Rustlers Roost and Quest 29 Open-Cut Mine Redevelopment

Draft Environmental Impact Statement (EIS)

Section 7.2 - Terrestrial Ecosystems

Prepared pursuant to the Environment Protection Act 2019

October 2021

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Key Project Terms

Term	Definition
Adaptive Management	Systematic process for incrementally improving management practices by learning from the outcomes of past and current practices.
Carbon in Leach	This process uses a dilute alkaline cyanide solution to leach (dissolve) gold from the ore material. Activated carbon removes gold out of dilute cyanide solution by adsorption (sticking). The leaching agent and activated carbon are added together in a slurry of ore and water.
Development Envelope	Defined as the maximum area within which the Project footprint could occur. The development envelope for the Project encompasses 790 ha, inclusive of Rustlers Roost, Quest 29, the accommodation camp and haul road.
Environmental Aspect	An element of the Primary Gold's activities, products or services that can interact with the environment.
Environmental Impact	Change to the environment whether adverse or beneficial, wholly or partially resulting from the Primary Gold's environmental aspects. Environmental impacts can be caused directly or indirectly from a Project activity or cumulatively with other non-Project related activities in a set area.
Environmental Factor	The NT EPA listed environmental objectives to identify environmental matters that have value to the Northern Territory and that need to be protected; and to state the objective to be achieved for each matter. The NT EPA has prepared these environmental objectives and organised these in structured divisions of the environment, called environmental factors.
Existing Disturbance Footprint	Defined as the direct disturbance area from known historical activities associated with the Rustlers Roost, Quest 29, accommodation camp and haul road areas. For Rustlers Roost and Quest 29 this is taken from the existing Mine Management Plans. The existing direct disturbance footprint encompasses 169.4ha within the development envelope.
Heap Leach Pad	Existing areas where historic mining placed ore for processing via a leaching solution to dissolve and capture the mineral. The pads contain the remaining material.
Maximum Vegetation Clearing Extent	The maximum extent of native vegetation clearing proposed for the Project based on mapped vegetation extent layers which account for historic anthropogenic disturbances to the development envelope (e.g. historic mining and pastoral activities). This area constitutes a total of 368.86 ha.
Project	The Project includes the expansion of existing pits, waste rock landforms, water storage dams and internal roads in both the Rustlers Roost and Quest 29 MLs. Two new pits will be constructed at Rustlers Roost and new infrastructure includes an onsite processing plant, a tailings storage facility, a landfill, laydown area, magazine, administration office, accommodation camp and groundwater bores for water supply. The Project is inclusive of an expanded connecting haul road between the non-contiguous extraction areas and an accommodation camp.
Project Area	The Project area is defined as wholly including ML1083 (Rustlers Roost), ML 29783 (Quest 29), ML 29814 (accommodation camp) and the connecting haul road. The entire Project area covers 1,143.25 ha.
Direct Disturbance Footprint	Defined as the direct disturbance area based on the current proposed infrastructure and material placement inclusive of Rustlers Roost, Quest 29, the accommodation camp and haul road. This area covers both historically disturbed and undisturbed areas. The disturbance footprint encompasses 532.84 ha within the Project area.
Significant Impact	A significant impact of an action is an impact of major consequence having regard to: (a) the context and intensity of the impact; and (b) the sensitivity, value and quality of the environment impacted on and the duration, magnitude and geographic extent of the impact.
Study Area	Refers to the area of survey or investigation for a specific study. This area may be beyond the Project area or development envelope.
Tailings Storage Facility	A specially engineered and constructed impoundment into which tailings (residue) from the ore processing plant is deposited for placement in perpetuity. The storage facility is constructed with confining embankments consisting of earthen material (e.g. rock and soil) and capped following closure.
Waste Rock Dump	An engineered and constructed impoundment into which overburden from the mining process is placed for safe storage in perpetuity.

Acronyms, Abbreviations and Units

Abbreviation, Acronym or Unit	Definition
$m	Million dollars
%	Percentage
+ve	Assessment of positive
µS	Microsiemens
4WD	Four-wheel drive
AADT	Average Annual Daily Traffic
AAS	Atomic Absorption Spectrophotometer
AAPA	Aboriginal Areas Protection Authority
AARL	Anglo American Research Laboratory
ABS	Australian Bureau of Statistics
AE	Aquatic Ecosystems
AEP	Annual Exceedance Probability
AFANT	Amateur Fishermen's Association of the Northern Territory
AHD	Australian Height Datum
ALA	Atlas of Living Australia
ALARP	As Low As Reasonably Practicable
AMD	Acid and Metalliferous Drainage
ANC	Acid Neutralising Capacity
ANCOLD	Australian National Committee on Large Dams
ANFO	Ammonium Nitrate
ANZG	Australia and New Zealand Government
ARI	Average Recurrence Interval
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
AS	Australian Standard
ASRIS	Australian Soil Resource Information System
ASX	Australian Stock Exchange
AS/NZS	Australian/New Zealand Standards
AUSRIVAS	Australian River Assessment System
BESS	Battery Energy Storage System
BoM	Bureau of Meteorology
BOO	Build-Own-Operate
BOOT	Build-Own-Operate-Transfer
Bq	Becquerel
BUD	Beneficial Use Declaration
CAD	Computer-Aided Design
CAPEX	Capital Expenditure
CCTV	Closed Circuit Television
CE	Community and Economy
CEO	Chief Operating Officer
CH_4	Methane

Abbreviation, Acronym or Unit	Definition
CIL	Carbon in Leach
CO_2	Carbon Dioxide
CO_2-e	Carbon Dioxide Equivalent
COPC	Contaminant of Potential Concern
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSL	Compact Soil Liner
CSM	Conceptual Site Model
C&D	Construction and Demolition
C&I	Commercial and Industrial
DAWE	Department of Agriculture, Water and Environment (Cth) (current)
DEPWS	Department of Environment, Parks and Water Security (NT) (current)
DGV	Default Guideline Value
DIDO	Drive-in Drive-out
DITT	Department of Industry, Tourism and Trade (NT) (current)
DIWA	Directory of Important Wetlands of Australia
DO	Dissolved Oxygen
DotE	Department of the Environment (Cth) (former)
DotEE	Department of the Environment and Energy (Cth) (former)
EC	Electrical Conductivity
EH&S	Environment, Health and Safety
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EMS	Environmental Management System
EPA	Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPL	Environment Protection Licence
EP Act	*Environment Protection Act 2019*
ERA	Energy Resources of Australia
ERP	Emergency Response Plan
ESCP	Erosion and Sediment Control Plan
ESD	Ecologically Sustainable Development
GDE	Groundwater Dependent Ecosystem
GGAP	Greenhouse Gas Abatement Plan
GHG	Greenhouse Gas
GJ	Gigajoule
GL	Gigalitre (1,000 Megalitres)
GPS	Global Positioning System
GRP	Gross Regional Product
GST	Goods and Services Tax
g/t	Grams Per Tonne
GV	Guideline Value
GWP	Global Warming Potential
ha	Hectare

Abbreviation, Acronym or Unit	Definition
HDPE	High Density Polyethylene
HEC-HMS	Hydrologic Modelling System
HFC	Hydrofluorocarbons
HP	Hydrological Processes
HSE	Health, Safety and Environment
IAP2	International Association for Public Participation
IBC	Intermediate Bulk Container
ID	Identification
IECA	International Erosion Control Association
IFC	International Finance Corporation
IPCC	Intergovernmental Panel on Climate Change
IPP	Independent Power Provider
ISO	International Organisation for Standardisation
IWEQ	Inland Water Environmental Quality
JORC	Joint Ore Reserve Committee
kL	Kilolitre
km	Kilometre
km^2	Square Kilometre
kV	Kilovolt
L	Litre
L/s	Litre Per Second
LED	Light Emitting Diode
LiDAR	Light Detection and Ranging
LNG	Liquefied Natural Gas
LOM	Life-of-Mine
LPG	Liquefied Petroleum Gas
M	Million
m	Metre
m^2	Metre squared
m^3	Cubic metre
mAHD	Metres Australian Height Datum
mBGL	Metres Below Ground Level
MCP	Mine Closure Plan
MEDLI	Model for Effluent Disposal Using Land
mg	Milligram
ML	Mining Lease (Granted)
MLA	Mining Lease Application
mm	Millimetre
MMP	Mining Management Plan
MNES	Matter of National Environmental Significance
MP	Management Plan
mRL	Metres Reduced Level
Mt	Million Tonnes

Abbreviation, Acronym or Unit	Definition
Mtpa	Million Tonnes Per Annum
MW	Megawatt
N_2O	Nitrous Oxide
NAF	Non-Acid Forming
NAPP	Net Acid Producing Potential
N/A	Not Applicable
NGER Act	*National Greenhouse Energy Reporting Act 2007*
NLC	Northern Land Council
NMD	Neutral Mine Drainage
NORM	Naturally Occurring Radioactive Material
NOI	Notice of Intent
NO_2	Nitrogen Dioxide
NSESD	National Strategy for Ecologically Sustainable Development
NT	Northern Territory
NTG	Northern Territory Government
NTU	Nephelometric Turbidity Unit
NT Act	*Native Title Act 1993*
NVIS	National Vegetation Information System
OPEX	Operational Expenditure
PAF	Potentially Acid Forming
PASS	Potential Acid Sulfate Soil
PER	Public Environmental Report
PET	Plecoptera, Ephemeroptera and Trichoptera
PFC	Perfluorocarbon
PGO	Primary Gold Limited, a wholly owned subsidiary of Hanking Australia Investment Pty Ltd
PMF	Probable Maximum Flood
PMLU	Post Mining Land Use
PMST	Protected Matter Search Tool
PPL	Perpetual Pastoral Lease
Q	Quarter
RL	Reduced Level
RMP	Risk Management Plan
RO	Reverse Osmosis
ROM	Run of Mine
RRMPL	Rustlers Roost Mining Pty Ltd
RSWL	Reduced Standing Water Level
SA	Statistical Area
SD	Saline Drainage
SDS	Safety Data Sheet
SEP	Stakeholder Engagement Plan
SEIFA	Socio-Economic Indexes for Areas
SF_6	Sulfur Hexafluoride
SGV	Site-Specific Guideline Value

Abbreviation, Acronym or Unit	Definition
SIGNAL	Stream Invertebrate Grade Number – Average Level
SoBS	Site of Botanical Significance
SoCS	Site of Conservation Significance
SSAN	Security Sensitive Ammonium Nitrate
SSC	State Suburb Code
SSTV	Site-Specific Trigger Values
STP	Sewage Treatment Plant
SWGs	Stock Water Drinking Guidelines
SWL	Standing Water Level
t	Tonne
TAMS	Territory Asset Management Services
TARP	Trigger Action Response Plan
TBD	To Be Determined
TE	Terrestrial Ecosystems
TEC	Threatened Ecological Community
TEQ	Terrestrial Environmental Quality
Th	Thorium
TN	Total Nitrogen
ToR	Terms of Reference
TP	Total Phosphorus
TPWC Act	*Territory Parks and Wildlife Conservation Act 1976*
TSF	Tailings Storage Facility
TSS	Total Suspended Solids
TSSC	Threatened Species Scientific Committee
U	Uranium
UC	Uncertain
V	Volt
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNFCCC	United Nations Framework Convention on Climate Change
WCD	Water Control District
WDL	Waste Discharge Licence
WMP	Water Management Plan
WONS	Weed of National Significance
WRD	Waste Rock Dump
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

7.2 Terrestrial Ecosystems

NT EPA Environmental Factor	Terrestrial Ecosystems
NT EPA Environmental Objective	*Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.*
Relevant Policy and Guidance	▪ Biodiversity Management: Leading Practice Sustainable Development Program for the Mining Industry (Australian Government 2016a); ▪ Cyanide Management: Leading Practice Sustainable Development Program for the Mining Industry (Australian Government 2008); ▪ Guidelines for Assessment of Impacts on Terrestrial Biodiversity (NT EPA 2013a); ▪ Guidelines for the Siting, Design and Management of Solid Waste Disposal Sites (In the Northern Territory) (NT EPA 2013b); ▪ Land Clearing Guidelines (DENR 2020); ▪ Leading Practice Sustainable Development Program for the Mining Industry – Mine Rehabilitation (Australian Government 2016b); ▪ Light Pollution: Effects of Wildlife (DAWE 2021); ▪ Matters of National Environmental Significance, Significant impact guideline 1.1 (DotE 2013); ▪ NT EPA Environmental Factors and objectives: Environmental impact assessment general technical guidance (NT EPA 2021a) and ▪ Tailings Managements: Leading Practice Sustainable Development Program for the Mining Industry (Australian Government 2016c).

This section provides an assessment of the terrestrial ecosystem factors relevant to the Project. This section has utilised existing desktop information and field survey data to establish the existing terrestrial environment baseline. Potential impacts of the Project on terrestrial ecosystem aspects have been identified and assessed in accordance with the risk assessment framework identified in Section 6. Actions to avoid or minimise potential impacts have subsequently been identified in accordance with the environmental decision-making framework.

7.2.1 Environmental Values

The following sections discuss surveys related to terrestrial ecosystem data collection and provide a detailed description of the existing environmental baseline for the values relevant to the Project area and surrounds.

The Project area supports native vegetation, cleared areas and several permanent waterbodies, consisting of Annie's dam and pit lakes. All permanent waterbodies in the Project area are non-natural and the result of historic mining activities at the site. Approximately 69% of the Project area is covered by native vegetation of varying condition (further discussed below in Section 7.2.1.1). Cleared or disturbed areas, arising from historic mining, grazing and agriculture activities, account for approximately 31%. Included in the area noted as native vegetation are areas of riparian vegetation. Although these are non-permanent water features, the ephemeral channels host a variety of wetland floristic species.

7.2.1.1 Vegetation

In accordance with the National Vegetation Information System (NVIS), the surrounding vegetation within the region is generally classified as Eucalyptus woodland on undulating rises and plains, extending onto low hills (DEPWS 2021). Areas along the main river lowlands of the Mary River and Adelaide River generally consist of Melaleuca low open woodland and Oryza tall closed tussock grassland. To the north of the Project area the regional vegetation outside of the primary drainage lines and floodplains transitions from Eucalyptus woodland to Eucalyptus open forest on undulating low plateaux, peneplains and rise, and upper slopes of ridges (Figure 7-6).

In accordance with the Northern Territory Government mapping (DEPWS 2021) the Project intersects three areas being (1) disturbed pastoral, horticultural and roads (31% of Project area), (2) Eucalyptus woodland (65% of Project area) and (3) Eucalyptus open forest (4% of Project area).

Overall, mapped remnant native vegetation comprises 68.78% of the Project area. Ecological surveys undertaken by Low Ecological Services P/L (LES) in 2016 and 2017 identified mapping of vegetation in the survey areas at a scale of 1:100,000 and found that there are two vegetation types as described by Wilson et al., (1990) over the Project area for Rustlers Roost and Quest 29. These vegetation types are described as 'Woodlands', and 'Low Woodlands'. The vegetation at Rustlers Roost consists entirely of 'Woodlands' vegetation dominated by *Eucalyptus tectifica*, *Eucalyptus latifolia* woodland with Sorghum grassland understorey which is common in the broader region (LES 2017a). The majority of the vegetation type at the Quest 29 consists of 'Low Woodlands' which is comprised of *Eucalyptus tintinnans* low woodland with Sorghum grassland understorey, with a minor portion of the area mapped as "Woodlands', similar to the Rustlers Roost portion of the Project area (refer to Figure 7-6).

For the accommodation camp portion of the Project area, the mapping by Wilson *et al.,* (1990) is generally consistent with NVIS mapping, with both showing the area traversing two broad vegetation types being Eucalyptus woodland in the east and Eucalyptus open forest in the west (Refer to Figure 7-7). While the majority of the haul road is mapped as being previously disturbed, the Project area intersects Eucalyptus woodland in several sections (Figure 7-7).

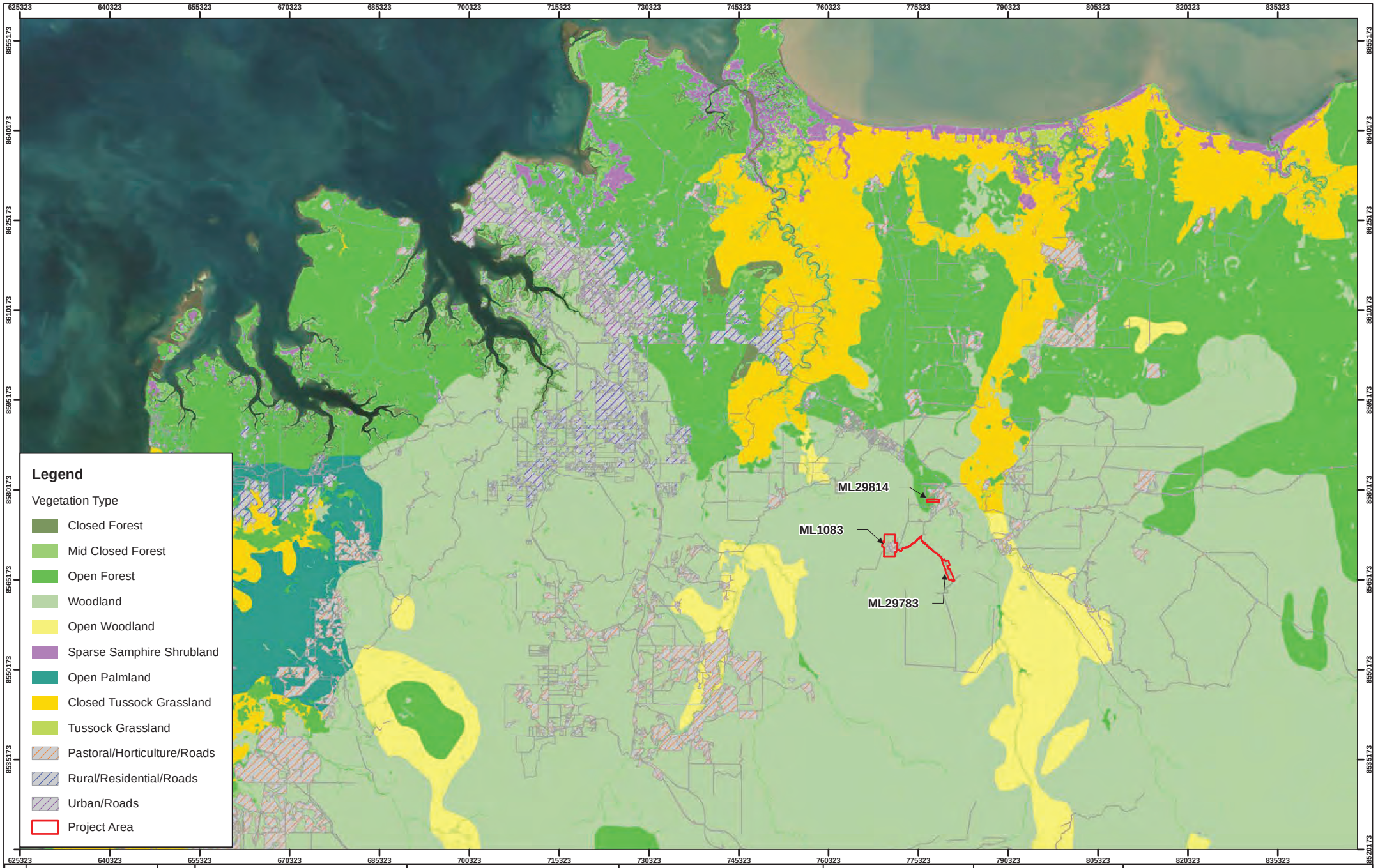
While flora and fauna values in the broader mining leases have previously been assessed and surveyed by LES in 2016 and 2017, it was determined through consultation with the Flora and Fauna Division at the DEPWS, that additional floristic surveys were required. Beyond the broadscale mapping, vegetation units have been developed at a more refined level for the accommodation camp (GHD 2015) and for the Rustlers Roost and Quest 29 portions of the Project (EcOz 2020a). These vegetation units are described for each area in Table 7-12 and presented in Appendix K. Photos of the vegetation in the predominant land units within the Project area are provided in Plate 7-4 to Plate 7-7 inclusive.

Table 7-12 Description of Vegetation Types for the Project Area

Land Unit	Project Area	Fine Vegetation Description	Area
2a Low Hills	Quest 29	Upper: *Eucalyptus miniata*, *Corymbia polysciada*), *Corymbia dichromophloia* and occasional *Corymbia clavegeria* [20% cover, 8-10 m high]. Low to mid high open woodland. Mid: *Erythrophleum chlorostachys*, *Corymbia dichromophloia* [30% cover, 2-8 m high]. Open shrubland. Ground: *Eriachne* sp., and *Triodia bitextura* [40% cover, 2-8 m high]. Tussock grassland.	260.25[8] [18.3 ha] [9]

[8] Indicative area of land unit (Refer to Table 7-4)
[9] Area verified for NVIS Level V criteria (EcOz 2020a)

Land Unit	Project Area	Fine Vegetation Description	Area
2b Rises	Rustlers Roost Haul Road, Accommodation Camp	**Rises and ridges:** Upper: *Corymbia polysciada, Eucalyptus miniata*, *Corymbia dichromophloia* and occasional *Eucalyptus tintinnans* [30% cover, 8-12 m high]. Low to mid high open woodland, Mid: *Erythrophleum chlorostachys*, *Corymbia dichromophloia* and *Gardenia megasperma* [20% cover, 1-8 m high]. Mid high open shrubland to shrubland Ground: *Eriachne* sp. *Heteropogon triticeus* and *Triodia bitextura* [40% cover, 0.2 – 0.8 m high]. Low to mid high open tussock grassland **Plateau:** Upper: *Eucalyptus tetrodonta/miniata* woodland. 30% cover, 8-12 m high]. Mid: Eucalypt saplings, *Erythrophleum chlorostachys, Livistona humilis* open shrubland [20% cover, 1-8 m high]. Ground cover of *Petalostigma quadriloculare,* and mixed grasses [40% cover, 0.2 – 0.8 m high].	800.66 ha [8] [214.5 ha][9]
3a Rises	Quest 29 Haul Road	Upper: *Eucalyptus miniata, Corymbia* sp., *Corymbia clavigera* [45% cover 12-14 m high] high woodland. Mid *Erythrophleum chlorostachys*, *Acacia auriculiformis, Calytrix exstipulata* [25% cover, 2-8 m high] shrubland. Ground: *Eriachne* sp. [10% cover, 0.2-1 m high] sparse tussock grassland and leaf litter	11.69 ha [8] [13.9 ha] [9]
3b Low Rises	Rustlers Roost Haul Road	*Corymbia polysciada, Erythrophleum chlorostachys, Corymbia foelscheana* and *Calytrix* spp. low woodland. Minor *Eucalyptus miniata, Eucalyptus tectifica* and *Corymbia bleeseri* woodland.	5.16 ha [8]
4a Low Rises	Accommodation Camp	*Erythrophleum chlorostachys, Eucalyptus miniata* mixed species woodland with *Sorghum plumosum, Themeda triandra, Chrysopogon fallax* and *Heteropogon triticeus* tussock grass understorey.	7.07 ha [8]
4b Plains	Quest 29	*Corymbia polycarpa, Corymbia grandifolia, Vitex glabrata* and *Lophostemon lactifluus* woodland with *Sorghum plumosum, Themeda triandra, Chrysopogon fallax* and *Eriachne burkittii* tussock grass understorey.	0.01 ha [8]
5b Alluvial Plans	Haul Road	*Corymbia polycarpa, Corymbia bella* and *Corymbia grandifolia* open woodland/woodland; minor *Melaleuca spp.; Eriachne burkittii, Chrysopogon setifolius, Themeda triandra* mixed tussock grass understorey.	12.09 ha [8]
5c Alluvial Plains	Haul Road Accommodation Camp	*Eriachne burkittii, Chrysopogon setifolius* mixed spp. tussock grassland with sedges.	12.09 ha [8]
6a Drainage Systems	Q29SVS6, Q29SP, Riparian like 6a	Upper: *Corymbia bella*, *Corymbia polycarpa, Ficus racemosa* and occasional *Melaleuca leucadendra, Alstonia actinophylla, Barringtonia acutangula and* Banyan trees, [55% cover, 12-14 m high] Mid high woodland to open forest. Mid: *Erythrophleum chlorostachys*, *Terminalia* sp., and *Acacia auriculiformis* and occasional *Planchonia careya* [35% cover, 6-10 m, high]. Open shrubland. Ground: *Aristida* sp., and Hyptis [1% cover, 0.6 m high]. Mid high open tussock grassland.	0.00 ha [8] [9.9 ha] [9]
6a1 Drainage Systems	Q29NVS4, RRS-sty	Upper: Mixed Corymbia species; *Corymbia bella*, *Corymbia polycarpa* and *Corymbia grandiflora* and occasional *Eucalypt bigalerita* and *Eucalyptus tectifica* [15% cover. 10-15 m high] Mid to high woodland over shrubland of mixed species. Mid: *Erythrophleum chlorostachys, Buchanania obovate* [15% cover, 2-7 high]. Ground: *Eriachne* sp. and *Mnesithea* sp. [3% cover 0.5 m high]. Sparse tussock grassland	18.58 ha [8] [9.1 ha] [9]



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Notes:

N

0 6,000 12,000 24,000

Meters

1 cm = 5,700 meters

GCS GDA 1994 MGA Zone 52

DISCLAIMER
CDM Smith has endeavoured to ensure accuracy and completeness of the data. CDM Smith assumes no legal liability or responsibility for any decisions or actions resulting from the information contained within this map.

