseline data contained in the referral documentation.	Section 6
5. Impacts	Description of the impacts contained in the referral documentation, including: • Habitat loss • Habitat degradation	Section 7
6. Proposed avoidance and mitigation measures	Description of the avoidance and mitigation measures proposed in the referral documentation.	Section 8
Table C: General content, style and formatting requirements		
1. Considerations for decision making		
1.1 Ecologically Sustainable Development	A description of how the proposed action meets the principles of ESD, as defined in section 3A of the EPBC Act. The following principles are principles of ecologically sustainable development: • Decision making processes should effectively integrate both long term and short term economic, environmental, social, and equitable considerations. • If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. • The principle of inter-generational equity–that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations. • The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision making. • Improved valuation, pricing and incentive mechanisms should be promoted.	Section 4
1.2 Economic and social matters	An analysis of the economic and social impacts of the action, both positive and negative. Details of any public consultation activities undertaken and their outcomes. Details of any consultation with Indigenous stakeholders. Indigenous engagement Identify existing or	Section 4

Requirement	Additional Information Requested by the Department	Section/Comment
	potential native title rights and interests, including any areas and objects that are of particular significance to Indigenous peoples and communities, possibly impacted by the proposed action and the potential for managing those impacts. Describe any Indigenous consultation that has been undertaken, or will be undertaken, in relation to the proposed action and their outcomes. The department considers that best practice consultation, in accordance with the Guidance for proponents on best practice Indigenous engagement for environmental assessments under the EPBC Act (2016) includes: • Identifying and acknowledging all relevant affected Indigenous peoples and communities • Committing to early engagement • Building trust through early and ongoing communication for the duration of the project, including approvals, implementation, and future management • Setting appropriate timeframes for consultation • Demonstrating cultural awareness Describe any state requirements for approval or conditions that apply, or that the proponent reasonably believes are likely to apply, to the proposed action with regards to Indigenous peoples and communities. Projected economic costs and benefits of the project, including the basis for their estimate through cost/benefit analysis or similar studies. Employment opportunities expected to be generated by the project (including construction and operational phases).	
1.3 Environmental record of the person(s) proposing to take the action	Include details of any past or present proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against: • The person proposing to take the action. • For an action for which a person has applied for a permit, the person making the application. • If the person is a body corporate—the history of its executive officers in relation to environmental matters; and • If the person is a body corporate that is a subsidiary of another body or company (the parent body)—the history in relation to environmental matters of the parent body and its executive officers.	Section 1.2
1.4 International obligations	Justify, with supporting evidence, how the proposed action will not be inconsistent with Australia's obligations under: • The Bonn Convention • China-Australia Migratory Bird Agreement • Japan-Australia Migratory Bird Agreement • International Agreement – Republic of Korea-Australia Migratory Bird Agreement • Any international agreement approved under subsection 209(4) of the EPBC Act	Section 7.3.2
1.5 Other approvals and conditions	The preliminary documentation must include information on any other requirements for approval or conditions that apply, or that you reasonably believe are likely to apply, to the proposed action if applicable. This must include: • A description of any approval obtained or required to be obtained from a State or Commonwealth agency or authority (other than an	Section 5

Requirement	Additional Information Requested by the Department	Section/Comment
	approval under the EPBC Act), including any conditions that apply (or are reasonably expected to apply) to the action; and • A description of the monitoring, enforcement and review procedures that apply, or are proposed to apply, to the action.	
2. Content, style and formatting requirements		
2.1 Style	Be written so that any conclusions reached can be independently assessed. Include all key claims, findings, proposals, and undertakings in the main document.	Throughout
2.2 Format	Be in a suitable format to be published in hardcopy (A4 or A3 size, with maps and diagrams in A4 or A3 size and in colour) and published in electronic format (e.g., MSWord or PDF) on the internet.	Throughout
2.3 Content	Include a cross-reference table indicating where the information fulfilling the requirements in Table 1, 2 and 3 is included in the preliminary documentation.	Throughout
Relevant standards, policies, and other guidance material	Refer to all relevant standards, policies and other guidance material published by the department. Any instances where published guidance is not followed must be justified. Where no Commonwealth standards exist, state government and industry standards may be useful. Relevant standards, policies and other guidance material include, but are not limited to: a. Department of Agriculture, Water and the Environment (2021). Guide for providing maps and boundary data for EPBC Act Projects. Canberra, ACT: Commonwealth of Australia. Available from: https://www.environment.gov.au/system/files/resources/5bb0509e-c4b5-4f7a-910b-5b04d82db491/files/epbca-mapsdata-guidelines.pdf b. Department of the Environment (2014). Environmental Management Plan Guidelines. Canberra, ACT: Commonwealth of Australia. Available from: Environmental Management Plan Guidelines 2014 (dcceew.gov.au) c. Department of Sustainability, Environment, Water, Population and Communities (2012). Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy. Canberra, ACT: Commonwealth of Australia. Available from: https://www.environment.gov.au/system/files/resources/12630bb4-2c10-4c8e-815f-2d7862bf87e7/files/offsetspolicy_2.pdf d. Department of Sustainability, Environment, Water, Population and Communities (2012). Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy. Canberra, ACT: Commonwealth of Australia. Available from: https://www.environment.gov.au/system/files/resources/12630bb4-2c10-4c8e-815f-2d7862bf87e7/files/offsetspolicy_2.pd e. Department of the Environment, Water, Heritage and the Arts (2010). Survey guidelines for Australia's threatened birds. Available from: Survey guidelines for Australia's threatened birds (dcceew.gov.au)	Throughout
2.5 Maps, diagrams and images	a. Maps, plans, diagrams, technical information (e.g. specifications, schematics) and images provided must be clearly annotated, in colour and of high resolution. b. All maps submitted as part of the response must be consistent with the department's Guide for providing maps and boundary data for EPBC Act projects (2021) (see Table C item 2.4a).	Throughout