DATA SOURCE
NT Government Open Source Data

DESIGNER

CDM Smith

CLIENT

PRIMARY GOLD

FIGURE 7-6

Vegetation Types in the Region

DRG Ref: 1001087-EIS-07-7.20

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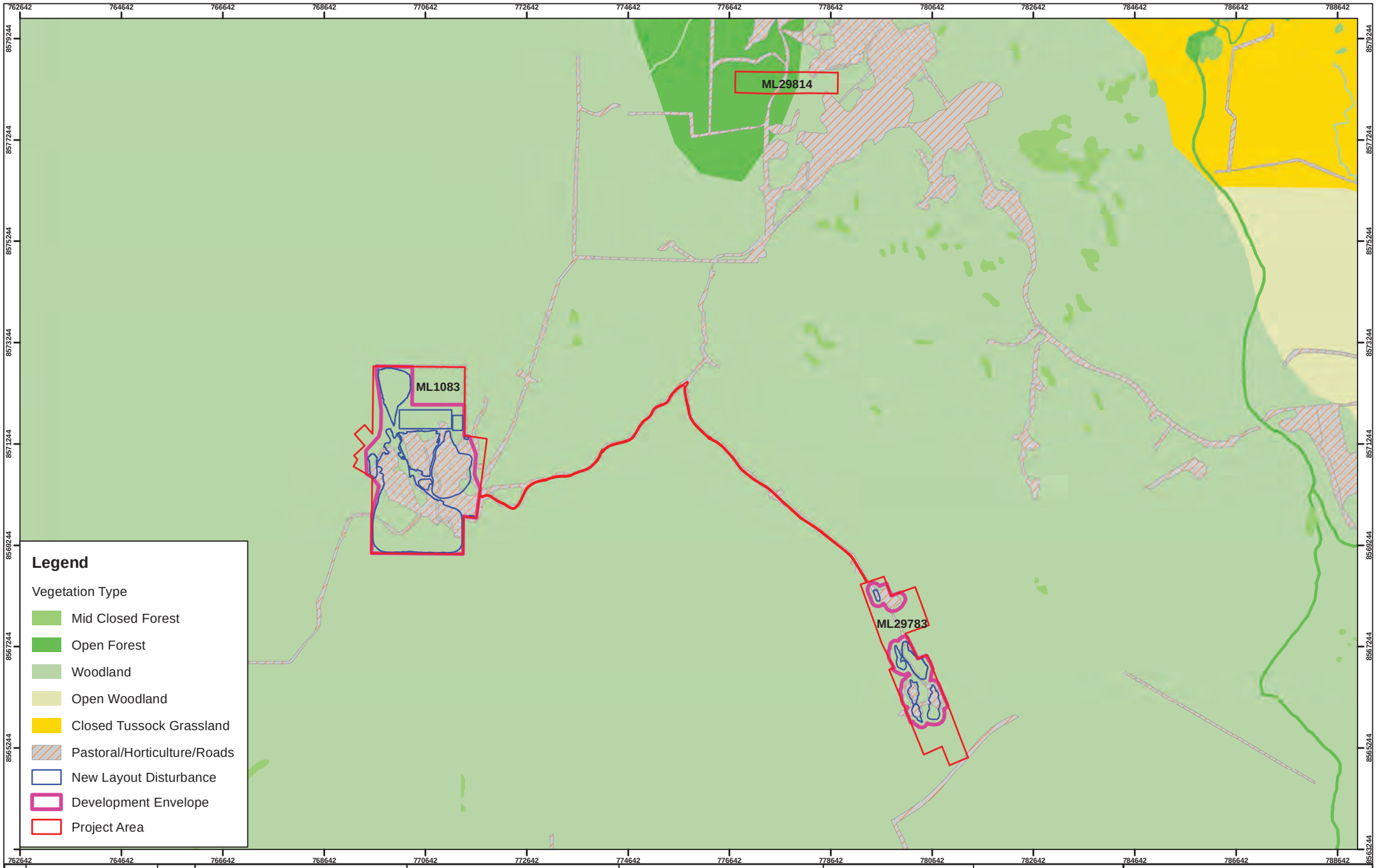

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Notes:

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0 700 1,400 2,800

Meters

1 cm = 674 meters

GCS GDA 1994 MGA Zone 52

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DATA SOURCE
NT Government Open Source Data

DESIGNER

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FIGURE 7-7

Broadscale Mapping of Vegetation Types within Project Area

DRG Ref: 1001087-EIS-07-7.8

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Plate 7-4 Vegetation in Land Unit 2b characteristic of Rustlers Roost site

Plate 7-5 Vegetation in Land Unit 2b characteristic of Rustlers Roost site

Plate 7-6 Vegetation in Land Unit 2a in Central Quest 29 WRD

Plate 7-7 Vegetation in Land Unit 6a Quest 29 Zamu Pit

Source: EcOz 2020a

The flora surveys identified riparian habitat within and immediately adjacent to the Project area and this was assessed for condition. The surveys were undertaken in October 2020 and July 2021, in accordance with *Guidelines and Field methodology for Vegetation Survey* (Brocklehurst et al. 2007) and focused on the haul road, Rustlers Roost and Quest 29 portions of the Project area.

Much of the riparian areas within, and to the east of Rustlers Roost have been disturbed due to previous mining activities, however, during the survey, these areas were found to contain some monsoonal species (*Maranthes corymbosa* and some large Milkwood trees). Riparian environments are typically more sensitive and susceptible to impacts. The presence of monsoon species is an indicator of the typical riparian environment.

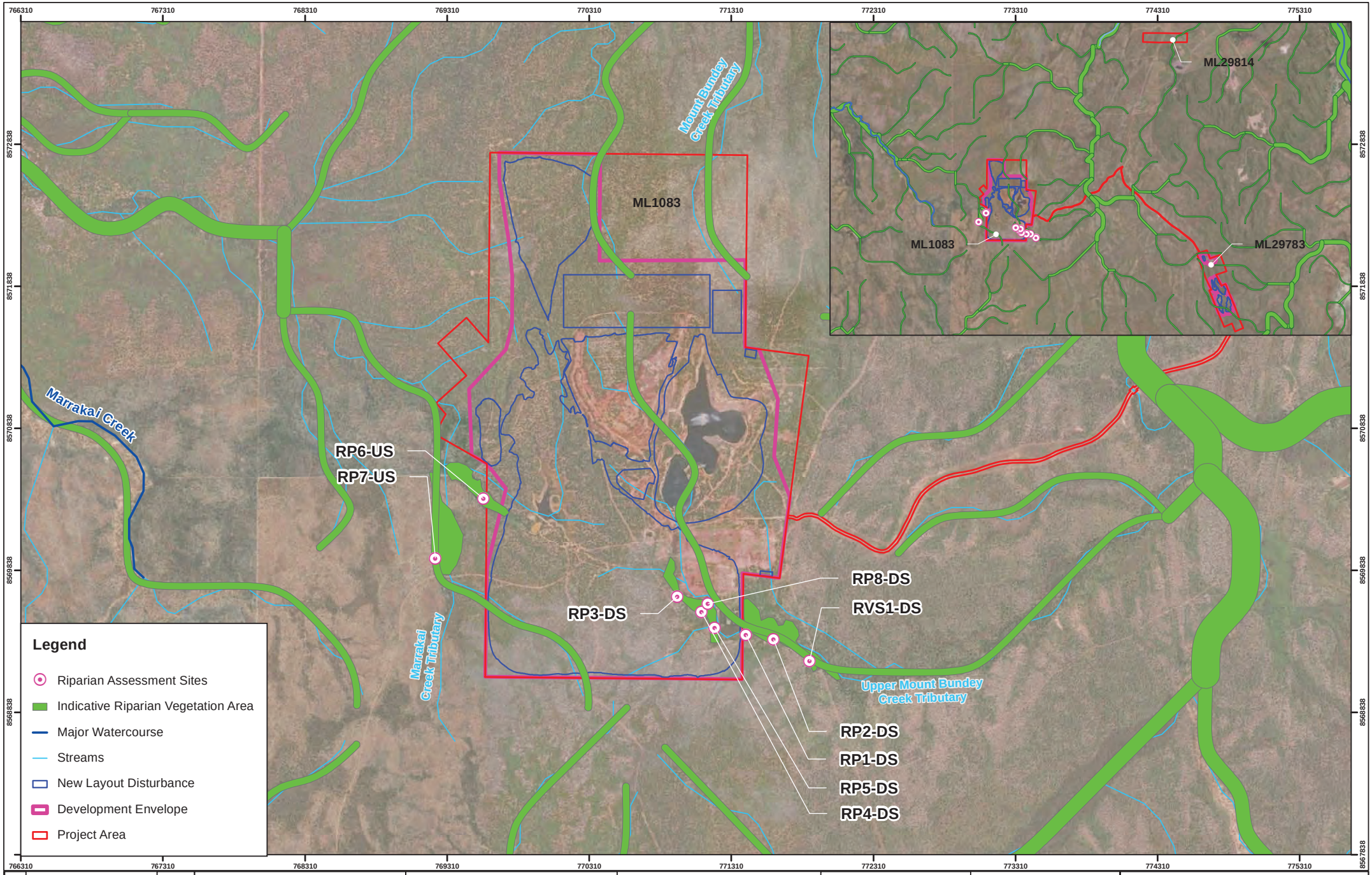
Riparian areas to the west of Rustlers Roost were largely intact and weed free (EcOz 2020a) (refer to Plate 7-4). Areas within the Quest 29 portion of the Project area were classified as the riparian land unit 6a and comprised of riparian vegetation and contained monsoon vine species (refer to Plate 7-5). Much of these riparian areas have been disturbed by previous clearing and stockpiling of fill material; weeds and feral animals were observed in these areas (EcOz 2020a). Riparian vegetation is common in the region with riparian habitat present downstream of the Project area in Mount Bundey Creek (Figure 7-8) (GHD 2018). The riparian habitat was largely intact along Mount Bundey Creek (GHD 2018).

The Project haul road intersects one site containing riparian vegetation communities (RP03) (Figure 7-8). The three other survey sites where the haul road intersects drainage features contain species more consistent with open drainage lines (Appendix M). The condition of these communities was assessed in the August 2021 survey to be in generally poor condition exhibiting historic disturbance and erosion (Appendix M).

The vegetation survey undertaken by EcOz (2020) also identified two areas of 'closed forest'. Closed Forests are considered to be sensitive and significant vegetation types in the Northern Territory, as they can be easily impacted by adjacent land-uses or management; or that they are spatially restricted habitat types that play an important role to wildlife (DENR 2020).

Macroinvertebrate sampling has also been completed at downstream sections of watercourses intersecting the Rustlers Roost and Quest 29 portions of the Project area. Macroinvertebrate results can be an indicator of watercourse and riparian zone health. The survey identified that the habitat characteristics of the upstream site on Marrakai Creek were quite different to its downstream characteristics and were also unlike those found in the Mount Bundey Creek catchment (AES 2021). Refer to Section 7.5 for further details of the aquatic ecosystem.

The upstream riparian zone lacked understorey vegetation, besides grasses, and trees were sparse (refer to Plate 7-8). This is likely to have resulted in lower shading, and a lower likelihood of detritus being deposited in the creek bed. The upstream site also contained submerged macrophytes, which provide structural habitat not found downstream (Plate 7-9). The habitat available at the two downstream sites closest to the Rustlers Roost Project area was similar, with more dense riparian environments consisting of shrubs and trees (refer to Plate 7-10 and Plate 7-11).



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APPROVED	TK	DATE	13/08/21

Notes:

N

0 260 520 1,040

Meters

1 cm = 240 meters

GCS GDA 1994 MGA Zone 52

DISCLAIMER
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DATA SOURCE
NT Government Open Source Data

DESIGNER

CDM Smith

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PRIMARY GOLD

FIGURE 7-8

Location of Riparian Survey Areas (EcOz 2020a)

DRG Ref: 1001087-EIS-07-7.9

C:\Users\shilpass\Desktop\Hanking Gold Mine EIS\1001087 - Rustlers Roost EIS\1001087 - Rustlers Roost EIS\02 MXD\Chapter 7\Figure 7-9.mxd

Plate 7-8 Upstream Riparian Vegetation of Marrakai Creek Tributary

Plate 7-9 Downstream Riparian Vegetation of Marrakai Creek Tributary

Plate 7-10 Upstream Riparian Vegetation of Mount Bundey Creek Tributary

Plate 7-11 Downstream Riparian Vegetation of Mount Bundey Creek Tributary

Source: AES 2021

7.2.1.2 Flora

Desktop and Field Surveys

The EPBC protected matters search tool (PMST)[10] identified two endangered flora species, *H. macrothrix* and *S. ensatum*, and one vulnerable flora species, *Goodenia quadrifida*, as potentially occurring within 20 km of the Project areas. The NT Flora Atlas identified records of *H. macrothrix* and *G. quadrifida* within the same search area, along with records of *Schoutenia ovata*, which is listed as vulnerable under the TPWC Act (refer to Figure 7-9). Twenty-one data deficient and three near threatened species were identified by the NT Flora Atlas as occurring within 20 km of the Project area. An overview for each of these species is further discussed below.

Field surveys were initially conducted over three main portions of the Project area (Rustlers Roost, Quest 29 and the accommodation camp) in 2016 and 2017. The surveys were conducted at the end of the dry season (November 2016) and at the start of the dry season (May 2017). Site descriptions were carried out within a 50 m x 50 m quadrat, with eight sites in each of the three separates survey areas (Figure 7-9). Site descriptions provided a snapshot of the landscape, geology, soil, dominant flora species and vegetation structure and density at each site. The presence of termite mounds, woody debris, impact from disturbance, weeds and current vegetation condition were also recorded. Photographs were taken at each site that represented the landscape and vegetation community, facing north, south, east and west. Flora species lists were completed, utilising a walkover of the quadrat. Voucher specimens were taken where plants could not be identified in the field. Voucher specimens were identified by botanists at the Northern Territory Herbarium, Darwin (LES 2017a).

Surveying was targeted towards habitat types that may support threatened species listed under the EPBC and TPWC Acts that were identified by the NT EPA and the desktop survey as occurring or potentially occurring within the study areas. More flora species were recorded in all survey areas during the post-wet season survey (May 2017: n = 186) than the late dry season survey (November 2016: n = 102), which was likely due to the higher soil moisture available from wet season rainfall. More flora species was recorded in the survey area covering the accommodation camp during both surveys (November 2016: n = 62; May 2017: n = 115) compared to Rustlers Roost (November 2016: n = 42; May 2017: n = 95) and Quest 29 (November 2016: n = 44; May 2017: n = 85) (refer to Appendix K).

In consultation with the Flora and Fauna Division at DEPWS, it was determined that further survey effort was required for the Endangered sub-shrub *H. macrothrix* and the dicotyledonous plant *S. ensatum* to document the riparian habitat value and current condition within and adjacent to the Project Area (EcOz 2020a). Habitat modelling prepared by the Northern Territory Government indicates that two threatened species, *H. macrothrix* and *S. ensatum* could occur in the Project area (refer to Figure 7-10) (NTG 2016a and NTG 2016b). *H. macrothrix* and *S. ensatum* are listed as Endangered under the EPBC Act and the TPWC Act.

The *H. macrothrix* field surveys were undertaken over four days between 15 and 17 September, and on 1 October 2020. The surveys for *H. macrothrix* were undertaken prior to the development of the specific survey guidelines for that species. The survey methodology was designed in consultation with the NT Herbarium (part of DEPWS). Prior to field surveys, specimens were viewed from the reference collections at the NT Herbarium to assist with the field identification and to become familiar with the diagnostic features of the plant. Other species within the genus were also examined including *Helicteres darwinensis, Helicteres cana* and *Helicteres angustifolia*, as these species can also be similar in appearance A reference site located approximately 5 km north-east of Quest 29 and 12 km east of Rustlers Roost – with a known *H. macrothrix*

[10] An initial PMST extract was created in 2016 for the ecological desktop analysis and reporting. An updated PMST extract was created in August 2021 to verify the results. No additional listed flora and fauna species were identified in the 2021 search.

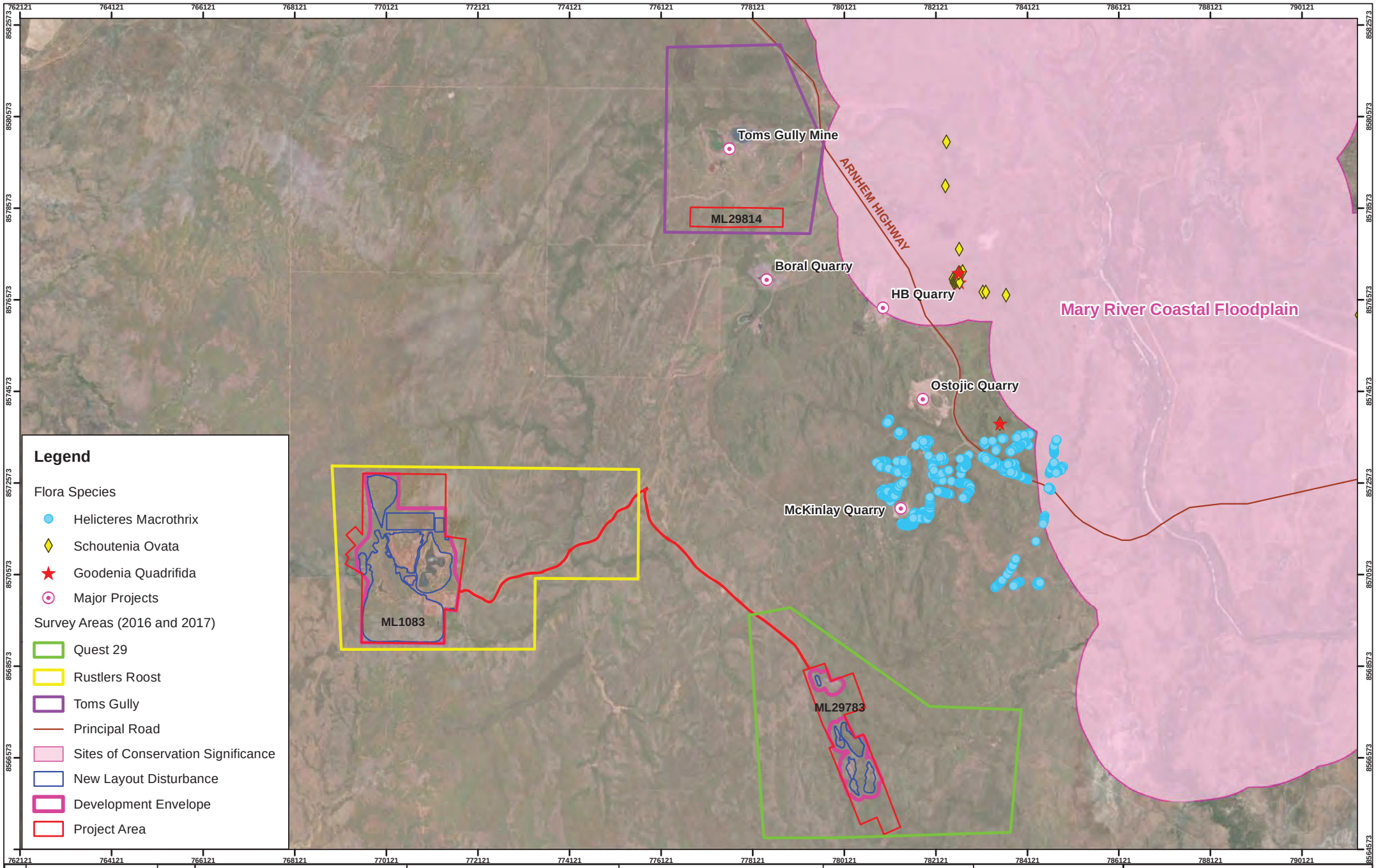
population was visited at the time of the field surveys to confirm the presence, habitat, phenological state and detectability of the species in the general area.

As advised by DEPWS, the areas modelled as potential habitat within the Project area were searched on foot by multiple observers following transects spaced 25 m apart which were pre-loaded onto handheld GPS units. Transects were placed perpendicular to the general direction of contours to ensure good coverage of topography, maximising the chance of detecting sub-populations. In the two small survey areas in the southern portion of Quest 29, a meander technique was utilised due to the very small size of these areas, and the steep topography in places being unsuitable for transects (EcOz 2020a). Approximately 87 km was walked across approximately 168 ha of potential habitat (refer to Figure 7-11 and Figure 7-12). *H. macrothrix* was not detected during these surveys (refer to Appendix M).

The Project area was refined following submission of the referral, and a subsequent targeted *H. macrothrix* survey using the same methodology as the 2020 survey was completed in areas subject to additional disturbance where it corresponded with the modelled extent. The location of flora surveys is shown in Figure 7-13 and detailed methodology for the survey is provided in Appendix M.

Targeted surveys were performed by EcOz during October 2020 at Rustlers Roost and Quest 29. Additional targeted surveys were completed in August 2021 at four locations where drainage lines intersect the haul road and 10 sites along the haul road. Using the broadscale NTG habitat model, there were three areas totalling 3 ha of potential *S. ensatum* habitat at the Rustler Roost and Quest 29 mining areas and 1.16 ha in the haul road Project area. The survey methodology was undertaken in line with the draft *Northern Territory guidelines for targeted surveys of threatened and significant plant species* (Glen Ewers pers. comm. 29 July 2021).

The NTG model indicated that *S. ensatum*, could occur based on the available data; however, due to its seasonal detectability, only habitat suitability was assessed during October 2020. Only one small (approximately 3,000 m²) patch of modelled *S. ensatum* habitat was considered to be marginally suitable habitat based on the known ecology of the plant. Other areas modelled as potential *S. ensatum* habitat within the Project area were assessed as being unsuitable and unlikely to support this species. (EcOz 2020a). LES (2017a) also indicated that there is a low likelihood of *S. ensatum* occurrence within the Project area. During subsequent targeted surveys within the optimal seasonal window of June-July 2021, no individuals of *S. ensatum* were detected.



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APPROVED	TK	DATE	12/08/21

Notes:

N

0 800 1,600 3,200

Meters

1 cm = 745 meters

GCS GDA 1994 MGA Zone 52

DISCLAIMER
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DATA SOURCE
NT Government Open Source Data

DESIGNER

CDM Smith

CLIENT

PRIMARY GOLD

FIGURE 7-9

Threatened Flora Records and Flora Survey Locations

DRG Ref: 1001087-EIS-07-7.10

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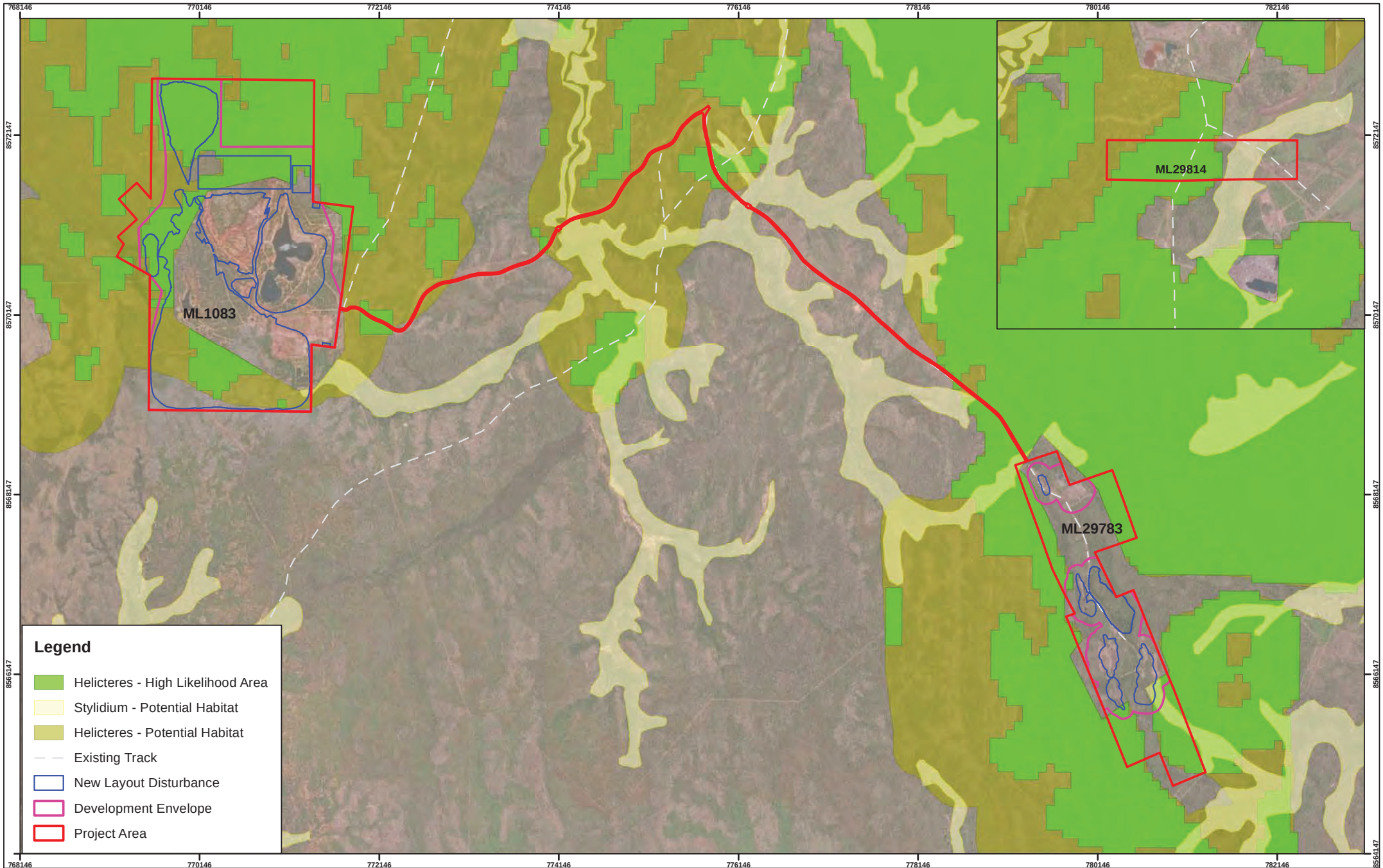

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APPROVED	TK	DATE	11/08/21

Notes:

N

0 415 830 1,660

Meters

1 cm = 382 meters

GCS GDA 1994 MGA Zone 52

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DATA SOURCE
NT Government Open Source Data

DESIGNER

CDM Smith

CLIENT

PRIMARY GOLD

FIGURE 7-10

Map of Modelled Distribution of Threatened Flora Species

DRG Ref: 1001087-EIS-07-7.11

C:\Users\shilpass\Desktop\Hanking Gold Mine EIS\1001087 - Rustlers Roost EIS\1001087 - Rustlers Roost EIS\02 MXD\Chapter 7\Figure 7-12.mxd

Conservation Significant Species

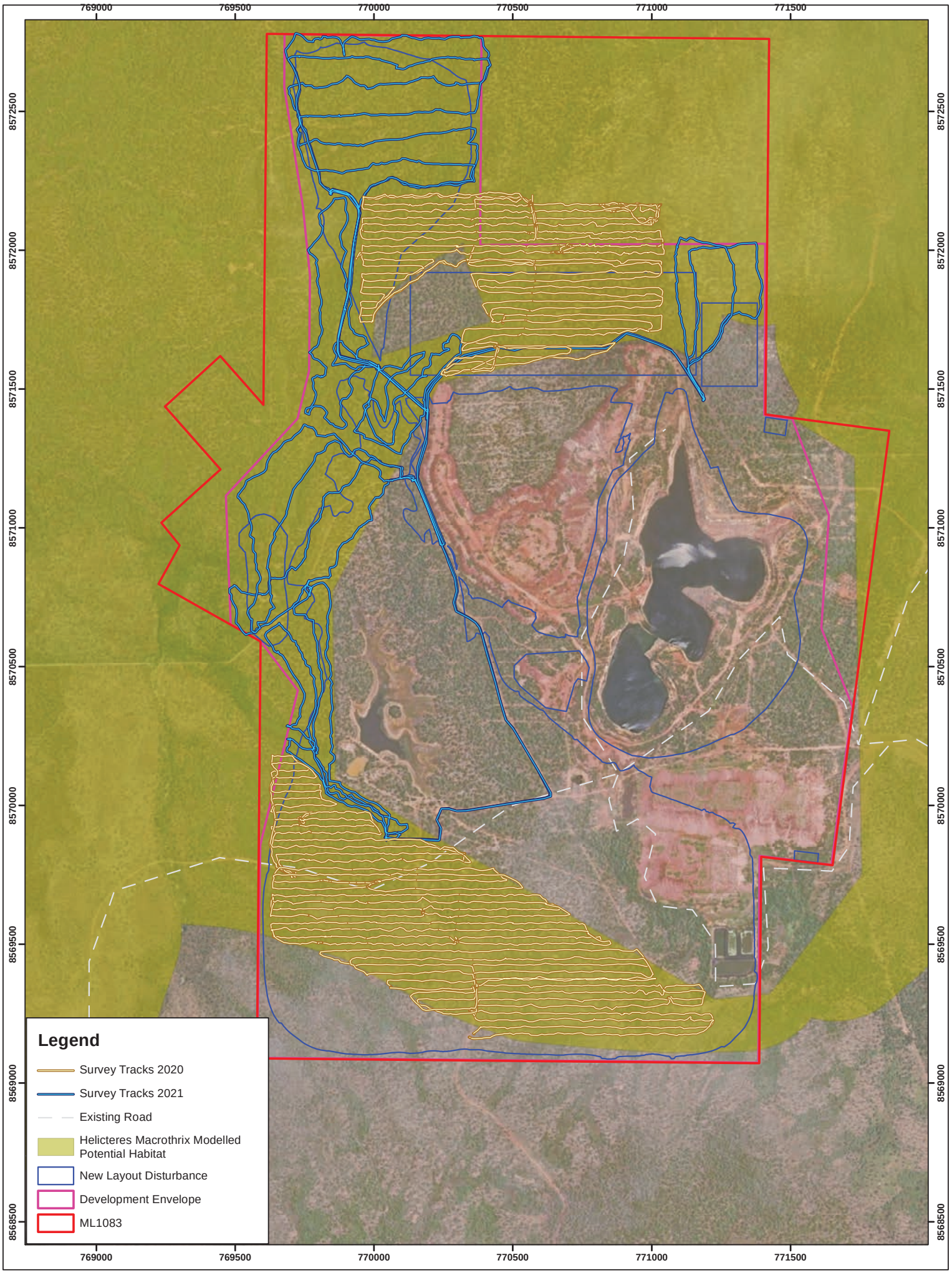
Helicteres Macrothrix

H. macrothrix is a multi-stemmed subshrub, one of approximately 13 species of the genus *Helicteres* from the Northern Territory (Cowie 2011). *H. macrothrix* is endemic to the Northern Territory and is listed as Endangered under both the TPWC Act and the EPBC Act.

H. macrothrix grows in *E. tectifica*, *E. miniata* or *E. tetrodonta* woodland on clayey soils derived from siltstone or more sandy soils derived from syenite. The species grows to 50 cm tall with ascending to erect branches, pink to purple flowers, and fruits, leaves and branches that are green and woolly-hairy. The aerial parts of the plant are annual, with perennial root stock. The plant is known to re-sprout from root stock, often vigorously, after fire. The species has been recorded from three populations – near Mount Bundey, near Batchelor and in the Lake Bennett area. The known extent of occurrence for this species is 915 km^2. *H. macrothrix* flowers from November to March and fruits from January to March (DENR 2012).

Plate 7-12 *Helicteres macrothrix* Leaves and Flowers
(Images I. D. Cowie)

Targeted surveys of the Project area were performed by EcOz during September 2020 and July 2021 at Rustlers Roost and Quest 29. Rustlers Roost and Quest 29 were both observed to contain large areas of potentially-suitable open woodland habitat, with dominant upper strata species often being the three species associated with *H. macrothrix* – commonly *E. miniata* and *E. tetrodonta*, and less commonly, patches of *E. tectifica* – on slopes and rises over soils ranging from sandy loam to silty clay. However, no occurrences of the species were detected in any of the surveys.



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APPROVED	-	DATE	01/10/21

Notes:

N

0 90 180 360

Meters
1 cm = 120 meters
GCS GDA 1994 MGA Zone 52

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DATA SOURCE
NT Government Open Source Data

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FIGURE 7-11

Map of *Helicteres Macrothrix* Survey Tracks at Rustlers Roost

DRG Ref: 1001087-EIS-07-7.12

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DESIGNED	SS	CHECKED	JM
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APPROVED	TK	DATE	01/10/21

Notes:

N

0 90 180 360

Meters
1 cm = 120 meters
GCS GDA 1994 MGA Zone 52

DISCLAIMER
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DATA SOURCE
NT Government Open Source Data

DESIGNER
CDM Smith

CLIENT
PRIMARY GOLD

FIGURE 7-12

Map of *Helicteres macrothrix* Survey Tracks at Quest 29

DRG Ref: 1001087-EIS-07-7.12

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Stylidium Ensatum

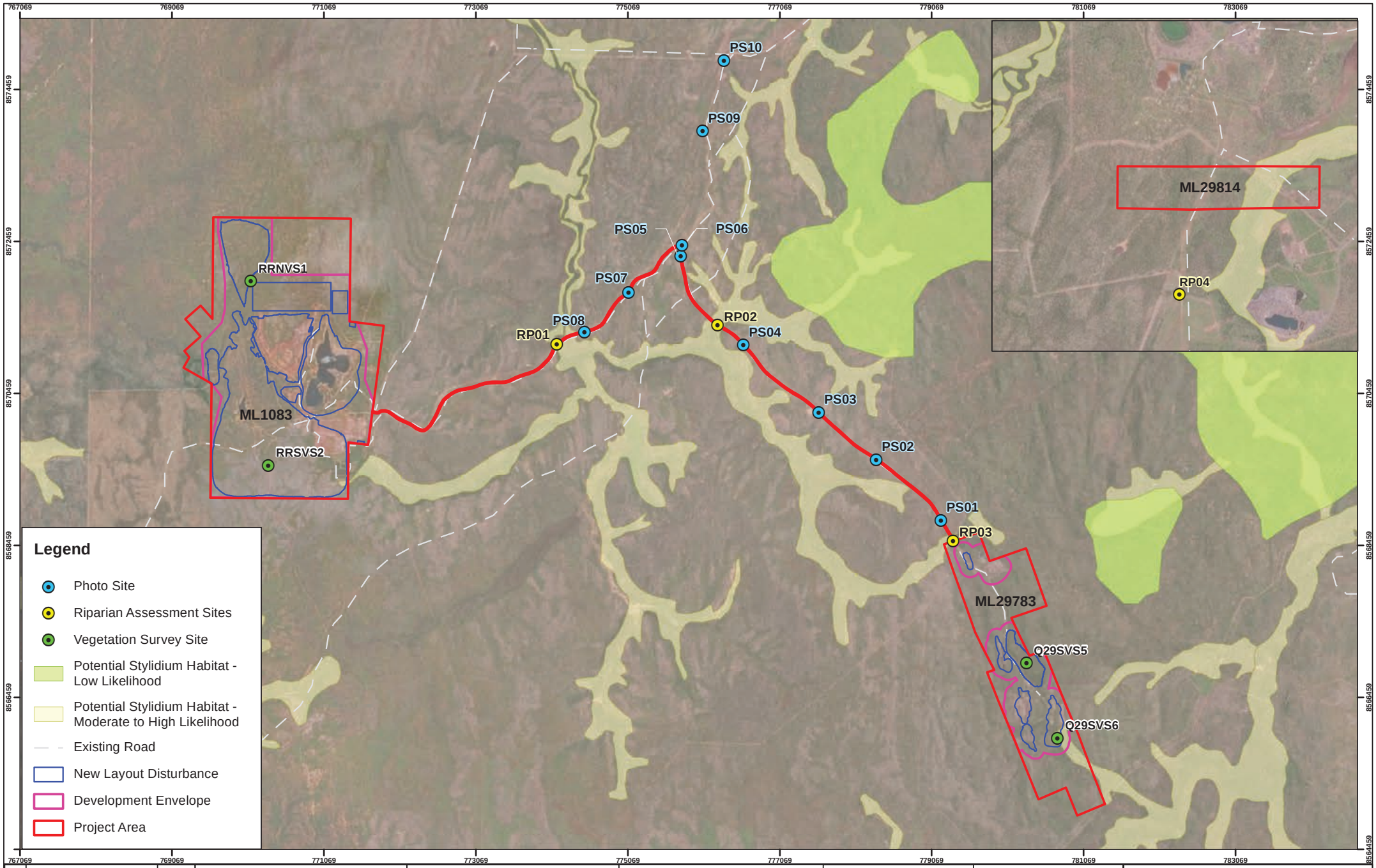
Stylidium ensatum is an annual herb that grows to 22 cm tall, has sessile obovate or orbicular leaves scattered along a short stem, and small pink flower with lobed petals. *Stylidium ensatum* is likely to germinate where water has recently receded in seepage areas and seasonally inundated sites. Plants grow in the early dry season and are best able to be detected between June and July when flowering and fruiting occurs (EcOz 2020a).

Stylidium ensatum grows on poorly drained grassy flats that stay wet into the dry season. It is often found with *Eriachne burkitii*, *Pandanus spp*., *Osbeckia spp*. and *Fimbristylis furva* (Northern Territory Herbarium 2013). The closest record of *S. ensatum* to the Project area is 60 km north-west of accommodation camp.

Stylidium ensatum is endemic to the Northern Territory and is listed as Endangered under both the TPWC Act and the EPBC Act. The modelled extent of occurrence is based on known recorded locations and potential suitable habitat using historical land resources that includes existing land unit and vegetation mapping. This has produced areas of low and moderate-high likelihood habitat. The modelling for *S. ensatum* serves as a guide to identify areas where the species may be present and is shown in Figure 7-13.

Plate 7-13 Photographs of *Stylidium ensatum* Leaves and Flower

Targeted surveys for this species to confirm presence or absence and whether appropriate habitat exists were undertaken in July 2021 for the Rustlers Roost and Quest 29 portions of the Project area, and in August 2021 for the haul road. During the field survey, no *S. ensatum* were recorded in the area.



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DESIGNED	SS	CHECKED	TK
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APPROVED	TK	DATE	01/10/21

Notes:

N

0 487.5 975 1,950

Meters

1 cm = 450 meters

GCS GDA 1994 MGA Zone 52

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DATA SOURCE
NT Government Open Source Data

DESIGNER

CDM Smith

CLIENT

PRIMARY GOLD

FIGURE 7-13

Map of Modelled Habitat for *Stylidium ensatum* and Survey Location

DRG Ref: 1001087-EIS-07-7.13

C:\Users\shilpass\Desktop\Hanking Gold Mine EIS\1001087 - Rustlers Roost EIS\1001087 - Rustlers Roost EIS\02 MXD\Chapter 7\Figure 7-14.mxd

Schoutenia Ovata

Schoutenia ovata is a tree that grows up to 10 m height with grey, flaky bark. The branchlets, petioles, leaf undersurface, calyx and capsule are densely hairy. The leaves are glossy above, three-veined at the base, elliptic to obovate, 25-98 mm long, 17-50 mm wide and reportedly deciduous. The leaf margin is entire to irregularly lobed in the upper half. Flowers are arranged in a racemose inflorescence up to 20 mm long. The petals of the flowers are often absent or reduced, up to 4.5 mm long, and the sepals are pale yellow and about 7.5 mm long. *Schoutenia ovata* flowers in February to March and fruits in May (Northern Territory Herbarium 2013). *Schoutenia ovata* is listed as Endangered under the TPWC Act but is not listed under the EPBC Act.

Schoutenia ovata grows in semi-deciduous vine thicket on syenite and limestone outcrops. *Schoutenia ovata* has been recorded approximately 2.5 km south-east of the Project area (Figure 7-9). There are also granitic outcrops (land unit 2d) near the accommodation camp and the north-eastern section of the Quest 29 survey area (Figure 7-4) which is the same land unit that *S. ovata* has been previously recorded in. Therefore, as part of the ecological surveys it was deemed to have a high likelihood of occurrence within land unit 2d in the survey areas (refer to Table 3.6 in Appendix K). However, *Schoutenia ovata* were not recorded within the survey areas during 2016, 2017, 2020 and 2021 events.

Plate 7-14 Photograph of *Schoutenia ovata*
(Images I. D. Cowie)

Goodenia Quadrifida

Goodenia quadrifida is known only from Hardy Creek within the Mary River floodplain and the upper Adelaide River, where it grows on cracking clay plains. *Goodenia quadrifida* is an annual herb with branches to 30 cm long. It has sessile, linear or narrowly oblanceolate leaves, 2-8 cm long and 0.2- 0.5 cm wide, which are hairy when young and become glabrous with age. Flowers are purplish, conspicuously hairy and solitary in axils, with pedicels 1-4 cm long. Flowering and fruiting occur from March to May (Northern Territory Herbarium 2013). *Goodenia quadrifida* is listed as Vulnerable under the EPBC Act but is listed as data deficient in the Northern Territory.

There are no cracking clay soils known from within the survey areas. However, there are records in the locality of the Project Area, approximately 15 km north-west of Rustlers Roost. Therefore, it was deemed to have a moderate likelihood of occurrence within the survey areas. However, *Goodenia quadrifida* were not recorded within the survey areas during 2016, 2017, 2020 and 2021 events.

Introduced and Weed Species

Weeds of National Significance (WoNS) are declared based on invasiveness, potential for spread and environmental, social and economic impacts. Strategic plans for WoNS are developed as a result of their declaration, which define responsibilities and identifies strategies and actions to control the species. Landholders and managers are ultimately responsible for managing WoNS, and the State/Territory governments are responsible for overall legislation and administration (DSEWPC 2013).

In the Northern Territory, a plant is declared a weed if it has been identified for control, eradication or prevention of entry into the Northern Territory. All landholders, land managers and land users must comply with the declaration classification. Based on the risk of harm they could cause and how difficult they are to control, weeds are placed into the following classes:

- Class A – to be eradicated;
- Class B – growth and spread to be controlled; and
- Class C – not to be introduced into the Northern Territory.

Forty-seven introduced flora species were identified as occurring or potentially occurring within 20 km of the survey areas by the EPBC PMST, NT Weeds public database or both (Appendix K). The 2016 and 2017 flora surveys identified 82 and 172 flora species respectively, across the Project area (refer to Appendix K). Seventeen of these species are introduced, five of which are considered to be Declared Weed species under the *Weed Management Act 2001*. These species are listed in Table 7-13 and the location of occurrence shown on Figure 7-14.

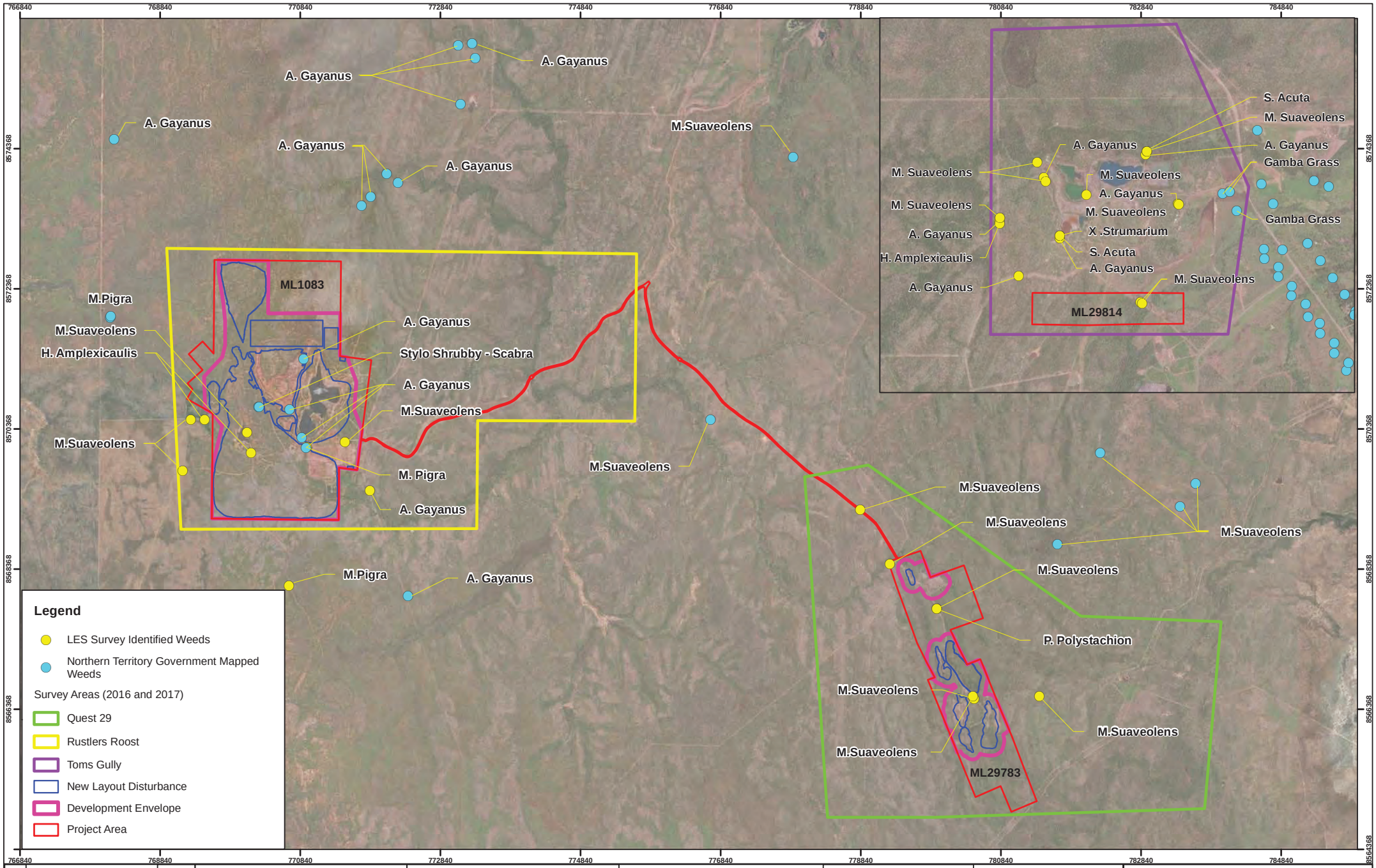
Table 7-13 Introduced Flora Species Recorded During Surveys

Species Name	Common Name	Status	
		NT	WoNS
Andropogon gayanus	Gamba grass	B, C	✓
Calopogonium mucunoides	Calopo		
Crotalaria goreensis			
Cynodon dactylon	Couch grass		
Cynadon radiatus			
Heliotropium indicum			
Hibiscus sabdariffa *Hymenachne amplexicaulis*	Olive hymenachne	B, C	✓
Leucaena leucocephala			
Mesophaerum suaveolens	Hyptis	B, C	✓
Mimosa pigra	Mimosa	B, C	✓
Passifllora foetida			
Pennisetum pedicellatus	Mission grass (annual)		

Species Name	Common Name	Status	
		NT	WoNS
Pennisetum polystachion	Mission grass (perennial)	B, C	
Pennisetum sp.	Spinyhead sida	B, C	
Sida acuta			
Stylosanthes viscosa	Stylo		
Trimfetta rhomboidea	Triumfetta		
Triumfetta sp.	Triumfetta		
Xanthium strumarium	Ngoora burr	B, C	

[1] The Toms Gully survey area has been included in the list above as it is inclusive of the accommodation camp area.

During the EcOz (2020a) vegetation survey, invasive weed species incidentally observed within the Project area were recorded, with the majority established in disturbed areas, and occasionally occurring in native bushland. The declared weed species, Hyptis was the most abundant weed within the Project area. Hyptis was recorded in high densities in the southern section of the Quest 29 Project area. Scattered Perennial Mission Grass and Gamba Grass were also observed, mostly within Quest 29 and along roadsides. Other weed species included Spinyhead sida (EcOz 2020a).



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APPROVED	TK	DATE	12/08/21

Notes:

N

0 500 1,000 2,000

Meters

1 cm = 487 meters

GCS GDA 1994 MGA Zone 52

DATA SOURCE
NT Government Open Source Data

DESIGNER

CDM Smith

CLIENT

PRIMARY GOLD

FIGURE 7-14

Location of Weeds Within and Surrounding Project Area

DRG Ref: 1001087-EIS-07-7.15

C:\Users\shilpass\Desktop\Hanking Gold Mine EIS\1001087 - Rustlers Roost EIS\1001087 - Rustlers Roost EIS\02 MXD\Chapter 7\Figure 7-15.mxd

7.2.1.3 Fauna

Desktop and Field Surveys

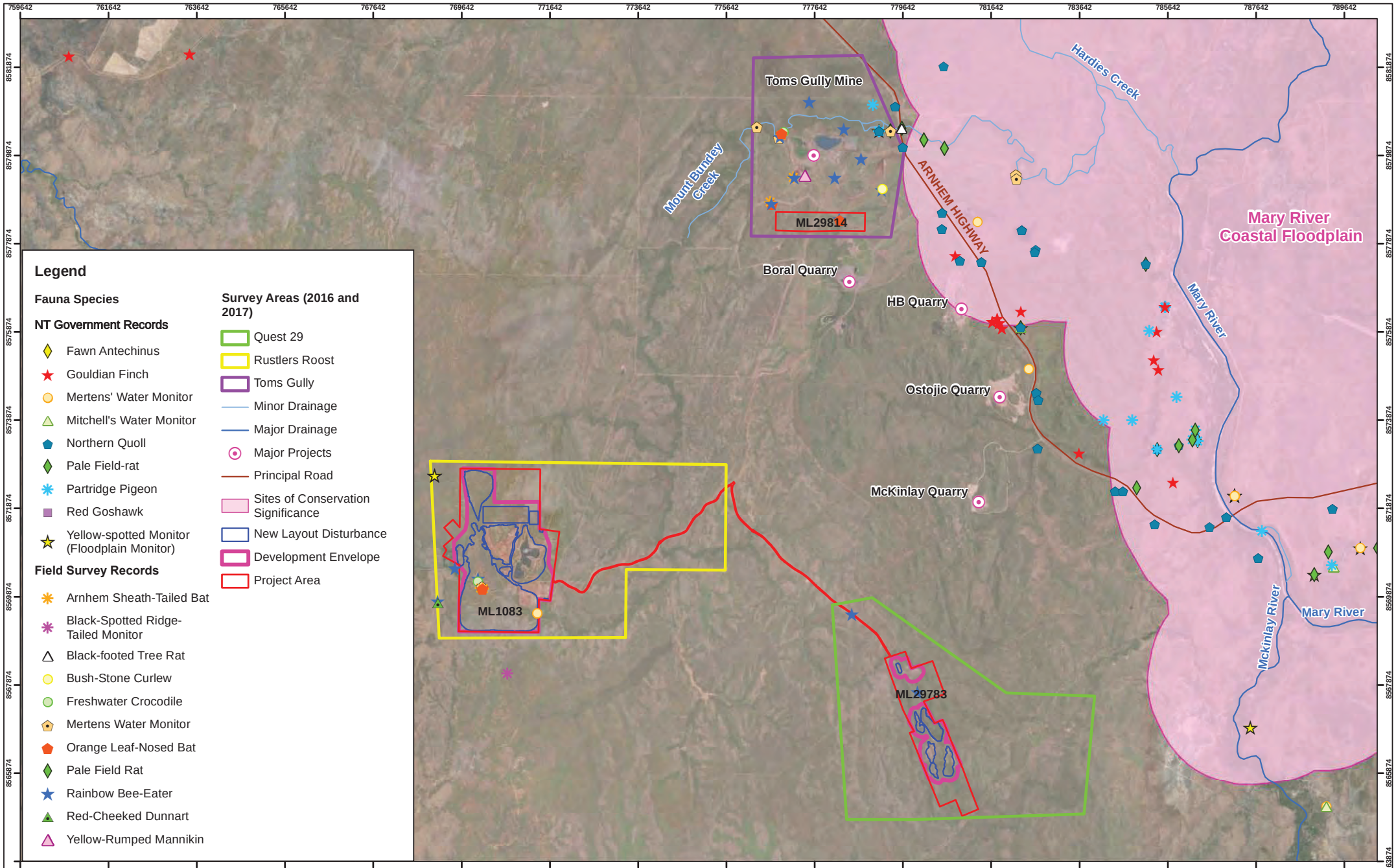
Field surveys for fauna were undertaken in the region during November 2016 and May 2017 covering the majority of the Project area with exception of a section of the haul road. The field surveys were undertaken in alignment with the methodology outlined in *NT EPA Guidelines for Assessment of Impacts on Terrestrial Biodiversity* (NT EPA 2013a). Discussion with Flora and Fauna Division at DEPWS in 2020 advised that survey effort was adequate for inclusion

Targeted searches were conducted on-ground for threatened species that may occur within the appropriate habitat in the survey area as identified by the desktop survey and for the threatened species identified by the NT EPA. Surveys were also undertaken to target other species listed as threatened under the EPBC Act and TPWC Act identified by the PMST and NT Fauna Atlas as occurring or potentially occurring within the survey areas. The fauna surveys involved the following techniques:

- Habitat searches – Searches for potentially suitable habitat for threatened species were undertaken while traversing the survey area;
- Trapping – Elliott, cage and funnel traps were used at all trapping sites;
- Bat detectors - Two bat detectors were deployed at ten sites encompassing the three survey areas;
- Secondary sign surveys – Searches for secondary sign of fauna species (e.g., tracks and scats) were undertaken within a 200 m x 200 m quadrat at each site twice a day for three days when traps were checked and set;
- Area searches – Area searches for direct observation of flora and fauna species were undertaken at each of the trapping sites and camera sites;
- Motion-sensing camera surveys – Motion-sensing cameras were deployed at four sites in each survey area to increase the chance of recording species not detected by other methods; and
- Spotlighting – Spotlighting was undertaken at 12 sites within the survey areas.

There was a total of 11 survey locations within Rustlers Roost and nine survey locations at Quest 29, and a single survey site in the accommodation camp Project area, with the addition of incidental observations being recorded as well. There were also four additional sites within 250 m of the accommodation camp Project area. The sites were surveyed using a variety of techniques, including trapping, cameras and spotlighting.

Rustlers Roost recorded 316 observations of fauna over the 2016 and 2017 survey period, primarily made up of birds, accounting for 245 of the records. Other groups of animals included amphibians (19 observation), arthropods (2 observations), mammals (28 observations) and reptile (22 observations). Quest 29 recorded a total of 257 fauna observations. Similarly, the survey results were dominated by birds, accounting for 206 observations, followed by mammals (28 observations), reptiles (13 observations), amphibians (8 observations) and arthropods (2 observations). The number of recordings for the survey area covering the accommodation camp are lower with 55 fauna observation recorded at survey site ST3. Birds accounted for 42 of the observation, with five observations of amphibians, seven mammals and one reptile. No arthropods were recorded at survey site ST3 (Figure 7-15 and Figure 7-16).