Requirement	Additional Information Requested by the Department	Section/Comment
2.6 Referencing standards	Reference all sources using the Harvard standard of referencing. Ensure that other supporting documents (e.g. academic studies, regulatory standards) are publicly accessible, with electronic links provided where possible.	Throughout
2.7 Evidence based conclusions	Where appropriate, the information provided must be supported by: • Evidence-based conclusions based on the best available peer-reviewed scientific literature with supporting references cited or expert opinion provided and/or the views of suitably qualified experts. • Scientifically robust methodologies that are appropriate for purpose, and sufficient description of the methodology used, and justification of why the methodology was selected. • Include detailed technical information, studies or investigations necessary to support the information in the standalone document as appendices.	Throughout
2.8 Inclusion of sensitive information	Must not contain any commercial in confidence markings. If the preliminary documentation contains sensitive information, please discuss this with the assessment officer. Redact the contact details of departmental officers. Include the names, roles and qualifications (where relevant) of all persons involved in preparing the preliminary documentation. The response will form part of the preliminary documentation that must be published for public comment. Therefore, the contact details of departmental officers must not be included in the response. The response should not contain commercial in confidence markings. If the response contains sensitive information, please discuss with the department.	Throughout
2.9 Ecological data	The preliminary documentation must include an appendix of occurrence records (both sightings and evidence of presence) for all listed threatened and migratory species identified during field surveys for the proposed action. This data may be used by the department to update the relevant species distribution models that underpin the publicly available Protected Matters Search Tool (PMST). The species occurrence records must be provided in accordance with the department's Guidelines for biological survey and mapped data (2018) using the species observation data template provided with this request for additional information. Sensitive ecological data must be identified and treated in accordance with the department's Sensitive Ecological Data – Access and Management Policy V1.0 (2016) or subsequent revision.	Following Appendices

Appendix 2: Conservation Significant Species Management Plan (Northern Star, 2025)

APPENDIX 3: TSF DESIGN REPORT (CMW, 2025)

APPENDIX 4: SUB-SURFACE MATERIALS CHARACTERISATION (SRK, 2022)

APPENDIX 5: GEOCHEMICAL SUPPLEMENTARY LEACH TESTING PROGRAM (SRK, 2023)

APPENDIX 6: GEOCHEMICAL ECOLOGICAL RISK ASSESSMENT FOR MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE (SLR CONSULTING, 2025)

APPENDIX 7: CONCEPTUAL MINE CLOSURE PLAN

APPENDIX 8: STAKEHOLDER ENGAGEMENT REGISTER

APPENDIX 9: SOCIAL AND ECONOMIC ASSESSMENT (CONFIDENTIAL)

APPENDIX 10: CONCEPTUAL AND NUMERICAL GROUNDWATER MODELLING (GEOWATER, 2023)

APPENDIX 11: ADDITIONAL SUPPORTING INFORMATION – GROUNDWATER ASSESSMENT (NORTHERN STAR, 2025)

APPENDIX 12: TECHNICAL REVIEW – CONCEPTUAL AND NUMERIC GROUNDWATER MODELLING (JURASSIC GROUNDWATER, 2022)

APPENDIX 13: PARTICLE TRACKING MEMO (DE GREY MINING LTD, 2025)

Appendix 14: Conceptual Long-term Drawdown at 200 Years (De Grey Mining Ltd, 2025)

APPENDIX 15: TIER 2 ECOLOGICAL RISK ASSESSMENT (MBS, 2024)

APPENDIX 16: ECOLOGICAL RISK ASSESSMENT TIER 3 MEMORANDUM (MBS, 2024)

APPENDIX 17: HEMI PIT LAKE MODEL (DE GREY MINING LTD, 2025)

APPENDIX 18: GROUNDWATER AND SURFACE WATER ASSESSMENT (GEOWATER, 2022)

APPENDIX 19: BASELINE AQUATIC ECOLOGY STUDY OF THE YULE AND TURNER RIVER (STANTEC, 2022)

Appendix 20: Baseline Aquatic Ecology Flood Study of the Yule and Turner River, Memorandum (Stantec, 2022)

APPENDIX 21: HEMI GOLD PROJECT FLORA AND VEGETATION STUDIES (UMWELT 2024)

APPENDIX 22: STATUS OF *SERINGIA EXASTIA* AT HEMI (UMWELT, 2022)

APPENDIX 23: DETAILED VERTEBRATE FAUNA SURVEY 2021 – 2022 (WESTERN WILDLIFE, 2023)

APPENDIX 24: HEMI GOLD PROJECT SUBTERRANEAN FAUNA SURVEY (BENNELONGIA, 2023)

APPENDIX 25: MNES ERA ASSESSMENT (MBS, 2024)

APPENDIX 26: IMPACT RECONCILIATION PROCEDURE