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APPROVED	TK	DATE	25/08/21

Notes:

N

0 850 1,700 3,400

Meters

1 cm = 785 meters

GCS GDA 1994 MGA Zone 52

DISCLAIMER
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DATA SOURCE
NT Government Open Source Data

DESIGNER

CDM Smith

CLIENT

PRIMARY GOLD

FIGURE 7-15

Fauna Field Survey Locations and Conservation Significant Species Records

DRG Ref: 1001087-EIS-07-7.15

C:\Users\shilpass\Desktop\Hanking Gold Mine EIS\1001087 - Rustlers Roost EIS\1001087 - Rustlers Roost EIS\02 MXD\Chapter 7\Figure 7-16.mxd

Conservation Significant Species

The NT Fauna Atlas identified 14,929 records of 386 fauna taxa identified to species level and a further 18 fauna taxa identified to genus level within 20 km of the survey areas. The majority of these records are along the Kakadu Highway and in the low lying areas near the Mary River that have been used as quarries. The NT Fauna Atlas identified records of 14 species listed as threatened under the TPWC Act within a 20 km radius of the survey areas (Figure 7-15). One of these species is listed as critically endangered, one as endangered and 12 as vulnerable.

The EPBC PMST identified 32 fauna species listed as threated under the EPBC Act as occurring or potentially occurring within 20 km of the survey area. Four are listed as critically endangered, 13 as endangered and 25 as vulnerable. Twenty-five bird species of conservation significance were identified by the PMST and/or NT Fauna Atlas as occurring or potentially occurring within a 20 km radius of the survey area.

An initial likelihood of occurrence assessment was completed for all fauna species identified in the records (Appendix K). The bird, mammal and reptile species listed in Table 7-14 were identified as having either a moderate or high likelihood of occurrence in the Project area.

Table 7-14 Likelihood of Assessment Summary for Fauna relevant to the Project Area

Species Name	Common Name	Status		Allocated Likelihood of Occurrence
		TPWC Act	EPBC Act	
Birds				
Burhinus grallarius	Bush Stone-curlew	NT	-	High
Calidris ferruginea	Curlew Sandpiper	VU	CR	Moderate
Epthianura crocea tunneyi	Alligator Rivers yellow chat	EN	EN	Moderate
Erythrotriorchis radiatus	Red goshawk	VU	VU	High
Erythrura gouldiae	Gouldian finch	VU	EN	High
Falco hypoleucos	Grey falcon	VU	-	High
Geophaps smithii smithii	Partridge pigeon (eastern)	VU	VU	High
Lonchura flaviprymna	Yellow-rumped mannikin	NT	-	High
Rostratula australis	Australian painted snipe	VU	EN	Moderate
Tyto novaehollandiae kimberli	Masked owl (northern)	VU	VU	Moderate
Mammals				
Antechinus bellus	Fawn antechinus	EN	VU	High
Dasyurus hallucatus	Northern quoll	CR	EN	Moderate
Macroderma gigas	Ghost bat	NT	VU	Moderate

Species Name	Common Name	Status		Allocated Likelihood of Occurrence
		TPWC Act	EPBC Act	
Phascogale pirata	Northern brush-tailed phascogale	EN	VU	Moderate
Rattus tunneyi	Pale field-rat	VU	-	High
Rhinonicteris aurantia	Orange leaf-nosed bat	NT	-	High
Saccolaimus saccolaimus nudicluniatus	Bare-rumped sheath-tailed bat	DD	CR	Moderate
Sminthopsis virginiae	Red-cheeked dunnart	DD	-	High
Reptiles				
Lucasium occultum	Yellow-snouted gecko	VU	EN	Moderate
Varanus mertensi	Mertens' water monitor	VU	-	High
Varanus mitchelli	Mitchell's water monitor	VU	-	High
Varanus panoptes	Floodplain monitor	VU	-	High

* DD – Data Deficient, NT – Near Threatened, VU – Vulnerable, EN – Endangered, CR – Critically Endangered
Note – no fish or shark species of conservation significance were deemed to have more than a low likelihood of occurrence.

The assessment of likelihood of occurrence of the species, was subsequently reviewed and refined, to consider the latest state of knowledge from survey efforts and observations specific to each species. This is presented further below.

During the field surveys, five species classified under the TPWC Act as threatened, near threatened and data deficient fauna species were recorded during the 2016 and 2017 field surveys (LES 2017a). The Northern Territory threatened species included the Merten's water monitor (*Varanus mertensi*) recorded at Rustlers Roost in 2017. Two near threatened species were recorded at Rustlers Roost in 2017; these were the Orange Leaf-nosed Bat (*Rhinonicteris aurantia*), and Arnhem Sheath-tailed Bat (*Taphozous kapalgensis*). Two data deficient species were recorded. These were the Red-cheeked Dunnart (*Sminthopsis virginiae*), and Black-spotted Ridge-tailed Monitor (*Varanus baritji*), both species were recorded during the 2016 survey at Rustlers Roost. No fauna species listed as migratory were recorded during either survey (LES 2017a).

While survey effort was targeted toward detecting flora and fauna species of conservation significance, there remains a possibility that some species are present in the survey areas but were not recorded. One notable fauna species identified by the NT EPA was the Yellow-snouted Gecko.

Spotlighting efforts targeting the Yellow-snouted Gecko was undertaken over six nights during each survey (i.e. six nights in November 2016 and six nights in May 2017 totalling 12 nights). Searches for habitat suitable for the Yellow-snouted Gecko were also undertaken during the day while travelling through the survey areas. The Yellow-snouted Gecko has been recorded in areas with well-developed leaf litter and grasses in open forests with red sandy-loam soils. Red sandy loam soils were not recorded in the survey areas. Therefore, survey effort was targeted towards those sites with woodland vegetation and well-developed leaf litter. Despite survey efforts, the Yellow-snouted Gecko was not recorded in the survey areas during either on-

ground survey period. Therefore, there is a low residual likelihood that the Yellow-snouted Gecko occurs in the Project area.

Camera traps, cage traps, spotlighting and searches for suitable habitat were undertaken for the Black-footed Tree rat. Specifically, signs of scratching on trees and eaten fruit that may indicate the presence of the species were looked for. These signs were not found, and Black-footed Tree Rats were not camera- or live-trapped and were not found during spotlighting despite there being potentially suitable habitat in the survey areas. Therefore, there remains a low likelihood that the Back-footed Tree Rat occurs within the Project area.

Habitat searches were undertaken to look for habitat suitable for the Bare-rumped Sheath-tail Bat. This species is considered to be an obligate hollow-roosting species, with potential habitat including woodlands and forests from coastal to adjacent inland areas in the Top End (Milne *et al*. 2006). All survey sites consisted of potentially suitable habitat for the Bare-rumped Sheath-tailed Bat and detectors were deployed at sites thought to be suitable for 12 nights for each of the two detectors. Despite these targeted survey efforts, this species was not recorded during either the November 2016 or May 2017 on-ground surveys. However, the assessment determined there was still a moderate likelihood that the Bare-rumped Sheath-tailed bat is present in the Project area.

Survey effort for the Northern Quoll involved searches for suitable habitat, live- and camera-trapping, search for secondary sign and spotlighting. Only one site in the survey areas (Cam T3.2) was identified as being suitable habitat for the Northern Quoll (T3.2 is 1.25 km north of the accommodation camp Project area). A camera-trap was placed at this site but did not detect Northern Quolls and no secondary sign was apparent. This species was not recorded in any survey area during either the November 2016 or May 2017 on-ground surveys despite these targeted efforts. Given the low availability of habitat in the survey areas, and the lack of sign that the Northern Quoll was present during on-ground surveys, there is considered to be a low likelihood that this species is present in the Project area[11].

Habitat searches, live- and camera-trapping and spotlighting were undertaken to investigate the presence of the Fawn Antechinus and Pale Field Rat. The Fawn Antechinus occurs in savanna woodland and tall open forest. These habitat types are widespread through the survey areas. Despite targeted survey effort, the Fawn Antechinus was not recorded during either November 2016 or May 2017, but the species has been recorded 3.5 km south-east of the accommodation camp. This species has undergone widespread declines across the Top End in the last decade (Young 2012), after this record was taken. Therefore, there remains a low to-moderate subsequent likelihood that the Fawn Antechinus occurs within the Project area[11].

The Pale Field Rat occurs in dense vegetation along creek lines. Vegetation along creek lines was not very dense during the November 2016 and May 2017 on-ground surveys and thought not to be optimal for Pale Field Rat. However, density of vegetation may differ between years due to differences in climatic conditions or grazing pressure and there is still a moderate likelihood that Pale Field Rat will be present in the Project area and immediately downstream if vegetation density increases along creek lines.

Searches for suitable habitat were undertaken for the Gouldian Finch and Partridge Pigeon. Further area searches were undertaken for these species in potentially suitable habitat. The Gouldian Finch inhabits wooded hills in the late wet and dry season, and lowland drainage during the wet season. This species has been particularly associated with *E. brevifolia* and *E. tintinnans* in the Northern Territory (Brazill-Boast *et al*. 2016; Tidemann *et al*. 1992). Despite targeted survey effort and potentially suitable habitat being present in the area, Gouldian Finches were not recorded during either the November 2016 or May 2017 on-ground surveys but have been recorded 1.5 km south-east of the Project area in the past. There is a high possibility that this species could occur in the Project area as potentially suitable habitat exists, and groups are known to be mobile depending on habitat suitability.

[11] This is a low subsequent likelihood considering the outcome of the surveys.

The Partridge Pigeon occurs in lowland eucalypt open forest and woodland with grassy understorey. These habitats are present throughout the Project area, particularly Rustlers Roost. The Partridge Pigeon was not recorded during either the November 2016 or May 2017 on-ground surveys but has been recorded within the survey area to the north of the accommodation camp in the past. There remains a high likelihood that the Partridge Pigeon could occur in the Project area.

Searches for suitable habitat, live- and camera-trapping and area searches were undertaken for the Floodplain Monitor and Mitchell's Water Monitor. Inland, the Floodplain Monitor inhabits waters in all river systems and Mitchell's water monitor inhabits floodplains, grasslands and woodlands. Watercourses through the survey area are ephemeral and standing water is in dams and mine pits. Therefore, there is limited habitat available for the Floodplain Monitor and likelihood of occurrence is considered low. Due to the proximity of prior records and potentially suitable habitat occurring within the survey areas, there remains a high likelihood that Mitchell's Water Monitor will occur within or immediately downstream of the Project area.

Each of the five species identified during the surveys are discussed below in more detail. In addition to these, details of the species considered to have either residual moderate or high likelihood of occurrence in the Project area have been considered further.

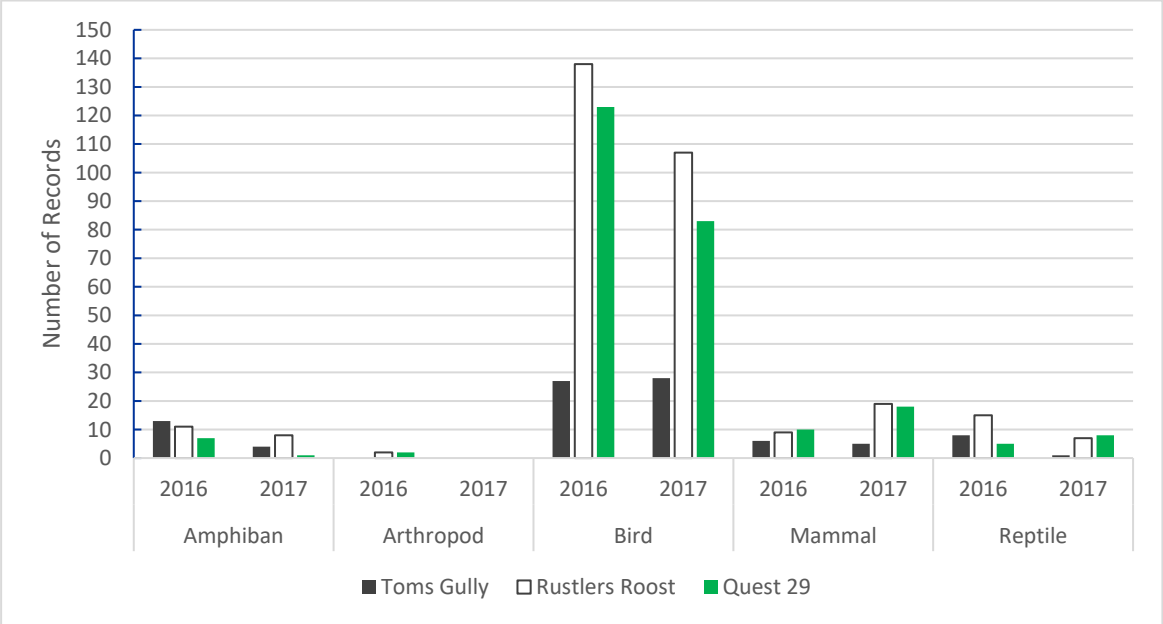


Figure 7-16 Fauna Surveys from November 2016 and May 2017 (LES 2017a)

Merten's Water Monitor

The Merten's Water Monitor is a medium- to large-sized semi-aquatic monitor found across far north Australia from the Kimberley to the west side of Cape York Peninsula (Ward *et al*. 2006). It is listed as vulnerable under the TPWC Act and is under review to be listed as Endangered under the EPBC Act. The Merten's Water Monitor is widespread throughout the Northern Territory, inhabiting all river systems throughout the Territory (Ward *et al*. 2006). The biggest threat to the monitor is from the invasion of the cane toad and the risk that it poses as a food source. The Merten's Water Monitor has been known to eat the cane toads and die as a result of the ingested toxins (Ward *et al.* 2006).

There was only a single sighting of the Merten's Water Monitor at Rustlers Roost over the two survey efforts (November and May). This was at the trapping location of SR1 situated at the southern point of Annie's Dam west of the existing mine pit. There is also a single record of the species occurring in the southern portion of the Rustlers Roost Project area in NR Maps. The details indicate the species was recorded in November 2015 foraging in the existing retention ponds (Figure 7-15).

The NT Fauna Atlas indicates that this species has a widespread distribution, and that this individual record is not likely to indicate the presence of an important population of the species. Due to the localised scale of the Project, it is not likely that the Project will negatively affect the conservation status of Merten's Water Monitor (LES 2017a). Mitigation measures for the protection of the Merten's Water Monitor have been included in Section 7.2.3.

Orange Leaf-nosed Bat

The Orange Leaf-nosed Bat is found across the top end of Australia, from the Kimberley to north-west Queensland. The populations of Orange Leaf-nosed Bats in the Pilbara are treated separately to those from the Kimberley, Northern Territory and Queensland (DES 2018). The *Rhinonicteris aurantia* species is native to the Northern Territory and classified as 'Near Threatened' under the TPWC Act. The field survey recorded the Orange Leaf-nosed Bat at location SR1 at Rustlers Roost in 2017 (Figure 7-15).

The Orange Leaf-nosed Bat forages in a range of habitats including grassland, open woodland, savannah woodland, and spinifex covered hills. The known threats to Orange Leaf-nosed Bat have been identified as the destruction and disturbance of roosts from human visitation to caves, mining activities, and the collapse or flooding of ageing mine roosts. In additional, inappropriate fire regimes is a potential threat to the bat (DES 2018).

The closest NT Fauna Atlas record of the Orange Leaf-nosed Bat is 4 km south-east of trapping site ST3 (Figure 7-15). The NT Fauna Atlas records indicate that this species is common in the local area that correlates with the land unit described as plains with open forest. TH island unit has not been identified as present in the Project area. Given the localised scale of the proposed operations there is a low likelihood that operations will negatively affect the conservation status of this species (LES 2017a). Mitigation measures for the protection of the Orange Leaf-nosed Bat have been included in Section 7.2.3.

Arnhem Sheath-tailed Bat

The Arnhem Sheath-tailed Bat has a restricted distribution of the western and northern coastline of the Top End. *Taphozous kapalgensisis* native to the Northern Territory and is classified as 'Threatened' under the TPWC Act. The field survey recorded the Arnhem Sheath-tailed Bat at location SR1 at Rustlers Roost in 2017 (Figure 7-15).

Little appears to be known about the Arnhem Sheath-tailed Bat. It is thought that they possibly roost in tree hollows, whilst also utilising the base of pandanus leaves (Australian Museum 2020). The Arnhem Sheath-tailed Bat is vulnerable to the loss habitat through a decline in roosting locations from the clearing of native vegetation and the loss of feeding areas by land degradation through agricultural activities.

The closest record from the NT Fauna Atlas for the Arnhem Sheath-tailed Bat is 55 km north-east of the ST3 survey area, in woodland habitat next to a tributary of the West Alligator River. Given that the Arnhem Sheath-tailed Bat was only recorded at one site in the survey area, it is likely that the species is not locally common in the area. Given the localised scale of the proposed operations there is a low likelihood that operations will negatively affect the conservation status of this species (LES 2017a). Mitigation measures for the protection of the Arnhem sheath-tailed bat have been included in Section 7.2.3.

Black-Spotted Ridge-tailed Monitor

The Black-spotted Ridge-tailed Monitor is endemic to the Top End and appears to be primarily located north of the Nitmiluk National Park. There is little information available for the *Varanus baritji*, and the species is considered to be one with a data deficiency.

The field survey recorded the black-spotted ridge-tailed monitor at location SR3 at Rustlers Roost. Trap location SR3 is outside of the Project Development Envelope and lies approximately 900 m south of the Project area.

The NT Fauna Atlas records of the black-spotted ridge-tailed monitor indicate that this species is widespread. Due to the localised scale of the proposed operations, it is not likely that they will have a negative effect on the conservation status of this species (LES 2017a). Mitigation measures for the protection of the black-spotted ridge tailed monitor have been included in Section 7.2.3.

Red-cheeked Dunnart

The Red-cheeked Dunnart (*Sminthopsis virginiae*) is distributed in Australia and Papua New Guinea. The habitat for the Red-cheeked Dunnart includes woodlands, open rocky forests, savannah grasslands, swamps, soaks and margins of tropical forests. There is little information available for the Red-cheeked Dunnart which leads the species to be listed as one that is data deficient.

The Red-cheeked Dunnart is understood to have a breeding season between October to March during the wet season and that the diet is mainly made up of small reptiles. The field survey recorded the Red-cheeked Dunnart at location SR4 at Rustlers Roost in 2016 which is approximately 480 m west of the Project area.

The Red-cheeked Dunnart was recorded on woodland on slope habitat. This is 13 km west of the nearest record of the species in the Mary River National Park. Potential impacts on this species from operations include vehicle impact and habitat clearance. NT Fauna Atlas records of the Red-cheeked Dunnart indicate that this species is widespread in the region. Therefore, due to the localised scale of the operations, it is unlikely that they will negatively affect the conservation status of this species (LES 2017a). Mitigation measures for the protection of the Red-cheeked Dunnart have been included in Section 7.2.3.

Pale Field-rat

The Pale Field-rat is a medium sized rodent found in higher rainfall areas of northern Australia (Young and Hill 2012). It is listed as vulnerable under the TPWC Act. The Pale field-rat inhabits dense vegetation along creeks (Young and Hill 2012). The closest record of the species is 3.5 km south-east of Project area around the accommodation camp. Given the potentially suitable habitat and the proximity of prior records, there is a moderate residual likelihood that this species is present in the survey area.

The decline of the pale field rat in the NT is thought to be associated with inappropriate fire regimes and predation by feral cats. The proposed operations are not likely to increase the impacts of these threats on the Pale Field-rat. Therefore, there the proposed operations are not likely to have a significant impact on an important population of the species. Nevertheless, Section 7.2.3 provides measures targeted at managing the fire regime within and surrounding the Project area, as well as controlling pests.

Bare-rumped Sheath-tailed Bat

The Bare-rumped Sheath-tailed Bat (*Saccolaimus saccolaimus*) is a large, high-flying, insectivorous bat distributed across north-eastern Australia (Milne and Woinarski 2006). It is listed as data deficient under the TPWC Act and critically endangered under the EPBC Act. The Bare-rumped Sheath-tailed Bat has been found in Pandanus woodland fringing the sedgelands of the South Alligator River in Kakadu National Park, and also in the eucalypt tall open forests of the Northern Territory (Milne and Woinarski 2006). Its status in the Northern Territory is very difficult to assign, given the low number of records, with just one specimen currently residing in the Northern Territory Museum.

There is no information from which to consider trends in status. Known threats to the species include habitat loss (prefers tree hollow roosts in tall eucalyptus open forest), competition for hollows by other species, and the possibility that more frequent burning impacts prey abundance and hollow (TSSC 2016). While the known range is currently very limited, this may largely reflect sampling constraints. Given this lack of critical information, the taxon is considered Data Deficient.

Habitat searches were undertaken to look for habitat suitable for the Bare-rumped Sheath-tailed Bat. Despite the targeted survey efforts, this species was not recorded during either the November 2016 or May 2017 on-ground surveys. It is difficult to distinguish the calls of the Bare-rumped Sheath-tailed Bat with several of the sympatric species *Chaerophon jobensis, Mormopterus beccarii* and *S. flaviventris*. All three of these species were identified during the on-ground surveys; *C. jobensis* and *S. flaviventris* in all three survey areas, and *M. beccarii* in Toms Gully and Quest 29. There is still a moderate likelihood that the Bare-rumped Sheath-tailed Bat is present in the survey areas.

The Project area is within a location that has previously undergone disturbance, and any further disturbance will be localised and it is not expected to have a significant impact on the population of the Bare-rumped Sheath-tailed Bat. Nevertheless, Section 7.2.3 provides measures targeted at managing the fire regime within and surrounding the Project area, as well as identification and search of hollow bearing trees prior to clearing.

Gouldian Finch

The Gouldian Finch (*Erythrura gouldiae*) is an easily recognised colourful finch that is restricted to isolated areas of tropical savannas in the NT and the Kimberley (DENR 2019). It is listed as vulnerable under the TPWC Act and endangered under the EPBC Act. In the late wet season and dry season (February to October) the Gouldian finch inhabits wooded hills containing a group of eucalypts called snappy or salmon gums, with hollows for nesting sites (DENR 2019).

Relevant threatening processes that have potentially contributed to the decline of Gouldian finches include the parasitic mite *Sternostoma tracheacolum*, trapping, and pastoral grazing practices. However, the most important factor in the decline appears to be change in the availability of foraging habitat of the understorey vegetation, impacted by pastoralism and/or changed fire regimes. Evidence suggests that large-scale late dry season fires reduce the seed availability that the Gouldian Finch relies on particularly during the early wet season.

Searches for suitable habitat were undertaken for the Gouldian Finch, however despite the targeted search effort, no Gouldian Finches were recorded in either the November 2016 or May 2017 field surveys. The closest record of a Gouldian Finch was 1.5 km south-east of the accommodation camp. There is a high possibility that this species could occur in the survey area as potentially suitable habitat exists, and groups are known to be mobile depending on habitat suitability (LES 2017a).

The Project is not likely to increase the impacts of the threatening processes identified above and from the lack of recorded evidence of the Gouldian Finch inhabiting the area, the Project is unlikely to have a significant impact on a population of this species. Nevertheless, Section 7.2.3 provides measures targeted at managing the fire regime within and surrounding the Project area.

Mitchell's Water Monitor

Mitchell's Water Monitor (*Varanus mitchelli*) is a slender medium- sized (total length up to 70 cm) semi-aquatic monitor found across far north Australia from the Kimberley to the west side of Cape York Peninsula. It is listed as Vulnerable under the TPWC Act.

The Mitchell's Water Monitor is found in the catchments of all rivers flowing to the Timor Sea, Arafura Sea and the Gulf of Carpentaria. Mitchell's Water Monitor inhabits the margins of watercourses, swamps and lagoons in Northern Australia, and is a strong swimmer that feeds largely on aquatic insects, fish, small lizards and frogs (Ward 2012).

The dominant threat to the Mitchell's Water Monitor is its propensity to eat cane toads and the high toxicity level that result from ingestion. Generally, monitors are highly susceptible to cane toad toxin and a Mitchell's Water Monitor can easily eat a cane toad large enough to result in death. Cane toads also deplete areas of potential prey for monitors, especially targeting the foods that are preferentially eaten by juvenile monitors. The competition will slow the recovery of populations following the initial crash (Ward 2012).

Searches for suitable habitat, live- and camera-trapping and area searches were undertaken for the Mitchell's Water Monitor, however, despite the targeted survey effort, Mitchell's Water Monitor was not recorded during either the November 2016 or May 2017 field surveys. There has been a record of the Mitchell's Water Monitor within 3.5 km of the accommodation camp in the past. Given the proximity of this previous record and the potentially suitable habitat occurring within the Project area, there remains a high likelihood that Mitchell's Water Monitor may occur within the Project area (LES 2017a).

Activities resulting from the Project are unlikely to impact the Mitchell's Water Monitor, and the Project is unlikely to increase the population of cane toads in the area, which has been identified as the dominant threat to the species. Nevertheless, Section 7.2.3 provides measures targeted at managing pest species in the Project area and water quality in the downstream environment which would be important to maintain prey species.

Floodplain Monitor (Yellow-Spotted Monitor)

The Floodplain Monitor (*Varanus panoptes*) is also known as the Northern Sand Goanna or Yellow-spotted Monitor. The Floodplain Monitor is a large terrestrial monitor that can grow up to 1.4 m long (Ward *et al*. 2012). It is listed as vulnerable under the TPWC Act.

The Floodplain Monitor has a broad geographic range across far north of Australia from the Kimberley to Cape York Peninsula, and southwards through most of Queensland. It is a strong ground-dwelling monitor occupying a variety of habitats, including beaches, floodplains, grasslands and woodlands. The Floodplain Monitor feeds mostly on small terrestrial vertebrates and insects (Ward *et al.* 2012).

Similar to the Mitchell's Water Monitor mentioned above, the greatest threat to the Floodplain Monitor is the cane toad, and its toxic effects to the Floodplain Monitor once ingested (Ward *et al.* 2012).

The field surveys conducted in November 2106 and May 2017, searched for suitable habitat, performed live- and camera-trapping; and area searches for the Floodplain Monitor. The watercourses identified throughout the survey area are considered to be ephemeral and the only standing water is in dams and mine pits, which are not considered to be suitable habitat for the Floodplain Monitor, therefore within the Project area there is limited habitat available for the species and despite the targeted survey effort, Floodplain Monitor was not recorded during either of the field surveys (LES 2017a).

Activities resulting from the Project are unlikely to impact the population Floodplain Monitor, and the Project is unlikely to increase the population of cane toads in the area, which has been identified as the dominant

threat to the species. Nevertheless, Section 7.2.3 provides measures targeted at managing pest species in the Project area and water quality in the downstream environment for which the species may inhabit.

Partridge Pigeon (Eastern)

The Partridge Pigeon (*Geophaps smithii smithii*) is a medium-sized grey-brown bird with conspicuous white leading edge to the wing and red bare skin on the face, which forages entirely on the ground, and only flies in response to danger (Woinarski 2006a). The Partridge Pigeon is listed as Vulnerable under both the TPWC Act and EPBC Act.

The Partridge Pigeon is distributed across the Northern Territory and Kimberley but has disappeared from the lower rainfall parts of its range (Woinarski 2006a). The Partridge Pigeon occurs in lowland eucalypt open forest and woodland with grassy understorey. These habitats are present throughout the Project area, particularly Rustlers Roost.

The dominant threat to the Partridge Pigeon is the change in grass composition and fire regimes. The increase in invasive grass species such as Gamba Grass has displaced the density and diversity of native grasses that previously existed for foraging activities. This has changed the diversity, timing and abundance of seed availability for the diet of the Partridge Pigeon (Woinarsk, 2006a). Partridge Pigeon was likely advantaged by the previous fire regime of frequent, patchy but localised fire, and is likely greatly disadvantaged by the current fire regime of fewer but more extensive fires (Woinarski 2006a). That current fire regime presents a greater disadvantage by the inclusion of high fuel loads associated with exotic grasses, that make for far hotter and more extensive fire (Woinarski 2006a).

Furthermore, the ground-dwelling behaviour of the Partridge Pidgeon for nesting, roosting and foraging, makes the species highly susceptible to the predation of feral cats. Additionally, Partridge Pigeons also rely on daily access to water for survival, and climate change is posing an additional threat to the survival of the species (Woinarski 2006a).

The Partridge Pigeon was not recorded during either the November 2016 or May 2017 on-ground surveys, but there were three records noted north of the accommodation camp in the past (recorded in 1987 and 1988). As this species can move up to 5-10 km in response to changes in resource availability, and due to potentially suitable habitat occurring within the survey areas and the past record of the species north of the Project area there remains a high likelihood that the Partridge Pigeon could occur in the Project area in the future. The main threats to the Partridge Pigeon are thought to be predation by feral cats, loss of water sources, the interactive impacts of invasive plant species and changes in fire regimes and the clearance of suitable habitat (Woinarski 2006a). The proposed operations are not likely to increase the impact of these threats on the Partridge Pigeon. Therefore it is not expected that the Project will have a significant impact on an important population of this species. Nevertheless, Section 7.2.3 provides measures targeted at managing pest species, the fire regime and the quality of water in the downstream environment.

Red Goshawk

The Red Goshawk (*Erythrotriorchis radiates*) occurs across the northern portion of Australia, from near Broome in the south-west Kimberley to south-eastern Queensland. The Red Goshawk generally occurs in taller forests characteristic of higher rainfall areas, but there are some isolated records from central Australia (Woinarski 2006b). The Red Goshawk is listed as Vulnerable under both the TPWC Act and EPBC Act.

The Red Goshawk preys on medium-sized birds (up to the size of Kookaburras and Black Cockatoos) and dominates a territory of typically up to 200 km^2 (Woinarski 2006b). The preferred habitat of the Red Goshawk is tall open eucalypt forest and riparian areas, including paperbark forest and gallery forests (Woinarski 2006b).

The threatening processes of particular relevance to the Red Goshawk include the clearance of preferred habitat for agriculture, with some localised problems related to illegal egg-collection, shooting, and threats from fire.

The Red Goshawk was not recorded during either the November 2016 or May 2017 on-ground surveys. The closest historic record of the Red Goshawk was recorded prior to the field survey and was noted to be 6.5 km east of the accommodation camp. With appreciation of the large territorial area that the Red Goshawk can occupy, and the historic disturbance that has previously occurred within the Project area, the proposed operations are not likely to contribute to the increase of threats on the Red Goshawk. Therefore it is not expected that the Project will have a significant impact on an important population of the Red Goshawk.

Introduced Fauna Species

Thirteen introduced fauna species were identified by the EPBC PMST as occurring or potentially occurring within 20 km of the survey areas. Nine introduced fauna species were identified by the NT Fauna Atlas within 20 km of the survey areas.

Several introduced fauna species were recorded during surveys of Toms Gully, Rustlers Roost and Quest 29 during the November 2016 on-ground survey. These were cattle, water buffalo, cane toad, horse, house mouse and pig. Cattle were recorded in Rustlers Roost. Water buffalo were recorded at Annie's Dam in Rustlers Roost. Cane toads were ubiquitous throughout all three survey areas. The impacts of three of these species are listed Key Threatening Processes and all have associated Threat Abatement Plans prepared by DAWE.

Horses and house mouse were recorded in the survey area covering the accommodation camp. Pigs were recorded incidentally in all three survey areas. Cats were recorded incidentally throughout the survey areas. Four introduced fauna species were recorded during the May 2017 on-ground surveys of the Toms Gully, Rustlers Roost and Quest 29 areas. These were cane toad, cattle, horse and pig. Cane toads were recorded at ST2, ST3 and CamT3 in Toms Gully, SR1 and SR2 in Rustlers Roost and SQ2 in Quest 29. Cattle were recorded at CamT4 in Toms Gully and CamR2 in Rustlers Roost. Horses were recorded at ST3 in Toms Gully. Pigs were recorded at CR1 in Rustlers Roost and CamQ4.2 in Quest 29.

7.2.1.4 Sites of Conservation Significance

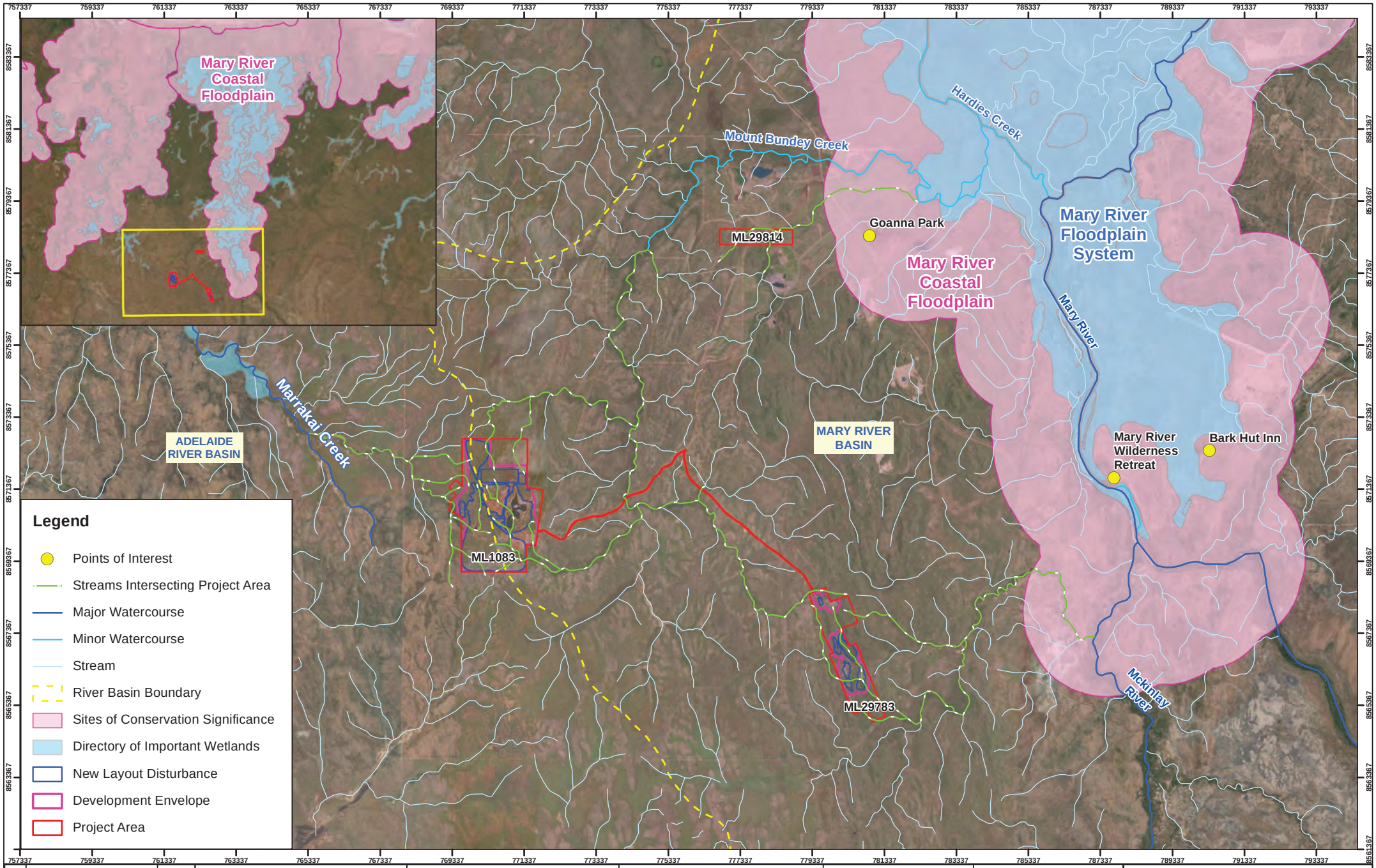
SoCS are sites identified as the most important sites for biodiversity that need further protecting in the Northern Territory. Sites of Botanical Significance (SoBS) are defined as areas that have botanical features distinguishing them from the surrounding landscape and are important for general plant conservation and for specifically mentioned species. The Mary River coastal floodplain SoCS occurs approximately 4.6 km to the east of the Quest 29 location of the Project area and 1 km east of the accommodation camp, at its nearest point. There are no SoBS within 20 km of the survey areas (LES 2017a).

The Mary River coastal floodplain is located 90 km east of Darwin and is unusual in the fact that is lacks a single major river channel through the floodplain to the ocean. The floodplain is poorly drained, and the inflow channel diffuses into vast seasonal swamps before reaching the sea through a number of tidal channels. This feature results in a greater area of wetland habitats that are flooded over extended periods and presents an extremely complex and productive system. The floodplain is dominated by a mix of sedge and grass communities and large paperbark forests in the north and fringed by open eucalypt woodland and pockets of monsoon forest (Harrison *et al.* 2009).

The Mary River coastal floodplain is of international significance and provides a reliable breeding site for Magpie Goose in the Northern Territory. Numbers of the Magpie goose can exceed 400,000 birds in some years. The floodplain environments provide a major breeding area for many fish species, notably Barramundi. Twelve threatened species occur on the floodplain, including the Vulnerable Yellow Chat (Harrison *et al.* 2009).

The environmental values of the Mary River coastal floodplain have been affected by the increase in the presence of weeds (including *Mimosa pigra*, olive hymenachne and para grass) and exotic animals (mainly feral pig). Condition assessments of the Mary River system have concluded that environments across the area are suffering substantial degradation as a result of impact from exotic species and fire (Harrison *et al.* 2009).

NR Maps provides records of several conservation significant species occurring in the Mary River floodplain, downstream of the Project. These include Northern Quoll, Partridge Pigeon, Floodplain Monitor (Yellow-spotted Monitor, Mitchell's Water Monitor, Brush-tailed Rabbit-rat, Greater Sand Plover, Lesser Sand Plover, Red Goshawk, Gouldian Finch, Common Brushtail Possum (north-western), Northern River Shark, Far Eastern Curlew, Great Knot, Curlew Sandpiper and Bar-tailed Godwit.



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Meters
1 cm = 948 meters
GCS GDA 1994 MGA Zone 52

DISCLAIMER
CDM Smith has endeavoured to ensure accuracy and completeness of the data. CDM Smith assumes no legal liability or responsibility for any decisions or actions resulting from the information contained within this map.

DATA SOURCE
NT Government Open Source Data

DESIGNER
CDM Smith

CLIENT
PRIMARY GOLD

FIGURE 7-17

Map of the Project Area in relation to the Mary River Coastal Floodplain

DRG Ref: 1001087-EIS-07-7.17

C:\Users\shilpass\Desktop\Hanking Gold Mine EIS\1001087 - Rustlers Roost EIS\1001087 - Rustlers Roost EIS\02 MXD\Chapter 7\Figure 7-17.mxd

7.2.2 Potential Impacts and Risks

The assessment of potential impacts that may arise from the Project have been addressed in accordance with the ToR and the assessment of impacts will have regard to those impacts that are considered to be potentially significant impacts (as defined by the EP Act). The EP Act defines a significant impact as:

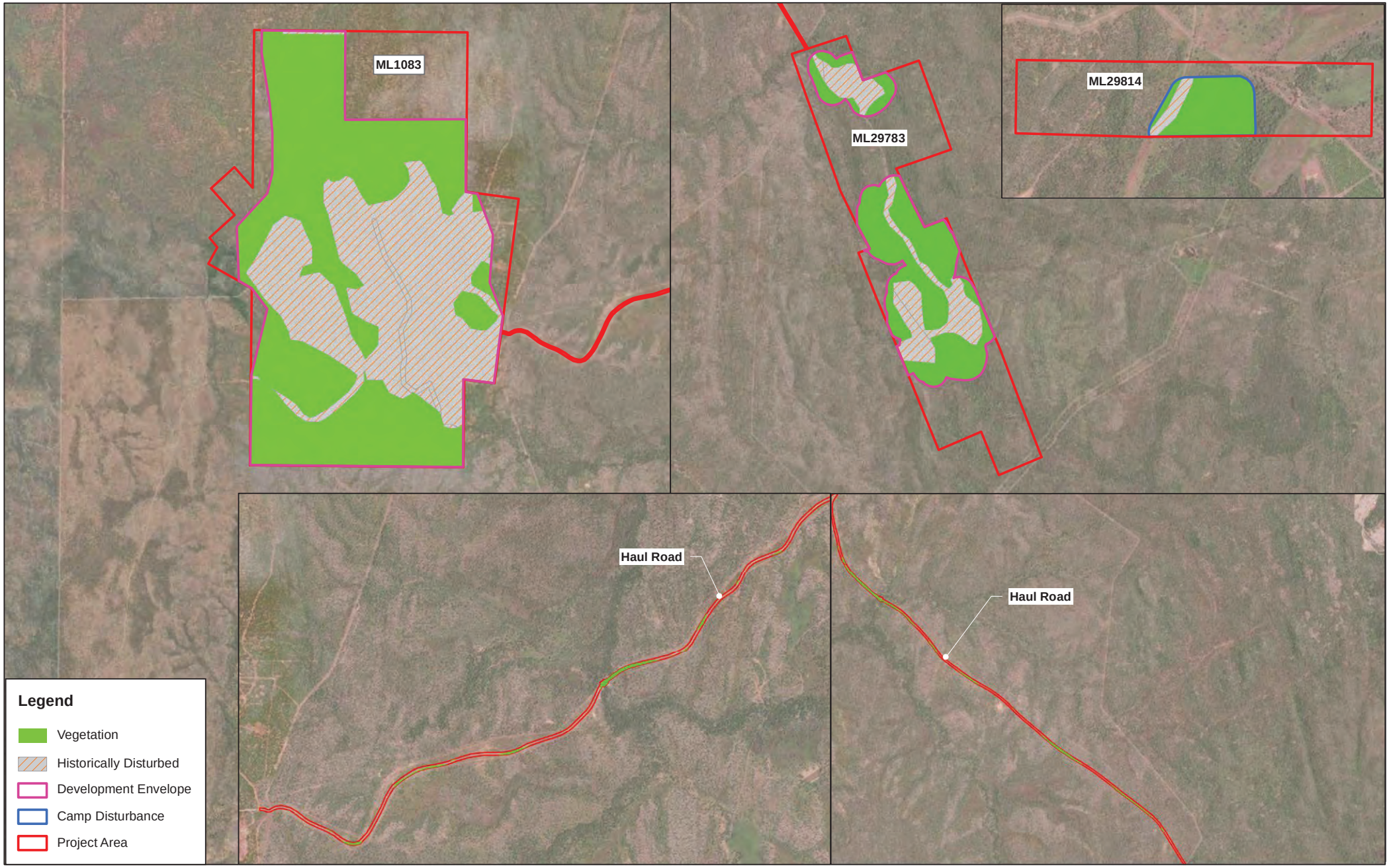
> *A significant impact of an action is an impact of major consequence having regard to:*
>
> *(a) the context and intensity of the impact; and*
>
> *(b) the sensitivity, value and quality of the environment impacted on and the duration, magnitude and geographic extent of the impact.*

The Project will have direct impacts to terrestrial ecosystems through the clearing of land for mining operations and supporting infrastructure, which is summarised in Table 7-15. Clearing within the Project area will result in a direct loss of approximately 368.86 ha of land that is characteristic of predominantly Eucalyptus woodland and Eucalyptus open forest

The Development Envelope for the Rustler Roost site is 611.0 ha. The Project requires an additional 333.4 ha direct disturbance to mapped flora and vegetation within the Rustlers Roost development envelope (refer to Figure 1-6). The development envelope for Quest 29 is 139.5 ha (refer to Figure 1-7). An additional 26.16 ha of clearing mapped vegetation will be required for the Project within the Quest 29 development envelope.

Table 7-15 Mapped Vegetation Clearing Extent for Construction and Mining Operations

Component	EIS Disturbance (ha)	Clearing Area of Mapped Vegetation
Rustlers Roost	Additional clearing of 333.4 ha of native vegetation within a 611 ha mine development envelope (vegetation clearance based on disturbing entire development envelope)	333.4
Quest 29	Additional clearing of 26.16 ha of native vegetation within a 139.5 ha development envelope (vegetation clearance based infrastructure footprints within the development envelope)	26.16
Accommodation Camp	Disturbing 2.3 ha of already cleared land and 7.3 ha of native vegetation within a 17.8 ha development envelope (vegetation clearance based on disturbing entire disturbance footprint)	7.3
Haul Road	Additional clearing of 2.0 ha of native vegetation within a 21.7 ha Haul Road disturbance (vegetation clearance based on disturbing entire development envelope)	2.0
	Total	**368.86**



R	Details	Date
1	Final	30/08/21
-	-	-
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DESIGNED	SS	CHECKED	TK
DRAWN	SS	CHECKED	TK
APPROVED	TK	DATE	30/08/21

Notes:

N

0 325 650 1,300

Meters

1 cm = 300 meters

GCS GDA 1994 MGA Zone 52

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DATA SOURCE
NT Government Open Source Data

DESIGNER

CDM Smith

CLIENT

PRIMARY GOLD

FIGURE 7-18

Direct Vegetation and Habitat Disturbance

DRG Ref: 1001087-EIS-07-7.18

C:\Users\shilpass\Desktop\Hanking Gold Mine EIS\1001087 - Rustlers Roost EIS\1001087 - Rustlers Roost EIS\02 MXD\Chapter 7\Figure 7-37.mxd

The identified impacts and risks have been assessed and are presented together with mitigation measures (where appropriate) in Section 7.2.6. The environmental risk assessment discussed in Section 6 and presented in Appendix B identified and considered 15 potential sources of impact to the terrestrial ecosystem aspects. These were considered with regard to the potential to cause significant impacts and residual consequences and are presented in Table 7-16.

Table 7-16 Potential Sources of Impact to Impact to Terrestrial Ecosystems

Risk No.	Source of Impact	Project Phase(s)	Summary of Potential Impacts
TE-1	Vegetation clearing for the Project	Construction	**Direct** - Disturbing an additional 333.4 ha of land for the Rustlers Roost, 26.16 ha for Quest 29, 7.3 ha for the accommodation camp and 2.0 ha for the haul road. Loss of 368.86 ha of undisturbed habitat. Fragmentation of a population and/or habitat modification and/or lifecycle disruption and/or impact on the size of a population for flora and terrestrial fauna. Impact to protect sensitive NT terrestrial flora species and their habitat. **Indirect or Cumulative** - Clearing for the Project increasing habitat loss and fragmentation within the wider area where previous or future clearing has or will occur as a result of nearby activities (including Toms Gully Mine, quarrying and the Mount Bundey Training Area). Increase in local weed population in areas of disturbance.
TE-2	Overtopping, embankment failure or seepage from the new TSF at Rustlers Roost leading to uncontrolled release of tailings material to surrounding environment.	Construction, Operation, Decommissioning or Closure	**Direct -** Contamination of surrounding land and water. Alteration of ecological characteristics, including chemical, physical, biological and aesthetic qualities. Adversely affecting the biological processes that depend on soil quality. Direct result in the loss of ecological integrity and suitable native fauna habitat in the impacted area. **Indirect or Cumulative -** Potential transportation of contaminated sediments and material throughout the Project area and external. Biological and human health implications (primary contaminant of concern being cyanide). Groundwater pathways contributing to environmental contaminants mobilised in the surrounding environment through historic mining and quarrying activities. Potential for bioaccumulation of excessive contaminants within native fauna (heavy metals).
TE-3	Overtopping, embankment failure or seepage from the process water storage at Rustlers Roost leading to uncontrolled release of process water to surrounding environment.	Operation, Decommissioning and Closure	**Direct -** Contamination of surrounding environment, potential destruction of vegetation, loss of biodiversity, ecological integrity and ecological functioning in the area of impact. **Indirect or Cumulative -** Potential transportation of contaminates in water and sediments throughout the Project area and external. Biological and human health implications (primary contaminant of concern being cyanide). Groundwater pathways contributing to environmental contaminants mobilised in the surrounding environment through historic mining and quarrying activities. Potential for bioaccumulation of excessive contaminants within native fauna (e.g. heavy metals).

Risk No.	Source of Impact	Project Phase(s)	Summary of Potential Impacts
TE-4	Poor water quality released from site during wet season (stormwater).	Construction, Operation, Decommissioning or Closure	**Direct** - Primary contaminants of concern in wet season stormwater release is acidity and sediment, thus resulting in increased turbidity of waterways. This could result in poor quality drinking water for fauna and sedimentation of riparian environments for which terrestrial fauna inhabit. Habitat modification and/or lifecycle disruption and/or impact on the size of a population (flora and/or terrestrial fauna). Depending on geochemistry of the waste rock material to be exposed in the new pits and the placement on site, runoff may also contain heavy metals and NORMS. These have potential for direct terrestrial fauna health implications should this water be ingested. **Indirect or Cumulative** - Decrease in fish populations and species richness resulting in decreased suitability of the environment for terrestrial species that may utilise the watercourses (e.g. birds). Potential for bioaccumulation of excessive contaminants within native fauna (e.g. heavy metals).
TE-5	Release of hazardous chemicals or materials during storage and handling onsite.	Construction, Operation, Decommissioning	**Direct** - Contamination of soil and water. Contamination of surrounding environment, potential destruction of vegetation, loss of biodiversity, ecological integrity and ecological functioning in the area of impact. Alteration of ecological characteristics, including chemical, physical, biological and aesthetic qualities. Potential direct mortality of flora and fauna that come into contact with the released chemical. **Indirect or Cumulative** - Indirect spread of chemicals throughout the environment through indiscriminate or unknown movement of contaminated materials (e.g. soil on vehicle tyres) or in downstream drainage line. Potential transportation of contaminated sediments and material throughout the Project area and external. Potential for bioaccumulation of excessive contaminants within native fauna (e.g. heavy metals).
TE-6	Release of hazardous chemicals or materials during transportation to site.	Construction, Operation, Decommissioning	**Direct** - Contamination of soil and water. Contamination of surrounding environment, potential destruction of vegetation, loss of biodiversity, ecological integrity and ecological functioning in the area of impact. Alteration of ecological characteristics, including chemical, physical, biological and aesthetic qualities. Potential direct mortality of flora and fauna that come into contact with the released chemical. **Indirect or Cumulative** - Indirect spread of chemicals throughout the environment through indiscriminate or unknown movement of contaminated materials (e.g. soil on vehicle tyres) or in downstream drainage line. Potential transportation of contaminated sediments and material throughout the Project area and external. Potential for bioaccumulation of excessive contaminants within native fauna (e.g. heavy metals).

Risk No.	Source of Impact	Project Phase(s)	Summary of Potential Impacts
TE-7	Production of domestic waste and storage of the waste onsite	Construction, Operation, Decommissioning.	**Direct** - Where inappropriate storage vessels and management is used, there is potential to increase pest fauna (rats/mice) and feral/predator species (dingoes, cats) causing reduction in native wildlife population. This could directly increase native fauna mortality in the local area. **Indirect or Cumulative** - Potential for cumulative pest fauna increases in the Mount Bundey locality where nearby operators also produce waste onsite.
TE-8	Unfinished/unsuccessful rehabilitation of Project due to inadequate funds or natural disaster (e.g. cyclone).	Construction, Operation, Decommissioning and Closure	**Direct** - Site not rehabilitated to required standards. Increased potential for offsite impacts from AMD, erosion and sedimentation. Degradation of land and fauna habitat onsite. Direct risk of fauna mortality from falls and being trapped in open pits and excavations. **Indirect or Cumulative** - Potential transportation of contaminated sediments and material throughout the Project area and external. Biological and human health implications (primary contaminant of concern being cyanide). Contamination of downstream environments resulting in human health risks that would necessitate the closure of watercourse to extraction of drinking water, recreation and fishing. Alteration of ecological characteristics, including chemical, physical, biological and aesthetic qualities. Potential direct mortality if contaminants (e.g. heavy metals or NORMS) are released from site. Given PGO is the same proponent for the Toms Gully Mine project it would likely result in unfinished or unsuccessful rehabilitation at both sites. This would result in a large area of disturbed and unrehabilitated land in the Mount Bundey catchment cumulatively resulting in loss of fauna habitat.
TE-9	Inability to establish native vegetation by local provenance species with resultant cover comparable to nearby areas	Construction, Operation, Decommissioning and Closure	**Direct** - Site not rehabilitated to required standards. Increased potential for offsite impacts from AMD, erosion and sedimentation. Degradation of land and fauna habitat onsite. **Indirect or Cumulative** - Potential transportation of contaminated sediments and material throughout the Project area and external. Biological and human health implications (primary contaminant of concern being cyanide). Contamination of downstream environments resulting in human health risks that would necessitate the closure of watercourse to extraction of drinking water, recreation and fishing. Alteration of ecological characteristics, including chemical, physical, biological and aesthetic qualities. Potential direct mortality if contaminants (e.g. heavy metals or NORMS) are released from site. Given PGO is the proponent for the nearby Toms Gully Mine project it would likely result in unfinished or unsuccessful rehabilitation at both sites. This would result in a large area of disturbed and unrehabilitated land in the Mount Bundey catchment cumulatively resulting in loss of fauna habitat.

Risk No.	Source of Impact	Project Phase(s)	Summary of Potential Impacts
TE-10	Lack of rehabilitation materials leads to inadequate tailings closure and poor quality site rehabilitation.	Decommissioning and Closure	**Direct** - Completion criteria and environmental outcomes unable to be met. Failure to establish appropriate capping and native vegetation. Therefore, lost potential for rehabilitation area to serve appropriate post closure ecological function. **Indirect or Cumulative** - Reduced area of vegetation in the general Mount Bundey locality resulting in a general low terrestrial fauna species abundance and lack of biodiversity.
TE-11	Inappropriate management of the decommissioned site, post closure landform.	Closure	**Direct** - Unauthorised access to the site by externals (including public, leaseholders and livestock) negatively affecting rehabilitation potential and contributing to rehabilitation failure. Failure to establish appropriate capping and native vegetation. Inappropriate management could also allow for the introduction and/or spread of flora weeds, reducing native flora species composition. **Indirect or Cumulative** - Reduced area of vegetation in the general Mount Bundey locality resulting in a general low terrestrial fauna species abundance and lack of biodiversity.
TE-12	Ineffective operational implementation of site environmental management system, plans and procedures.	Construction, Operation, Decommissioning Closure	**Direct** - Environmental incidents causing degradation of environmental features that support flora and fauna. Potential direct species health implication (reduced physical health or mortality) depending on whether the ineffective management leads to contamination. Inability of impacted areas to maintain biological qualities to support standard flora and fauna. **Indirect or Cumulative** - Rehabilitation success is affected by inappropriate operational procedures which results in decreased likelihood of achieving rehabilitation goals and closure requirements following decommissioning. Agreed Post Mine Land Use (PMLU) cannot be achieved due to unsuccessful rehabilitation process (e.g. vegetation establishment, weed infestation etc). Given PGO is the proponent for the nearby Toms Gully Mine project it would likely result in unfinished or unsuccessful rehabilitation at both sites. This would result in a large area of disturbed and unrehabilitated land in the Mount Bundey catchment cumulatively resulting in loss of fauna habitat.
TE-13	Use of Project machinery, equipment, vehicles and activities causing fire through sparks or heat ignition source.	Construction, Operation, Decommissioning Closure	**Direct** - Damage to existing fauna habitat, including areas that potentially provide for listed threatened flora or fauna species. Potential contamination of soils due to fire extinguishers (depending on where it happens) and material consumed by the fire which could adversely affect the establishment of vegetation and success of rehabilitation. **Indirect or Cumulative** - Indirect loss of nutrients from topsoil dispersal and reduced viability of soils to re-establish vegetation, leading to potential introduction or spread of weeds. Indirect impact of reduced ability for successful revegetation due to loss of topsoils. Reduced area of vegetation in the general Mount Bundey locality resulting in a general low terrestrial fauna species abundance and lack of biodiversity.

Risk No.	Source of Impact	Project Phase(s)	Summary of Potential Impacts
TE-14	Dust generation from Project activities such as vehicular movements and earthworks.	Construction, Operation, Decommissioning Closure	**Direct** - Dust emissions impact upon onsite and surrounding vegetation and fauna health. Loss of productive topsoil inhibiting growth potential of retained media. **Indirect or Cumulative** - Potential cumulative dust lift-off and deposition on vegetation within the Project area and wider area in conjunction with Toms Gully Mine, nearby quarries and the Mount Bundey Training Area. Indirect impact of reduced ability for successful revegetation due to loss of topsoils.
TE-15	Noise and vibration emissions from construction and operational activities (e.g. vehicle movements and blasting).	Construction, Operation, Decommissioning Closure	**Direct** - Ground vibration from blasting, material dropping or large vehicle movements could have an adverse impact on local fauna. **Indirect or Cumulative** - Potential increase in cumulative impact on fauna in conjunction with Toms Gully Mine, nearby quarries and the Mount Bundey Training Area.
TE-16	Construction and operational activities (incl. vegetation clearing) result in introduction of new weeds and spread of existing weeds into new areas.	Construction, Operation, Decommissioning or Closure	**Direct** - Impact of reduced ability for successful revegetation due to weed spread. Impact on native vegetation. Increased fire risk. Reduced foraging and nesting grounds for fauna. **Indirect or Cumulative** - Increased weed species in the area negatively affecting rehabilitation potential and contributing to rehabilitation failure. Failure to establish appropriate capping and native vegetation. There is a risk that Post Mine Land Use (PMLU) may not be achieved due to unsuccessful rehabilitation process (e.g. vegetation establishment, weed infestation etc). Cumulative impact as a result of reduced area of natural vegetation in the general Mount Bundey locality resulting in a general low terrestrial fauna species abundance and lack of biodiversity.
TE-17	Increased density of weed infestations.	Construction, Operation, Decommissioning or Closure	**Direct** - Impact of reduced ability for successful revegetation due to weed spread. Impact on native vegetation. Increased fire risk. Reduced foraging and nesting grounds for fauna **Indirect or Cumulative** - Increased weed species in the area negatively affecting rehabilitation potential and contributing to rehabilitation failure. Failure to establish appropriate capping and native vegetation. There is a risk that Post Mine Land Use (PMLU) may not be achieved due to unsuccessful rehabilitation process (e.g. vegetation establishment, weed infestation etc). Cumulative impact as a result of reduced area of natural vegetation in the general Mount Bundey locality resulting in a general low terrestrial fauna species abundance and lack of biodiversity.

Risk No.	Source of Impact	Project Phase(s)	Summary of Potential Impacts
TE-18	Artificial light emissions from construction and/or operation of the mine site.	Construction, Operation, Decommissioning or Closure	**Direct** - Disrupt lifecycle processes of fauna and or impact on the size of the populations. Emissions of artificial light can affect both nocturnal and diurnal animals by disrupting natural behaviour, with intensity and duration of exposure potentially evoking different responses. Impacts from increased light levels include disorientation from or attraction toward artificial sources of light; mortality from collisions with structures; and effects on light-sensitive cycles of species (e.g. breeding and migration for fauna and flowering in plants). **Indirect or Cumulative** - Potential increase in cumulative impact on fauna in conjunction with Toms Gully Mine, nearby quarries and the Mount Bundey Training Area. An artificial increase in lighting can also influence the abundance and behaviour of predators.
TE-19	Vehicle/machinery interaction with terrestrial fauna	Construction, Operation, Decommissioning	**Direct** - Loss of life or injury to fauna species. **Indirect and Cumulative** - Potential increase in cumulative impact on fauna in conjunction with Toms Gully Mine, nearby quarries and the Mount Bundey Training Area.

In summary, the Project has the potential to result in direct and indirect impacts to terrestrial ecosystems including:

- Clearing of flora and vegetation, and corresponding fauna habitat;
- Increase in weed species and density;
- Fauna injury and mortality;
- Increase risk of fires;
- Increase in air quality emissions, including dust, noise, vibration and light;
- Uncontrolled release of process water to surrounding environment;
- Release of poor water quality during the wet season;
- Uncontrolled discharge of hazardous chemicals;
- Production and storage of domestic waste;
- Inefficient rehabilitation effort;
- Inadequate implementation of environmental management system; and
- These are addressed in turn, in the following sub-sections.

7.2.2.1 Vegetation and Flora

The clearing of vegetation associated with the Project will reduce local and regional vegetation communities and has the potential to impact conservation significant flora (*H. macrothrix* and *S. ensatum*). These vegetation types are considered to be common in the region and the habitat value of the area is considered to be degraded due to previous mining activities and from the pressures of grazing and agriculture in the region.

Vegetation mapping undertaken by the Northern Territory Government indicates that there are suitable environmental qualities within the Development Envelopes for the flora conservation significant species of *H. macrothrix* and *S. ensatum* to be present. Targeted field surveys undertaken in 2020 and 2021 did not find any evidence of these endangered species, or any other flora species of conservation significance within the Development Envelopes for the Project area.

Riparian vegetation has also been identified in the Rustlers Roost portion of the Project area. Based on surveys completed in 2020, the Project will result in the clearance of approximately 4.85 ha of riparian vegetation with the largest portion being in the upper Mount Bundey Creek tributary for construction of the TSF (4.58 ha) and a portion on the tributary to Marrakai Creek on the western edge of the Development Envelope for the TSF (0.27 ha).

The disturbance to vegetation may cause habitat fragmentation impacting on the reliant fauna population within the area. The modification to the habitat of the local fauna may disrupt foraging and breeding behaviours that may have short term impacts to the lifecycle of individuals. Due to the scale of the Project and its operations, and the pre-existing land use and prior disturbance, it is anticipated that the level of impact from clearing will be localised Table 7-17 provides a summary of the vegetation disturbance clearing extents.

Table 7-17 Mapped Vegetation and Clearing Extents

Component	Net Clearing Area of Mapped Vegetation (ha)	Vegetation Type	
		NVIS Level 3	NVIS Level 4
Rustlers Roost	333.4	333.4 – Eucalyptus woodland	Eucalyptus mid woodland\ Erythrophleum low open woodland\Sorghum mid tussock grassland
Quest 29	26.16	26.16 ha – Eucalyptus woodland	Eucalyptus mid woodland\ Erythrophleum low open woodland\Sorghum mid tussock grassland
Accommodation Camp	7.3	6.27 ha – Eucalyptus open forest	Eucalyptus mid open forest\Livistona low sparse palmland\ Heteropogon tall tussock grassland
		1.03 ha – Eucalyptus woodland	Eucalyptus mid woodland\ Erythrophleum low open woodland\Sorghum mid tussock grassland
Haul Road	2.0	2.0 ha - Eucalyptus woodland	
Total	**368.86 ha**		

7.2.2.2 Introduction or Spread of Invasive and Pest Species

The increase in invasive flora species is widely recognised as a significant threat to biodiversity and conservation (Brooks *et al.* 2004). The proliferation of weeds can directly impact native plants by becoming either monopolisers or donors of limiting resources. Weeds can also indirectly impact native vegetation and change the integrity of an ecosystem by altering soils stability, promoting erosion, colonising open substrates affect the accumulation of litter, salt or other soil resources and promote or suppress fire regimes (Brookes *et al.* 2014).

The introduction or spread of weeds at the Project area can be caused by the movement of vehicles, plant and machinery, soil and plant material, as well as ground disturbance during clearing and operations, associated with the Project. Weeds have the potential to reduce native vegetation species abundance and distribution, competing with native flora species. This can adversely affect the health, survival or regeneration of local native plant species, leading to an overall decline in ecosystem function. The increase in weeds can cause degradation to the habitat of native fauna, including those species of conservation significance. The introduction of non-native vegetation can cause changes to the existing habitat structure, shelters, availability of food and foraging behaviours.

Most notably, and of particular relevance to the conservation significant species identified and considered likely to occur in and surrounding the Project area, is the impact weeds can have on the natural fire regime. Introduced species have been shown to result in more intense and frequent dry season fires (LES 2017a). As most weed species are of a grass-like nature, some weeds may be easily ignitable and therefore increase the risk of fire in the Project area. More intense fires are harder to control and can result in a reduction in the woody component of a vegetation community (LES 2017a). High frequency and intensity fires have also been shown to reduce vegetation diversity and complexity in all strata. For many obligate seeders, one fire can kill an adult plant and the survival of that species in an area is dependent on regeneration from seed (Woinarski *et al*. 2009). Gamba Grass (*A. Gayanus*) is considered a key species that contributes to these altered fire regimes and has been identified throughout the Project area and surrounding landscape (Figure 7-14). Further details on the risks and impacts of fires are discussed in Section 7.2.2.3.

Six weed species have been identified in the Project area at five locations during a systematic flora survey in the dry season of 2016, compared to 18 weed species across an additional seven locations for the 2017 field survey. Four of these species are listed as Declared Plants *(Cenchrus pedicillatus, Cenchrus polystachion, Hyptis suaveolens* and *Senna obtusifolia*) and three are noted as being a WoNS (*Andropogon gayanus, Hymenachne amplexicaulis* and *Mimosa Pigra*). It was noted that there was an additional WoNS species present, adjacent to Rustlers Roost during the field survey of November 2016 (LES 2016), and poor management and hygiene practices could lead to this species becoming more widespread as a result of the Project activities.

The presence and prevalence of weeds within the Project area may impact on the success of rehabilitation and revegetation of the area at the end of the mine life (see Section 7.2.2.8). As weeds thrive in cultivated soils and disturbed environments, the rapid establishment of weeds in areas that are primed for revegetation adversely affect the native species that are favoured for rehabilitation. Some native species require external triggers, such as smoke or heat, for germination. This delay in germination, gives weed species favourable and timely conditions to occupy areas earmarked for successful rehabilitation before the native plant species get a chance to germinate.

7.2.2.3 Change to Fire Regime

Fire is a type of disturbance and ecosystems are partly defined on the basis of their disturbance regimes such as area specific frequency, extent, intensity, seasonality and type. A fire regime can be defined as the average time for a fire to a burn a specific area; or the average time before a fire reburns a specific area (Brooks *et al.* 2014).

Fire regimes may be altered locally within the Project area due to clearing of native vegetation and proliferation of existing weeds such as *A. guyanus* (Gamba Grass). Fire history from North Australia & Rangelands Fire Information (NAFI 2020) indicate that the Project area is frequently burnt, having historically been burnt for 10 to 15 years within a 20-year period.

The presence of weeds can increase the fuel loads and the intensity of a fire and increase the biomass of an area to up to 50% in some cases (Brooks *et al.* 2014). The introduction of the invasive species and WoNS such as *A. guyanus* into the shorter-statured grassland habitats of Australia, and the Project area, directly contributes to the increase in fuel load, resulting in much hotter fire than previously experienced (Brooks *et al.* 2014).

Despite aspects of the Australian landscape relying on the presence of fire for ecosystem function, any significant alteration to the fire regime will have an impact on the existing ecological processes. Fire has the potential to displace fauna through the damage and destruction of their habitats and food sources; and can wipe out local populations of conservation significant species.

There is a risk of potential contamination to soil and waterways at both a local and regional scale. Soil and water contamination can arise from the residue of the material that is consumed by the fire; and the use of fire-fighting foams to contain the fire. The contamination of soil can impact the chemical and physical structure of the soil, resulting in adverse implications for regeneration of native vegetation and rehabilitation at the end of the Project. Contaminated waterways can impact on the ecosystem function of the aquatic environments and the health of aquatic species and those predatory animals that feed on them.

The impacts from fire can be felt at a broader scale with the change in the surrounding landscape, becoming more disturbed, more populated and more prone to fire events. With mining activities resuming in the Mount Bundey area, there are greater risks from the increase in flammable material available for combustion during a fire and the nature of these materials. Fires events in the area are no longer solely burning the native vegetation. In addition they will also burn hazardous materials and chemicals that are constructed, used and stored onsite. The impacts from burnt contaminated material and their residues which will be released post fire, have potential to impact on the soils, waterways, surrounding vegetation and fauna populations.

7.2.2.4 Fauna Injury, Mortality and Displacement

Fauna are at risk of direct mortality, injury or displacement due to construction and operations. The potential impacts to fauna from these activities are not new, as these activities are inherent within similar operations. The likelihood of the impact occurring is expected to increase as a result of the Project throughout all phases of the operation, particularly as there will be changes to vehicle movements within the Project area and haulage routes.

Clearing activities have potential to lead to some injury and mortality of fauna. Fauna species that are ground dwelling or exhibit limited mobility are more likely at risk. The agility and aerial nature of most avian species make them unlikely to be directly impact by clearing activities. However, roosts for avian and bat species such as the Bare-rumped Sheath-tailed Bat are particularly susceptible to displacement through clearing. Increase vehicle and machinery movements during clearing and haulage operations have the potential to result in vehicle strikes, causing mortality or injury to animals.

Collisions are more likely to occur along the access and haul roads than within production areas given that vehicles will be traveling at higher speeds along these corridors. The potential for vehicle collisions is increased at night when visibility is reduced. There is also the consideration that nocturnal species will be impacted from their opportunistic foraging activities along the roads, as roads may provide a new and convenient pathway for obtaining food through the way of insects, water and roadkill. Vehicle strikes may increase the number of carcasses in the Project area, resulting in an increase of predators and increased predation on native fauna.

It is unlikely that isolated mortalities of individuals would affect the conservation status and distribution of any fauna species. However, of the areas of operation and activities proposed for the Project, movements on the haul road are considered highest risk for direct mortality due to intact woodland adjacent the road, constant large vehicle movements and speeds at which the vehicles will be travelling. Within the haul road Project area, the three areas intersecting watercourses are considered the highest risk for interactions with fauna.

7.2.2.5 Emissions

Dust

The Project has the potential to increase dust emissions from construction and operation related activities such as, vegetation clearing, increased vehicle movements, drilling and blasting, handling and haulage of waste rock and ore, and wind erosion from exposed surfaces.

Clearing during the construction period will result in previously vegetated soil being exposed to wind and surface flow of waters. There is the potential for erosion to occur as the soils area no longer protected by roots or the above ground vegetation.

Post clearing these exposed areas may also be impacted by wind, leading to further erosion. Increased dust emissions can lead to dust deposition on vegetation, reducing conditions favourable for plant growth, and subsequently reducing the health of vegetation. Dust can impact of the biological processes of plants such as photosynthesis, respiration, transpiration and allow the penetration of phytotoxic gaseous pollutants (Farmer 1993).

Dust deposition can have both a physical and a chemical impact on vegetation. Plant foliage may be physically smothered by the dust, blocking the stomata and reducing rate of respiration, impacting the lifecycle processes like growth and reproduction. Additionally, the chemical composition of the dust can also impact vegetation through impacting a plant at the cellular level impacting on cell destruction, reproduction, causing disease (Farmer 1993). These effects from dust can result in changes to vegetation and plant community structure. However, Recent research on threatened flora in a semi-arid environment in Western Australia found no significant impact on plant health as a result of a range of dust accumulation loads caused by vehicle movements (Matsuki *et al.* 2016). The deposition of (unpaved) road dust on nearby freshwater wetlands caused by heavy traffic increases from local energy development projects found minimal impact on water quality or soils (Creuzer *et al.* 2016).

An increase in fugitive dust emissions can impact the health of human populations through the inhalation of excessive or contaminated dust and respiratory issues (Chaston and Doley 2006). Due to the location of the Project and the nearest sensitive receptor being over 5 km from the closest mining work area (in proximity to the Boral Quarry), it is anticipated that dust emissions from the Project will meet the regulatory requirements and dust deposition is only likely to be experienced in immediate proximity to the work areas. This is considered further in Section 7.6 (Community and Economy).

Noise and Vibration

During the construction and operational phases of the Project, noise and vibrations may impact on local fauna species. Sources of noise and vibration may include, but not limited to blasting, gold processing plant including crushers, vibrating screens, mills and compressors; and the operation of fixed and mobile plant and equipment, such as vehicle reversing alarms drills, loaders, haul trucks, and excavators. The level of impact of noise and vibration emissions to the receiving environment, including animals, will vary depending on the species. The nature of the emission will also play a part in the level of impact, i.e. volume, frequency, duration and rate of occurrence.

There are no current government policies or guidelines that recommend noise or vibration thresholds or limits in relation to fauna. Noise may adversely affect wildlife by interfering with communication, masking the sound of predators and prey, causing stress or avoidance reactions, and in some cases, may lead to changes in reproductive or nesting behaviour. Excessive noise may lead some species to avoid noisy areas, potentially resulting in the fragmentation of species habitat. Radle (2007) states the consensus that terrestrial fauna will avoid any industrial plant or construction area where noise or vibration presents an annoyance to them. Additionally, many animals react to new noise initially as a potential threat, but quickly 'learn' that the noise is not associated with a threat (Radle 2007).

Noise and vibration generated as part of the Project activities may cause animals to avoid the area for short- or long-term periods. Some animals may become accustomed to the new environmental conditions and either stay during the period of change from the emissions of noise and vibration, while others may return realising the low level of threat. Emissions from noise and vibration have the potential to disrupt lifecycles of fauna or impact the size of populations through reduced breeding events or reducing the distance that a mating call can be heard (Parris and McCauley 2016). The impacts of noise and vibration can also interfere with an animal's ability to navigate, its regular behaviours, like changing an individual from being diurnal to nocturnal creature, simply to avoid the impacts from noise.

Light

Artificial lighting will be used in the production area including the crib and administration buildings, processing plant and other supporting infrastructure and facilities. Artificial light sources such as lighting towers may be used temporarily at various areas during construction and along the haul roads during operation for the safety and well-being of employees. Light emissions will increase in the Project area as a result of construction and mining activities operating 24 hrs per day. The increase in light has the potential to impact the sleeping patterns of fauna and disrupt their natural behavioural activities such as nesting, foraging, breeding and navigation.

Many species have adapted to use the cover of natural darkness to their advantage. Nocturnal fauna species use it to carry out important activities, like hunting, foraging and migrating; while other species also use it to avoid being seen by the predators. When artificial light is introduced into an environment, it can disrupt fauna behaviours, which can lead to negative health effects. For example, an alteration in light patters can interfere with migration or transport corridors, contributing to the decline to a threatened species; or prevent fauna species foraging for food or risk being eaten by predator species (DAWE 2021).

Artificial lighting may have a range of impacts across different groups of taxa and between species within these groups. Rodents may avoid brightly lit areas at night. Frogs and nocturnal reptiles may congregate at artificial lights to feed on insects attracted to light (Perry *et al.,* 2008). Similarly, many microbat species may congregate at artificial lighting (Rich and Longcore 2006), although other species may avoid well-lit areas (Threlfall *et al.* 2013). Species such as Sugar Glider (*Petaurus breviceps*) have been experimentally shown to reduce foraging time under artificial lighting (Barber-Meyer 2007), although whether this effect occurs in natural situations is unknown. Known impacts on birds include disruption of migratory patterns and choice of nest sites (Longcore and Rich 2004).

There are few if any studies to suggest the fauna inhabiting the woodland around the Project area will be impacted to more than a minor extent. As suggested by the evidence above, there will be differing responses between species or taxa groups with some responses considered quite benign (e.g. microbats and other taxa attracted to night lighting). Habitat around the Project area is largely intact Eucalypt woodland with various potential conservation significant species present (refer to Section 7.2.1.3). With informed lighting placement and measures aimed at limiting light spill (refer to Table 7-19), this habitat will be at a distance where light levels would have attenuated to levels where they are unlikely to be causing a significant impact to fauna.

7.2.2.6 Uncontrolled Discharges

The Project has the potential to unintentionally release contaminants into the environment. This may arise of from:

- Overtopping of the TFS (Rustlers Roost);
- Embankment failure of the TSF (Rustlers Roost);
- Seepage from the TSF (Rustlers Roost);
- Overtopping of the process water storage within the TSF (Rustlers Roost);
- Seepage from the process water storage dam (Rustlers Roost);
- Uncontained spillage of hazardous materials from storage and handling;
- Uncontained spillage of hazardous materials during transport; and
- Uncontrolled discharge of septic waste (refer to section 7.2.2.7).

The unintentional and uncontrolled release of contaminated material has the potential to adversely affect the surrounding land and water environments. This can include the alteration of the ecological characteristics including the chemical, biological, physical and the aesthetic components of the immediate and surrounding areas. The change to the ecological characteristics caused by the release of contaminants can cause a decline in vegetation health, density and composition, ecological integrity and function; and loss of biodiversity of both fauna and flora.

Depending on the nature of the contaminate, the impact from an uncontrolled discharge may have short term impacts on the area. This includes the removal of surface material during clean up or immediate death to nearby organisms; or it may have long term impacts like bioaccumulation of toxins that could be felt along the food chain.

The principle dangerous goods that will be transported, stored and used on site will be hydrocarbons (diesel, oil and lubricants) as well as processing chemicals (including cyanide). Containment failure during transportation of chemicals within the site or onsite tanks or storage containers is possible.

Hydrocarbons will be stored on site for refuelling as well as servicing of vehicles and machinery. Process chemicals will be stored on within the processing plant. The storage of chemicals will be stored on previously cleared areas, away from waterways and will be adequately bunded. Based on similar operations small spills could easily occur during all stages; however, larger spills are highly unlikely with standard controls.

Riparian habitat downstream of the Project area could be impacted if significant AMD contamination were to occur. The potential for AMD contamination to occur is discussed in Section 7.1.

7.2.2.7 Waste

The Project will generate waste during all phases. The types of waste that are anticipated to be generated as a result of Project activities include domestic waste such as timber, paper, metal, and food; and prescribed wastes such as tyres, septic waste, chemicals; and discharge water from storage areas. Prescribed wastes are those waste that are defined under Schedule 2 of the *Waste Management and Pollution Control (Administration) Regulations 1998*.

A landfill will be constructed over 4 ha to a depth of 5 m and be utilised for the 10 year Project period. The landfill will be designed and constructed in accordance with the NT EPA Guidelines for the Siting, Design and Management of Solid Waste Disposal Sites in the Northern Territory (NT EPA 2013b). Solid waste materials including non-putrescible commercial and industrial (C&I) waste, non-putrescible construction and demolition (C&D) waste, green waste and limited hazardous waste in the form or contaminated soils will be placed in the landfill. Other hazardous wastes will not be landfilled onsite and will be taken from site by a licensed contractor to an authorised collection or licenced waste disposal facility.

A landfill aligns with the classification of 'Industrial Waste Landfill' as to the NT EPA Guidelines (NT EPA 2013b) The poor management of industrial C&I, C&D green and hazardous waste, and the spread of uncontrolled litter, can impact the surrounding environment and result in a loss of visual amenity to the site, increase in foul odours, attraction of native and pest fauna species.

Landfills can create opportunities for animals such as rats, feral cats and dogs to thrive. These pests can seriously threaten local native animal populations and transfer disease causing organisms to humans, either directly, or through contamination of food or other animals (NT EPA 2013b). Animals and insects may transfer pathogens to drinking water collection or storage areas, transmit salmonella and other food borne diseases, as well as depositing excreta and food scraps (NT EPA 2013b).

Incorrect disposal of weed species, such as Gamba Grass, can facilitate the spread to weeds throughout an area. This can impact on native vegetation and pose a risk to fauna in the event of poisoning from weedicide use.

Sewage will be generated on site at the accommodation camp and at the ablutions established on site at the crib and office areas in the Rustlers Roost portion of the Project. The generation of sewerage poses a health risk to employees and also has the potential to impact the surrounding environment if not appropriately managed. The potential impact of raw sewerage on the environment will depend on the volume and the area that the release occurs, however, its effect on the environment will be consistent with that discussed in Section 7.2.2.6.

Excess water from water storage areas (pits) will be dewatered prior during the wet season. The primary contaminants of concern from the operation of the Project are likely to be higher levels of acidity, metals and sediment. The increase in sediment will results in elevated turbidity levels in the downstream waterways. The release of poor quality process water could result in contaminated drinking water for fauna, poor vegetation health and growth, and sedimentation of riparian environments, altering surface water flows and habitats for flora and fauna. The modification of the habitats may further disrupt lifecycle and reproduction events, further attributing to a decrease in population size and species richness in an area.

Should contaminated or poor quality water enter the aquatic environment, there is a potential impact to the species richness and size of local fish populations. The change in the aquatic environments will likely have an indirect impact on the terrestrial fauna species that rely on these habitats for food. Additionally, should the poor quality include the increased levels of other contaminates, there is further risk of bioaccumulation of these contaminates in the food chain.

7.2.2.8 Rehabilitation

Rehabilitation is fundamental to achieving post-mining land uses as part of good industry practice, and to meet stakeholder expectations. The goals of undertaking rehabilitation can vary from reforming an area to create conditions that are more stable and safe than what they were during the operational mining period, to restoring an area to exhibit the values that were present pre-mining activities (Australian 2016).

The Project has considered the potential impacts of inadequate rehabilitation to the Project area and the impacts that this will have on the terrestrial environment. Inadequate rehabilitation may arise from:

- Unfinished or unsuccessful rehabilitation;
- Inability to establish native vegetation with local provenance species;
- Lack of rehabilitation material; and
- Inappropriate management of the decommissioned site and the post-closure landform.

Unsuccessful, inadequate or incomplete rehabilitation can have adverse impacts within the Project area and further offsite. The poor management of the soil and landform infrastructure including TSF and WRD, can lead to contamination through acidification of soils or heavy metals to the wider environment. There is potential for the post closure open pit lakes to contain AMD impacted water. Fauna will likely have access to these water sources. These impacts are discussed further in Section 7.1.

The risk of erosion is higher if the Project is not completed in accordance with standards/guidelines. Lack of established vegetation will increase the likelihood of erosion, further impacting the success of vegetation establishment; and increase the sediment load in riparian systems and waterways, causing impacts to the aquatic fauna and on ecosystems further downstream. This is discussed further in Section 7.5.

To meet the criteria for successful rehabilitation, it is anticipated that the final outcomes will be a functioning ecosystem, consisting of native vegetation of local provenance species which will resemble nearby unimpacted areas. The success of the rehabilitation will be primarily reliant on the management of the material that is removed for clearing and ground disturbance activities during the construction and operational phases of the Project. The material that is removed must be managed and stored appropriately to provide the adequate quantity and quality of rehabilitation material is available at the end of the Project. This will include establishing the appropriate capping material, including topsoil containing the original seed bank. If required local provenance seeding material and/or tube stock will be used to assist with establishing native vegetation during rehabilitation to reduce the potential of weed species competing for viability and to provide soil stabilisation in lieu of the seed bank obtaining optimal conditions for germination.

The Project areas of Rustlers Roost and Quest 29 are 12 km and 5 km respectively from the Arnhem highway turnoff, which is also in close proximity to tourist areas including the Mary River and various nature-based tourism facilities. Unauthorised access to the site by members of the public, leaseholders or livestock may be the direct cause or contributing factor to poor performance and ultimate failure of successful rehabilitation. The inability to successfully rehabilitate the area will greatly reduce the ability of the area to return to a functional ecosystem.

7.2.2.9 Environmental Management System

An EMS is a set of processes and practices that enable an organisation to identify and reduce environmental impacts whilst allowing an opportunity to increase the business's operating efficiency (USEPA 2021). Establishing an EMS framework will assist PGO to achieve its environmental goals through the approach of 'plan, do, check, act', allowing for the review and evaluation of actions and performance; and identifying

areas for improvement. The environmental management system and framework for PGO is summarised in Section 10.

The Project has considered the impacts to the terrestrial ecosystem should there be an ineffective implementation of site environmental management systems, including plans, procedures and processes. As a direct result of an inadequate EMS or the ineffective implementation of the EMS, the occurrence of environmental incidents will cause a significant degradation to the environmental features that support the species of flora and fauna that inhabit the Project area and beyond.

The poor management of material can lead to contamination of soil, sediment and vegetative matter throughout the Project area, and more widespread across the region. This can lead to issues like weed infestation, increase acidity of soils and possible transportation of hazardous chemicals and pathogens that could affect the health of the waterways, soil, vegetation or fauna and the livelihoods and health of nearby communities.

7.2.2.10 Cumulative Impacts

There are four active extractive industry operations and one approved, but not yet active, mining operation in proximity to the Project (refer to Figure 7-19). The construction and operation of the Project has the potential to incrementally contribute fragmentation of the vegetation from clearing activities in a cumulative context and temporary displacement of animals from the reduced options of habitat and change in the local amenity for these species.

To address the ToR requirement for this Draft EIS, an assessment of the cumulative impacts of the Project across four spatial scales has been conducted. The spatial scales of consideration are:

- Property – defined as Mount Bundey Station and McKinlay River Station;
- Catchment – defined as the Mount Bundey Creek catchment, Marrakai Creek catchment and McKinlay River catchment;
- Region – defined as the Marrakai-Douglas Daly unincorporated area; and
- Bioregion – defined as the Pine Creek bioregion.

The cumulative impact assessment has considered the effects of multiple actions or impacts on the terrestrial ecosystems, including habitats for threatened species, vegetation types and natural features considered important by the Land Clearing Guidelines (DENR 2020) (refer Table 7-18).

The Project lies within the area classed as being a potential suitable habitat, with a high likelihood of occurrence, for *H. macrothrix*. The NTG mapping conservatively estimates 12,700 ha of potential habitat within the known extent, with 8,000 ha of that area being potential habitat with the highest likelihood of occurrence (Figure 7-20). From the indicative NTG mapping (2021a), 192.6 ha has been mapped as the highest likelihood suitable habitat within the Development Envelopes which constitutes 2.4% of the mapped highest likelihood suitable habitat. During the targeted field surveys conducted in September and October 2020, no individuals of *H. macrothrix* were recorded. The Northern Territory government mapping of the area of likely occurrence and potential habitat for *H. macrothrix* extends broadly throughout the Pine Creek Bioregion, covering a total of 50,300 ha across the Territory.

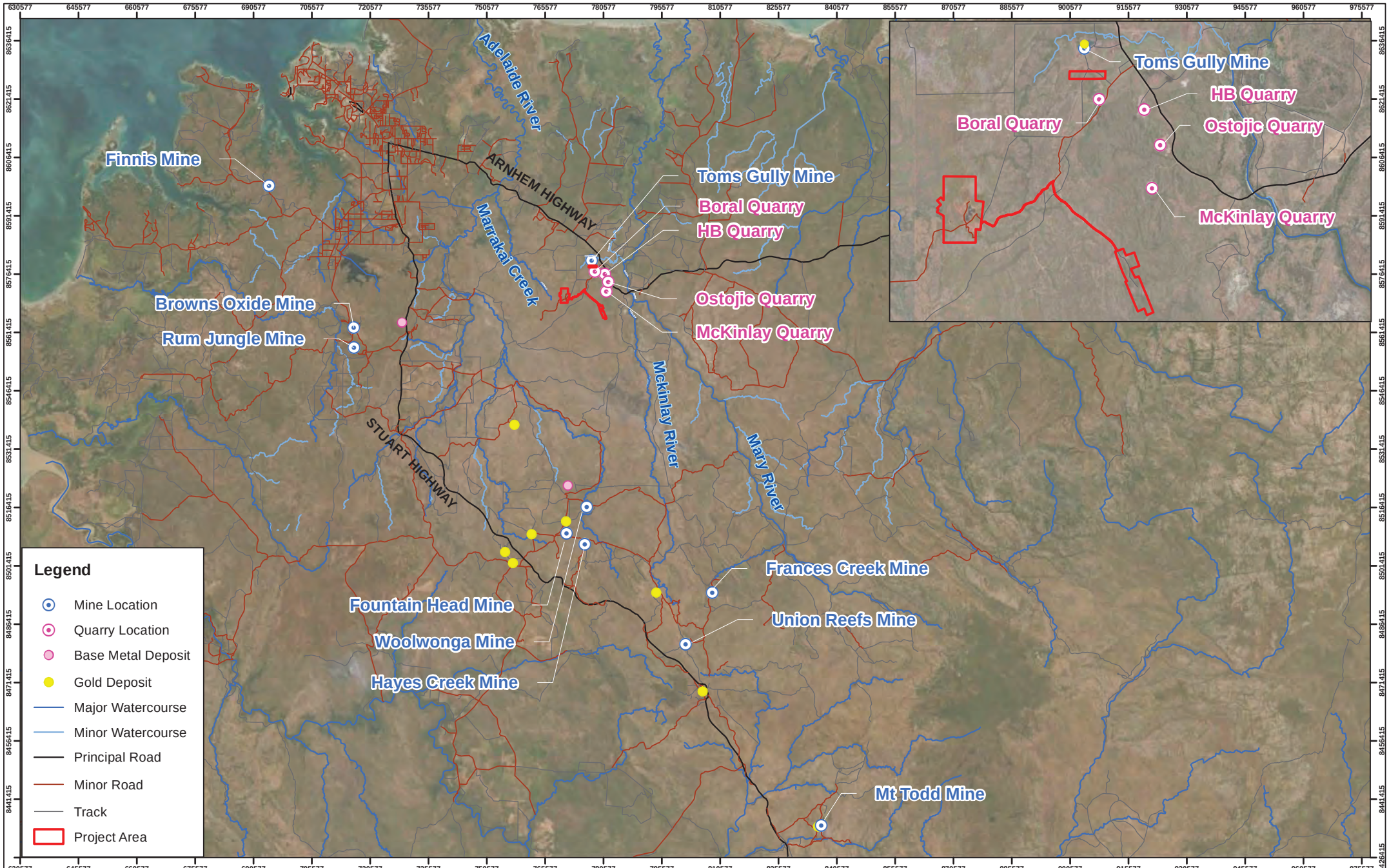
The Project is unlikely to have an impact on the *H. macrothrix* population, due to no observations being recorded of the species during the multiple surveys, and that the direct disturbance to the potential habitat is not considered to be significant. Additionally, topsoil removal will be located within close proximity to point of origin and labelled to ensure that they correct soils and seed profiles are returned at the time of closure.

Another key flora species of concern is the *S. ensatum.* The Project lies within the area classed as being a potential suitable habitat, with a high to moderate likelihood of occurrence, for *S. ensatum.* The NT Government mapping conservatively estimates 8,100 ha of potential habitat within the known extent, with 3,000 ha of that area being potential habitat with the highest likelihood of occurrence (Figure 7-20). From the indicative NT Government mapping (2021a), 7.2 ha has been mapped as potential suitable habitat within the development envelopes which constitutes 0.24% of the mapped highest likelihood suitable habitat. Notably, the Project area is on the western extent of the area mapped as potential habitat and there are no confirmed occurrences of the species in the lower Mary River floodplain, below the Project area. No individuals of *S. ensatum* were detected to occur in the Project area from targeted surveys to date.

Based on the review of the selected Projects at varying spatial scales (Table 7-18), it is estimated that cumulative impacts at the property and catchment scale consist of approximately 592.36 ha of Eucalyptus woodland and fauna habitat[12], approximately 602.36 ha in the region and approximately 904.99 ha in the bioregion. As a comparison, using total extent of mapped Eucalyptus woodland in these four spatial scales, indicates the cumulative impact will constitute approximately 1.28% of Eucalyptus woodland at the property scale, 0.32% at the catchment scale, 0.15% at the region scale and 0.03% at the bioregion scale.

The presence of multiple mining activities in the upper Mount Bundey Creek catchment has the potential to indirectly stress riparian vegetation in Mount Bundey Creek, from alteration of water quality associated with AMD. The cumulative impact on soils, water quality and aquatic ecosystems in the Mount Bundey Creek are discussed further in Section 7.1 and Sections 7.4 and 7.5 respectively.

[12] Note – much of this calculated Eucalyptus woodland disturbance has already occurred with development of the quarries.



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Notes:

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Meters

1 cm = 8,872 meters

GCS GDA 1994 MGA Zone 52

DISCLAIMER
CDM Smith has endeavoured to ensure accuracy and completeness of the data. CDM Smith assumes no legal liability or responsibility for any decisions or actions resulting from the information contained within this map.

DATA SOURCE
NT Government Open Source Data

DESIGNER

CDM Smith

CLIENT

PRIMARY GOLD

FIGURE 7-19

Surrounding Mining and Extractive Industry Projects

DRG Ref: 1001087-EIS-07-7.19

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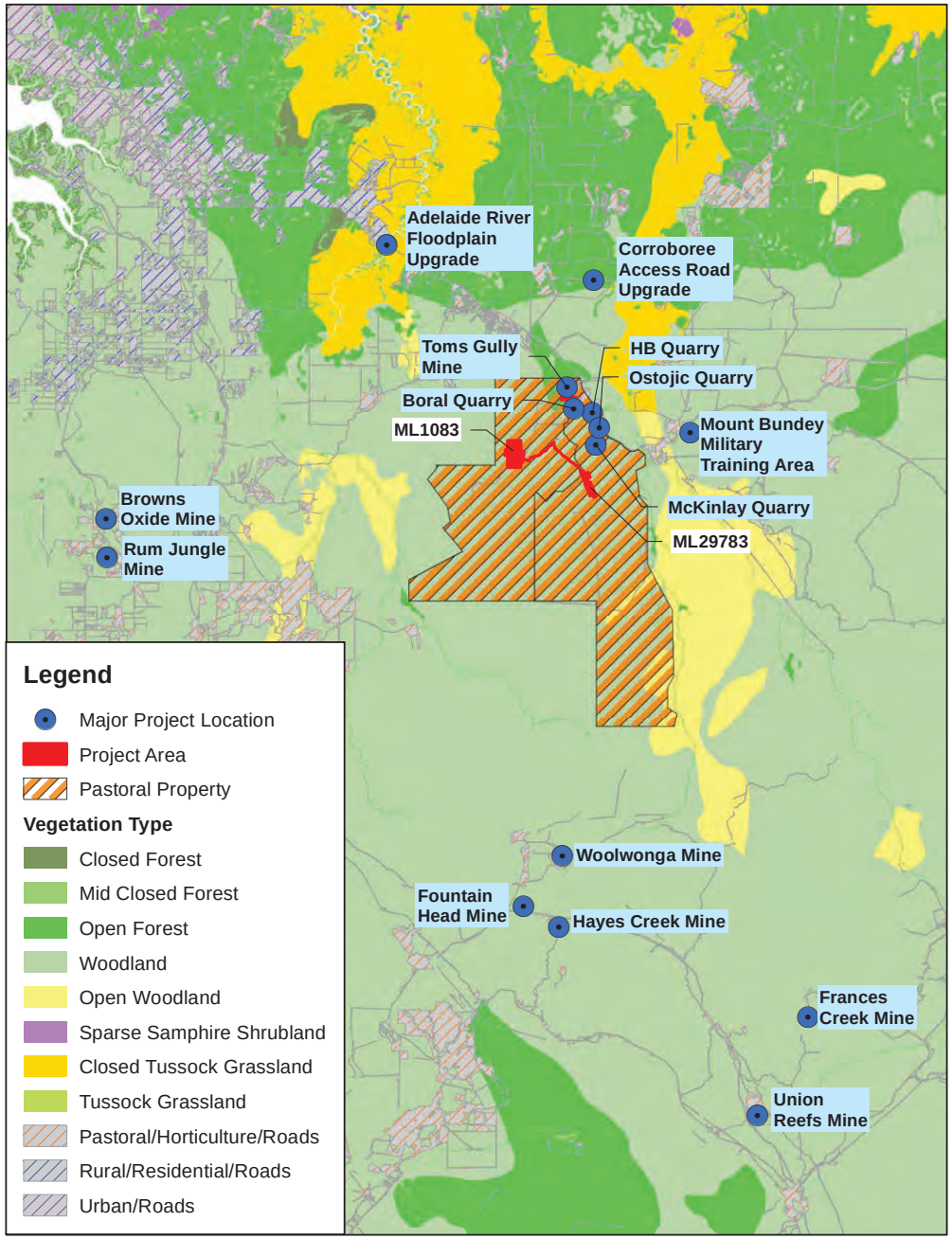

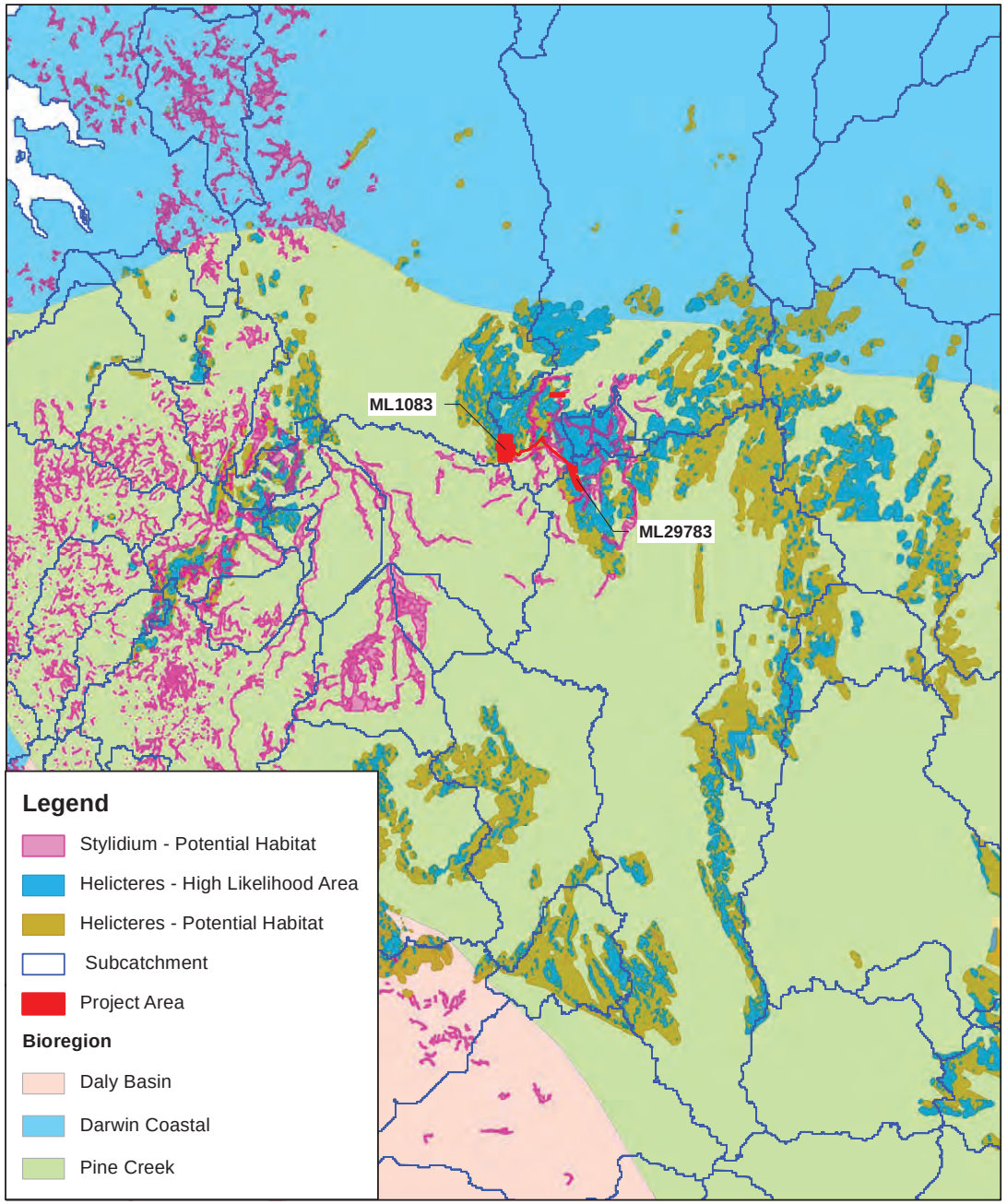

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1 cm = 6,872 meters

GCS GDA 1994 MGA Zone 52

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DATA SOURCE
NT Government Open Source Data

DESIGNER

CDM Smith

CLIENT

PRIMARY GOLD

FIGURE 7-20

Areas of Influence for Cumulative Impact

DRG Ref: 1001087-EIS-07-7.20

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Table 7-18 Assessment of Cumulative Impacts to Terrestrial Ecosystems

Project	Spatial Extent				Approx. Distance from Project	Impact Details	Reference
	Property	Catchment	Region	Bioregion			
Toms Gully Mine	✓	✓	✓	✓	0 km	Native vegetation and fauna habitat loss = 76 ha (consisting of eucalyptus open forest and woodland, Vegetation units 4 and 5) One plant species (*Helicteres macrothrix*) listed as endangered under the EPBC Act is known to occur in the vicinity of the Proposal and could be impacted by clearing or disturbance associated with the Proposal. Unlikely to significantly impact any of the ten fauna species listed under the TPWC Act or EPBC Act Impact to *S. ensatum* potential habitat - UNLIKELY Impact to *H. macrothrix* potential habitat - YES	NT EPA 2020a
Boral Quarry	✓	✓	✓	✓	700 m	Approximately 35 ha of disturbance (including access road of 2.5) Impact to *S. ensatum* potential habitat - YES Impact to *H. macrothrix* potential habitat - YES	NR Maps spatial mapping tool (DEPWS 2021) DLRM 2016a DLRM 2016b
HB Quarry	✓	✓	✓	✓	2 km	Approximately 47.5 ha of disturbance. Impact to *S. ensatum* potential habitat - NO Impact to *H. macrothrix* potential habitat - YES	NR Maps spatial mapping tool (DEPWS 2021) DLRM 2016a DLRM 2016b
McKinlay Quarry	✓	✓	✓	✓	3.5 km	Approximately 17.5 ha of disturbance (including access road of 3 km) Impact to *S. ensatum* potential habitat - UNLIKELY Impact to *H. macrothrix* potential habitat - YES *H. macrothrix* – This project lies within the area classed as potential habitat, with a highly likelihood of the species occurring. Records to the NW an SE within 2 km and 2km respectively and along access road. *S. ensatum* - majority of project not located in associated habitat, with exception of SE corner of project. This this in area classed as "low potential habitat'. A corridor of high potential habitat run eat-west at the southern portion of project. Species recorded north of Humpty Doo and south of Hays Creek Mine	NR Maps spatial mapping tool (DEPWS 2021) DLRM 2016a DLRM 2016b

Project	Spatial Extent				Approx. Distance from Project	Impact Details	Reference
	Property	Catchment	Region	Bioregion			
Ostojic Quarry	✓	✓	✓	✓	4.4 km	Approximately 47.5 ha of disturbance. Impact to *S. ensatum* potential habitat - UNLIKELY Impact to *H. macrothrix* potential habitat - YES *H. macrothrix* – This project lies within the area classed as potential habitat, with a highly likelihood of the species occurring. Records indicated that species have been located within 400 m to the south-western portion of the Project. *S. ensatum* - majority of project not located in associated habitat, with exception of NW corner of project where dam is located. This this in an area classed as "low potential habitat'. Species recorded north of Humpty Doo and south of Hays Creek Mine	NR Maps spatial mapping tool (DEPWS 2021) DLRM 2016a DLRM 2016b
Mount Bundey Military Training Area			✓	✓	9 km	The Mount Bundey Training Area is a 117,300 ha. No publicly available data No more than 10 ha of disturbance Impact to *S. ensatum* potential habitat - NO Impact to *H. macrothrix* potential habitat - YES	NR Maps spatial mapping tool (DEPWS 2021)
Woolwonga Mine				✓	47 km	Impact to *S. ensatum* potential habitat - NO Impact to *H. macrothrix* potential habitat - NO	
Hayes Creek Mine				✓	58 km	Native vegetation and fauna habitat loss = 33 ha (consisting of Eucalyptus woodland on sandstone plains and Eucalyptus woodland on low sandstone hills and rises) Impact to *S. ensatum* potential habitat - NO Impact to *H. macrothrix* potential habitat - YES	LES 2017b
Union Reefs Gold Mine				✓	60 km	Clearing of regrowth vegetation required = 1 ha Impact to *S. ensatum* potential habitat - NO Impact to *H. macrothrix* potential habitat - NO	NT EPA 2020b
Frances Creek Iron Ore Mine				✓	75 km	Clearing of approximately 172 hectares of native vegetation, of which 78 hectares has been previously disturbed (open eucalypt woodland over grassland) Impact to *S. ensatum* potential habitat - NO Impact to *H. macrothrix* potential habitat - NO	MBS Environmental 2006
Finnis Lithium Mine					80 km	Native vegetation and fauna habitat loss = 100.9 ha None of the vegetation types are rare or threatened.	EcOz 2020b

Project	Spatial Extent				Approx. Distance from Project	Impact Details	Reference
	Property	Catchment	Region	Bioregion			
						Disturbance will occur in land unit 1b and 5a, which supports Eucalyptus woodland, open woodland vegetation communities and poorly drained shrublands dominated by *Grevillea pteridifolia*, *Pandanus spiralis* and *Lophostemon lactifluus*. Impact to *S. ensatum* potential habitat - UNLIKELY Impact to *H. macrothrix* potential habitat - NO	
Fountain Head Gold Mine				✓	90 km	Native vegetation and fauna habitat loss = 80.6 ha (eucalyptus woodland) Impact to *S. ensatum* potential habitat - NO Impact to *H.s macrothrix* potential habitat - NO	ERIAS 2021
Jabiru Hybrid Power Station				✓	140 km	Project area of 20 ha with 16.03 ha of disturbance. Impact to *S. ensatum* potential habitat - UNLIKLEY Impact to *H. macrothrix* potential habitat - NO	CDM Smith 2021

Increasing areas of disturbed land will increase the prevalence of weeds at the Project area and surrounds, as vehicle movements increase between the mining areas of Rustlers Roost and Quest 29. This will also result from an increase in deliveries and transport of goods to and from site during construction, operation and decommissioning. As the accommodation for construction and operational mining personnel will be located adjacent to the nearby Toms Gully Mine, there is greater risk of weeds and seeds being spread beyond the Project area. However, as the accommodation is also operating by PGO, the standards and procedures for maintaining weed, seed and vehicle hygiene will be implemented at both the accommodation and operating areas of the Project. Toms Gully Mine will be operating under the same EMS and utilising the same mitigation strategies to avoid the cumulative impact of the spread of weeds.

The Proponent, PGO, is currently seeking approval to commence operation of this Project, occupying the mine areas of Rustlers Roost and Quest 29, and the underground mine operations of the nearby Toms Gully (which has been subject of separate EIS assessment and approval). PGO will have overarching accountability for the implementation of the EMS across these related sites. Similarly, in response to closure and rehabilitation of the Project, a clear understanding of the completion requirements and access to adequate funding will be necessary to achieve compliance and handover of mining projects in the region.

Considering the Project context, the existing predominant pastoral land use of the local area, and the implementation of management measures (described further in Section 7.2.3), the cumulative land clearing impacts are considered unlikely to impact the terrestrial ecosystems.

7.2.3 Avoidance, Mitigation and Management

Table 7-19 presents the strategy of a hierarchical approach of avoidance, mitigation and management to minimise potential impacts to the environmental values of terrestrial ecosystem quality.

Potential impacts to flora and fauna associated with land clearing, weed and fire management, noise and dust, will be mitigated by industry standard controls under an approved MMP.

Table 7-19 Avoidance, Mitigation and Management Measures

Potential Impacts	Measures
Direct loss of vegetation and flora	**Avoid** ▪ Baseline flora and vegetation surveys completed prior to commencement of development activities to characterise the receiving environment values and inform mine planning. ▪ Make use of already disturbed areas. ▪ Adhere to buffer widths recommended by the Northern Territory Land Clearing Guidelines with regard to Sensitive or Significant vegetation Types, e.g. riparian vegetation in drainage lines. ▪ Avoid land clearing during the December to March portion of the wet season. ▪ Identification and protection of 'No-Go Areas' in accordance with the Environmental Management Plan. **Mitigation and Management** ▪ Only clearing what is absolutely necessary for the portion of the Project to be implemented. ▪ Adherence to Ground Disturbance Procedures. ▪ Implement erosion and sediment controls in accordance with an ESCP. ▪ Clearly mark limits of clearing. ▪ Have a trained fauna spotter on site during clearing operations. **Rehabilitation** ▪ Progressive rehabilitation will be undertaken on those areas that are no longer required to service the operation of the Project. ▪ Rehabilitation activities will be undertaken in accordance with internal rehabilitation procedures. ▪ Vegetative material removed in the early stages of clearing (e.g. stumps, branches and debris) will be placed in rehabilitated areas to be used as fauna habitat. ▪ Rehabilitation will be planned to support local ecological linkages.
Introduction or Spread of Invasive and Pest species	**Avoid** ▪ Annual weed mapping (by June each year) to understand nature of the spread of weeds and plan weed control activities accordingly. ▪ Weed inspections completed regularly and prior to commencement of development activities to inform weed management and detection. ▪ Construction material required for site will be inspected prior to entry to site (e.g. any fill material). ▪ No unauthorised plant or vegetative material to be brought to site. **Mitigation and Management** ▪ Develop and implement a Weed and Pest Management Plan for the Project that specifically addresses the following: ▪ Reduction and management of the local cane toad population – to reduce the threat to listed monitor species in the area;

Potential Impacts	Measures
	▪ Active management of invasive grass species (particularly Gamba Grass) within the Project area – to reduce the risk of inappropriate fires; ▪ Reduction and management of feral predators in the local area particularly cats which are known to predate on Pale Field-rats, Red-cheeked Dunnarts and Partridge Pigeon. ▪ Conduct seasonal weed control activities in consultation with local landholder (in and surrounding the Project boundary) in accordance with the site Weed and Pest Management Plan (grazing control as option). ▪ Implementation of the biodiversity management actions within the Project-wide EMP. ▪ Weed hygiene procedures - including inspection and wash down of all vehicles and machinery entering site. ▪ Compliance with ground disturbance and clearing procedures. ▪ Ensure all employees are aware of the Declared weeds and WoNS during inductions. **Rehabilitation** ▪ Progressive rehabilitation of disturbed areas, including areas of disturbance generated from previous disturbance within the mining envelope; and ▪ Vegetation materials removed prior to clearing, to the extent practicable, for subsequent re-use.
Change to fire regime	**Avoid** ▪ Liaise with Bushfires NT regarding regional (and site) fire break. ▪ Project to establish designated smoking areas. ▪ Vehicles not to park in vegetation areas (to prevent hot engines causing bush fire). **Mitigation and Management** ▪ PGO to implement appropriate fire regime within the Project tenements in consultation with leaseholder and in accordance with best management practices (to be informed by guidance material on regimes to support best ecological outcomes). ▪ Establish and implement hot work procedures. ▪ Regular inspections of generators and other sources of heat/power. ▪ Fire extinguishers available around site and on all vehicles and machinery. ▪ Training and inductions include Emergency Response Plan (ERP). ▪ Develop Fire Management Plan (or inclusion in ERP above). ▪ Vehicles, plant and machinery to be switched off when not in use. ▪ Implementation of Project EMP (incorporating fire and dust management measures).
Fauna injury, morality and displacement	**Avoid** ▪ Baseline fauna surveys completed prior to commencement of development activities to characterise the receiving environment values. ▪ Vehicles to remain on designated tracks. ▪ Implement speed limits of 40 km/hr on internal Project roads and the 60 km/hr on the haul road. ▪ Vehicles to drive to conditions (e.g. dawn and dusk, fog). **Mitigation and Management** ▪ Areas identified to assist in mining operations will be cleared progressively to minimise impact of local fauna and creation of dust. ▪ Implementation and compliance with internal procedures and standards related to clearing, including:

Potential Impacts	Measures
	▪ Pre-clearance surveys will be undertaken to identify and relocate any animals found to be directly impacted from clearing activities; ▪ Pre-clearance surveys will involve the inspection of all visible tree hollows for the presence of roosting fauna, notably Bare-rumped Sheath-tailed Bat. ▪ Inductions to include information regarding identification and reporting of sightings of fauna species on site, including those that have been previously identified: - Merten's water monitor (*Varanus mertensi*), - Orange leaf-nosed bat (*Rhinonicteris aurantia*) - Arnhem sheath-tailed bat (*Taphozous kapalgensis*) - Red-cheeked dunnart (*Sminthopsis virginiae*), and - Black-spotted ridge-tailed monitor (*Varanus baritji*). **Rehabilitation** ▪ Progressive rehabilitation of disturbed areas, including areas of disturbance generated from previous disturbance within the mining envelope. ▪ The timeframes between mining and rehabilitation will be minimised as far as practicable to ensure that rehabilitation is progressive and allowing fauna habitats to establish for recolonisation. ▪ Rehabilitation activities will be undertaken in accordance with Final Mine Closure Plan as approved for the Project. ▪ Vegetative material removed in the early stages of clearing (e.g. stumps, branches and debris) will be placed in rehabilitated areas to be used as fauna habitat. ▪ Rehabilitation will be planned to support local ecological and habitat linkages.
Emissions (dust, noise, vibration and light)	**Avoid** ▪ Areas identified to assist in mining operations will be cleared progressively to minimise impact of local fauna and creation of dust. ▪ Site planning to consider only the necessary clearing of areas and avoid clearing on significantly windy days. ▪ Enforcing speed limits to ensure that all operations are operating at the lowest possible noise level to minimise the impacts of noise and vibration upon wildlife. ▪ Mitigate noise by properly maintaining all equipment in accordance with manufacturers specifications. ▪ Where possible, choose the ""Buy Quiet"" option for the purchase of equipment. ▪ Vehicles, plant and machinery to be switched off when not in use. ▪ Lighting to be switch off when not in use at administration, crib and work areas. **Mitigation and Management** ▪ Development and implementation of Dust Management Plan. ▪ Implement an ESCP. ▪ ESCP controls implemented where ground cracking identified. ▪ Employees will carry out visual monitoring and individual assessment of dust emissions prior to undertaking tasks or attending work areas. ▪ Biodiversity Management Plan to incorporate dust mitigation and artificial lighting mitigation measures. ▪ Comply with approved vegetation clearance. ▪ Ground Disturbance Permit procedure to be adhered to. ▪ Monitoring of area surrounding high vibration activities for ground instability. ▪ Noise management and controls to be addressed in Project EMP. ▪ Develop and implement Noise and Vibration Management Plan. ▪ Operations in line with noise regulations. ▪ Use of low voltage/wattage light bulbs where possible.

Potential Impacts	Measures
	Rehabilitation ▪ Progressive rehabilitation of disturbed areas, including areas of disturbance generated from previous disturbance within the mining envelope.
Uncontrolled discharges	**Avoid** ▪ Manage the site water balance to reduce any build-up of water. ▪ Design the location of water storage facilities away from wetlands and drainage channels. ▪ Chemical storage will be located a minimum 30 m from any drainage line or watercourse. ▪ Design, storage and handling of hazardous materials to Australian Standards and regulations. ▪ Specific adherence of the ANFO storage to *Dangerous Goods Act 1998* and the NT *Work Health and Safety (National Uniform Legislation) Act 2011*. ▪ Regular maintenance of storage facilities. ▪ Bunding of the process plant. ▪ Ensure containment bunding is adequate and SDS available. ▪ Standard pre-requirements for contractors (must meet standard requirements and licensing). ▪ Ensure transportation contractors undertake standard pre-departure checks. ▪ Appropriate site access for large vehicles. ▪ All external operators to complete induction that includes transportation safety considerations. **Mitigation and Management** ▪ Development of Monitoring Plan / Operational Manual which includes weekly inspections of the TSF. ▪ Develop and implement programme for the monitoring of groundwater. ▪ Implementation of AMDMP. ▪ Develop and implement WMP. ▪ The management of tailings from processing activities will be undertaken in alignment with the Department of Industry guideline Leading Practice Sustainable Development Program for the Mining Industry – Tailings Management (DFAT 2016b) (or as amended). ▪ Development of Monitoring Plan and Operational Manual for the Process Water Dams which includes weekly inspections of the facilities. ▪ Develop and implement a groundwater monitoring programme to include the monitoring of Ag, As, Al, Cd, Co, Cr, Cu, Fe, Mo, Ni, P, Pb, Se, Ti, U, V and Zn, and nitrate. ▪ Storage and management of cyanide in accordance with the Commonwealth of Australia Leading Practice Handbook for Sustainable Mining - Cyanide Management (Australian Government 2008) (or as amended). ▪ Chemicals and substances will be reviewed and approved prior to coming to site. ▪ A chemical storage register and SDSs will be maintained and made available on site. ▪ Chemical storage areas will be capable to of meeting the volume requirements for each substance. ▪ Display relevant Dangerous Goods information. ▪ Storage in accordance relevant stage requirements (i.e. incompatible materials not store together); and appropriately bunded. ▪ Bunding to have a minimum capacity of 100% of the largest container; or 25% of the capacity of the total volume of the material stored, whichever is larger. ▪ Chemical storage will comply with AS 1940:2004. ▪ Diesel in bunded storage tanks. ▪ Waste oil stored bunded tanks/containers e.g. IBC.

Potential Impacts	Measures
	▪ Weekly inspections of storage areas, tanks, containers for leaks or damages. ▪ Spill kits available around the site and procedures and training for the cleaning up of hazardous spills. ▪ Develop Emergency Response Plan and include in inductions. ▪ Implementation of hazardous materials management plan training for emergency response.
Waste	**Avoid** ▪ All water storage facilities geotechnically stable and engineered to ANCOLD guidelines. ▪ Weekly inspections of freeboard, structural integrity and pipelines. ▪ Material will be supplied in bulk where appropriate to reduce the among of packaging material going to landfill/offsite disposal. ▪ Landfill will be set out as prescribed by the Guidelines for the Siting, Design and Management of Solid Waste Disposal Sites in the Northern Territory. **Mitigation and Management** ▪ Compliance with the WDL. ▪ Implementation of AMDMP. ▪ Implementation of WMP. ▪ Water quality monitoring program including annual sediment and macroinvertebrate monitoring. ▪ Waste receptacles to have lids that can be secured during periods of non-use to avoid litter and pests. ▪ Establish dedicated hardstand at accommodation camp for waste receptacles. ▪ Weekly inspections of, waste area, landfill and general tidiness of site. ▪ Burial of waste in dedicated landfill. ▪ Design and construct landfill in accordance with relevant standards. ▪ Obtain and comply with landfill licensing requirements. ▪ Implement leachate prevention and capture into landfill design. ▪ Develop and implement programme for the monitoring of groundwater. ▪ Regular (weekly) waste contractor to removed waste from site. ▪ Wastes will be segregated into appropriate waste streams and sent off site for recycling (including metals, paper and cardboard and wood), or disposal (Prescribed waste). ▪ Declared weeds will not be disposed in the landfill. ▪ PGO will obtain necessary licences for the production/management of sewerage.
Rehabilitation	**Avoid** ▪ Clearing and ground disturbance will only take place within areas of the mining footprint; ▪ Areas will not be clear areas unless they are approved for direct mining or supporting infrastructure and activities; ▪ Early planning and financial provision for closure works; and ▪ Financial provisioning for closure implementation. **Mitigation and Management** ▪ Implementation of detailed Mine Closure Plan; ▪ Final closure design to account for rehabilitation potential; ▪ Infrastructure design to withstand extreme events; ▪ Ongoing management of levels in water infrastructure; ▪ Improve site drainage controls; ▪ Rehabilitation trials to determine effective methods; ▪ Planning and allocation of appropriate rehabilitation media (topsoil and organic matter); ▪ Establishment of a fire regime that promotes native vegetation;

Potential Impacts	Measures
	▪ Implement active weed control and prevention during construction, operation and closure; ▪ Monitoring of areas that have been rehabilitated and closed from further mining and associated activities; ▪ Calculation of material requirements and identification of extraction areas; ▪ Prepare and implement Clearing and Topsoil Management Procedure; ▪ Prepare and implement Ground Disturbance Management Procedure; ▪ Recover topsoil from TSF, WRD and processing plant footprints; ▪ Appropriate handling storage of topsoil and rehab material during construction and operation; and ▪ Implementation of Mine Closure, **Rehabilitation** ▪ Progressive rehabilitation of disturbed areas, including areas of disturbance generated from previous disturbance within the mining envelope; ▪ Identify suppliers of local provenance seed and revegetation material; ▪ Implement fencing and access restriction to prevent vehicle and livestock accessing rehabilitation areas; ▪ Erect signage at areas that have been rehabilitation; and ▪ Ongoing monitoring of rehabilitation.
Environmental Management Systems	**Avoid** ▪ Corporate commitment to EMS implementation via policy; ▪ The EMS will align with AS 14001; and ▪ Environmental Management System will include management plans and procedures (EMP, WMP, MMP etc.). **Mitigation and Management** ▪ All events/incidents to be reported and managed through to resolution via event/incident reporting procedures; ▪ All personnel will be inducted into the area and informed of the hazards and relevant management protocols of the areas; and ▪ All personnel will be trained in the appropriate management practices as is relevant to their position.

To minimise the potential for AMD, WRD and TSF landforms will be designed by appropriately qualified engineers in accordance with accepted industry guidelines and standards. Material characterisation, material handling, backfill placement and strategies to flood remaining existing open pits with water will minimise the likelihood of AMD affected pit water quality, thus reduce potential impacts to fauna utilising the pit water. Potential AMD impacts and mitigation measures are further discussed in Section 7.1.

7.2.4 Monitoring and Reporting

The identified terrestrial ecological risks are part of the Project Risk Register (Appendix B). The Risk Register and risk assessment have been initially reviewed by the on-site management team and then will undergo regular review. The overall responsibility for risk management will reside with the chief operating officer (CEO) in the construction phase, the General Manager Operations in the operational phase and be incorporated into day-to-day management of the operation.

PGO will undertake monitoring of the following to assist with the tracking of environmental compliance and evaluation of general terrestrial ecological health of the Project Area:

- Groundwater quality;
- Surface water quality;
- Sediment quality;
- Biota (fish and macroinvertebrate);
- Weed monitoring and mapping;
- Dust lift-off and monitoring (visual);
- Water discharges through WDL and annual reporting; and
- Monitoring the implementation and conformance to the Project EMP.

Specific monitoring points and the approach to monitoring groundwater, surface water, sediment and biota are detailed in the attached WMP (Appendix I).

PGO will be required to produce annual reports as part of its obligations as a corporate entity. The annual report will cover many of the mitigation measures identified for the terrestrial ecology risks.

PGO will be required to report annually to the Department of Environment, Parks and Water Security (DEPWS) on implementation of the Project. The preparation and review of annual reports will also enable reporting of any significant changes in terrestrial ecological circumstances, or the Project implementation that may warrant adaptive management appropriate the stage of Project development.

7.2.5 Residual Impact

The significance of the residual impacts of the Project, taking into account the implementation of avoidance, mitigation and management measures, was assessed in accordance with the risk assessment framework presented in Section 6. The assessment considered potential impacts to or from:

- Vegetation and fauna;
- Introduction and the spread of weeds;
- Changes to fire regimes;
- Fauna injury, mortality and displacement;
- Emissions;
- Uncontrolled discharges;
- Waste management;
- Rehabilitation;
- EMS; and
- Cumulative impacts.

All potential residual impacts were assessed as below moderate, with the exception of impacts related to the clearing of vegetation. The Project acknowledges that despite the efforts to reduce the consequence of potential impacts from vegetation clearing the likelihood of occurrence remains unchanged, as do many of the direct impacts. The Project will require the clearing of native vegetation to gain access to ore reserves and to assist with the construction of supporting infrastructure. However, clearing will be undertaken where required and progressively and rehabilitation also be undertaken on a progressive basis when the area is signed off by the General Manager Operations for closure.

The terrestrial ecological risks identified for the Project are presented in the Project Risk Register (Appendix B). The inherent risks are categorised as ranging from moderate to extreme. The application of mitigation measures reduces the risk profile such that there are no residual extreme risks and six risk factors have been reduced to low (Table 7-20). The majority identified residual terrestrial ecological risks associated with the Project have a low probability of occurrence and in the unlikely event that they do occur, are predicted to have either a negligible or local impact on the environmental values for terrestrial ecology.

The terrestrial ecological impacts and risks associated with the Project are able to be managed through the mitigation measures identified in Section 7.2.3. PGO will develop relevant management plans in consultation with the regulator to ensure the sustainable protection of the biodiversity values for the Project area and surrounding environment are maintained and consistent with the approved MMP (to be developed).

Table 7-20 Terrestrial Ecology Residual Impact Assessment Summary

Risk No.	Source of Impact	Project Phase(s)	Inherent Risk	Summary of Controls	Residual Risk
TE-1	Vegetation clearing for the Project	Construction	Extreme	> Adherence to Ground Disturbance Procedures. > Progressive clearing and rehabilitation. > Implement erosion and sediment controls in accordance with an ESCP. > Only clearing what is absolutely necessary for the portion of the Project to be implemented. > Implementation of Biodiversity Management Plan. > Clearly mark limits of clearing. > Make use of already disturbed areas where possible. > Adhere to buffer widths recommended by the Northern Territory Land Clearing Guidelines with regard to riparian vegetation in drainage lines. > Avoid land clearing during the December to March portion of the wet season. > Have a trained fauna spotter on site during clearing operations.	High
TE-2	Overtopping, embankment failure or seepage from the new TSF at Rustlers Roost leading to uncontrolled release of tailings material to surrounding environment.	Construction, Operation, Decommissioning or Closure	High	> TSF to be planned, designed, constructed and operated in accordance with approaches details in the guideline Tailings Management: Leading Practice Sustainable Development Program for the Mining Industry (DFAT 2016b). > Design TSF to contain a range of design storm and rainfall sequences events up to and greater than the required design criteria. > An operational emergency spillway to be constructed as part of each embankment raise. > Development of Monitoring Plan / Operational Manual which includes weekly inspections of the TSF, survey pins to monitor the embankment and piezometers to measure pore water pressure. > Tailings performance monitoring (e.g. TSF water volume, collection efficiency of underground system). > Install seepage control and underground drainage including a cut-off trench, compact soil liner, basin underdrainage collection system, underdrain collection sump and embankment tow drain. > Groundwater monitoring to check quality and any seepage. > Implementation of AMDMP and WMP. > Manage the site water balance to reduce any build-up of water.	Moderate
TE-3	Overtopping, embankment failure or seepage from the process water storage at Rustlers Roost leading to	Operation, Decommissioning and Closure	High	> Development of Monitoring Plan / Operational Manual which includes weekly inspections of the process water dams. > Groundwater monitoring.	Moderate

Risk No.	Source of Impact	Project Phase(s)	Inherent Risk	Summary of Controls	Residual Risk
	uncontrolled release of process water to surrounding environment.			> Implementation of AMDMP and WMP. > Manage the site water balance to reduce any build-up of water. > Storage and management of cyanide in accordance with the Commonwealth of Australia Leading Practice Handbook for Sustainable Mining - Cyanide Management (Australian Government 2008).	
TE-4	Poor water quality released from site during wet season (stormwater).	Construction, Operation, Decommissioning or Closure	Extreme	> Compliance with the WDL. > Implementation of AMDMP and WMP. >All water storage facilities geotechnically stable and engineered ANCOLD guidelines. > Groundwater / surface water quality monitoring > Weekly inspections of freeboard, structural integrity and pipelines.	Moderate
TE-5	Release of hazardous chemicals or materials during storage and handling onsite.	Construction, Operation, Decommissioning	High	> Design, storage and handling of hazardous materials to Australian Standards and regulations. > Specific adherence of the ANFO storage to *Dangerous Goods Act 1998* and the NT *Work Health and Safety (National Uniform Legislation) Act 2011*. > Regular maintenance of storage facilities. > Bunding of the process plant. > Ensure containment bunding is adequate and SDS available. > Diesel in bunded storage tanks, waste oil in stored bunded tanks . > waste oil stored bunded tanks/containers e.g. IBC . > Weekly inspections of storage areas, tanks, containers. > Develop Emergency Response Plan and include in inductions. > Weekly inspections of storage areas for leaks or damages. > Spill kits available around the site and procedures and training for the cleaning up of hazardous spills. > Implementation of hazardous materials management plan training for emergency response. > Cyanide management and storage will be aligned to the Commonwealth of Australia Leading Practice Handbook for Sustainable Mining - Cyanide Management (DISS 2008). > Chemical storage will be located a minimum 30m from any drainage line or watercourse.	Moderate
TE-6	Release of hazardous chemicals or materials during transportation to site.	Construction, Operation, Decommissioning	High	> Standard pre-requirements for contractors (must meet standard requirements and licencing). > Appropriate site access for large vehicles. > Ensure transportation contractors undertake standard pre-departure	Moderate

Risk No.	Source of Impact	Project Phase(s)	Inherent Risk	Summary of Controls	Residual Risk
				checks. > All external operators to complete induction that includes transportation safety considerations.	
TE-7	Production of domestic waste and storage of the waste onsite	Construction, Operation, Decommissioning.	Moderate	> Secure dustbin lids. > Establish dedicated hardstand at accommodation camp for waste receptacles. > Weekly inspections of, waste area, landfill and general tidiness of site. > Burial of waste in dedicated landfill. > Design and construct landfill in accordance with relevant standards. > Implement leachate prevention and capture into landfill design. > Segregation of wastes and recycling of wastes where possible. > Groundwater monitoring.	Low
TE-8	Unfinished/unsuccessful rehabilitation of Project due to inadequate funds or natural disaster (e.g. cyclone).	Construction, Operation, Decommissioning and Closure	High	> Progressive rehabilitation of disused disturbed areas. > Implementation of detailed mine closure plan. > Early planning and financial provision for closure works. > Infrastructure design to withstand extreme events. > Ongoing management of levels in water infrastructure. > Improve site drainage controls.	Low
TE-9	Inability to establish native vegetation by local provenance species with resultant cover comparable to nearby areas	Construction, Operation, Decommissioning and Closure	High	> Financial provisioning for closure implementation. > Rehabilitation trials to determine effective methods Rehabilitation monitoring. > Final closure design to account for rehabilitation potential. > Planning and allocation of appropriate rehabilitation media (topsoil and organic matter). > Establishment of a fire regime that promotes native vegetation. > Implement active weed control	Moderate
TE-10	Lack of rehabilitation materials leads to inadequate tailings closure and poor quality site rehabilitation.	Decommissioning and Closure	High	> Financial provisioning for closure implementation. > Calculation of material requirements and identification of extraction areas. > Recover topsoil from TSF, WRD and processing plant footprints. > Progressively rehabilitating the mine. > Clearing and Topsoil Procedures Implementation of Mine Closure.	Moderate
TE-11	Inappropriate management of the decommissioned site, post closure landform.	Closure	Moderate	> Implement fencing and access restriction to prevent vehicle and livestock accessing rehabilitation areas. > Ongoing monitoring of rehabilitation. > Progressive rehabilitation during mining to enable more established areas	Low

Risk No.	Source of Impact	Project Phase(s)	Inherent Risk	Summary of Controls	Residual Risk
				upon closure. > Weed prevention and management during operation and closure.	
TE-12	Ineffective operational implementation of site environmental management system, plans and procedures.	Construction, Operation, Decommissioning Closure	High	> Corporate commitment to EMS implementation via policy > Environmental Management System and various management plans (EMP, WMP, MMP etc.). > All events/incidents to be reported and managed through to resolution via event/incident reporting procedures. > All personnel will be inducted into the area and informed of the hazards and relevant management protocols of the areas. > All personnel will be trained in the appropriate management practices as is relevant to their position.	Moderate
TE-13	Use of Project machinery, equipment, vehicles and activities causing fire through sparks or heat ignition source.	Construction, Operation, Decommissioning Closure	High	> Liaise with Bushfires NT regarding regional (and site) fire break. > Establish hot work procedures. > Regular inspections of generators and other sources of heat/power. > Fire extinguishers available around site and on all vehicles and machinery. > Training and inductions include Emergency Response Plan. > Establish and implement appropriate control fire regime for area in the MLs.	Moderate
TE-14	Dust generation from Project activities such as vehicular movements and earthworks.	Construction, Operation, Decommissioning Closure	Moderate	> Implementation of Dust Management Plan. > Progressive clearing and progressive rehabilitation. > Avoid clearing on windy days. > Visual monitoring and individual assessment of dust emissions prior to undertaking tasks or attending work areas.	Low
TE-15	Noise and vibration emissions from construction and operational activities (e.g. vehicle movements and blasting).	Construction, Operation, Decommissioning Closure	High	> Monitoring of area surrounding high vibration activities for ground instability. > ESCP controls implemented where ground cracking identified. > Enforcing speed limits to ensure that all operations are operating at the lowest possible noise level to minimise the impacts of noise and vibration upon wildlife. >Mitigate noise by properly maintaining all equipment in accordance with manufacturers specifications. > Noise management and controls to be addressed in Project EMP. > Where possible, choose the "Buy Quiet" option for the purchase of equipment. > Develop and implement Noise and Vibration Mgt Plan.	Moderate

Risk No.	Source of Impact	Project Phase(s)	Inherent Risk	Summary of Controls	Residual Risk
TE-16	Construction and operational activities (incl. vegetation clearing) result in introduction of new weeds and spread of existing weeds into new areas.	Construction, Operation, Decommissioning or Closure	High	> Annual weed mapping (by June each year) to understand nature of the spread of weeds and plan weed control activities accordingly. > Conduct seasonal weed control activities in consultation with local landholder as necessary and in accordance with the Project Weed and Pest Management Plan (grazing control as option). > Implementation of the Biodiversity MP and Project EMP. > Weed hygiene procedures - including inspection and wash down of all vehicles and machinery entering site. > Establish and implement appropriate control fire regime for area in the MLs. > Develop and Implement Weed and Pest Management Plan. > Construction Material required for site will be inspected prior to entry to site (e.g. any fill material). > No unauthorised plant or vegetative material to be brought to site.	Moderate
TE-17	Increased density of weed infestations.	Construction, Operation, Decommissioning or Closure	High	> Annual weed mapping (by June each year) to understand nature of the spread of weeds and plan weed control activities accordingly. > Conduct seasonal weed control activities in consultation with local landholder as necessary and in accordance with the Weed and Pest Management Plan (grazing control as option). > Implementation of the Biodiversity MP Project EMP. > Weed hygiene procedures - including inspection and wash down of all vehicles and machinery entering site. > Establish and implement appropriate control fire regime for area in the MLs. > Develop and Implement Weed and Pest Management Plan.	Moderate
TE-18	Artificial light emissions from construction and/or operation of the mine site.	Construction, Operation, Decommissioning or Closure	High	> Implementation of Project EMP (incorporating light management measures). > Implementation of Biodiversity MP (incorporating artificial lighting mitigation measures). > Vehicles, plant and machinery to be switched off when not in use. > Use of low voltage/wattage light bulbs where possible.	Low
TE-19	Vehicle/machinery interaction with terrestrial fauna	Construction, Operation, Decommissioning	Moderate	> Vehicles not to park on vegetation areas (to prevent hot engines causing wildfire). > Vehicles to remain on designated tracks. > Speed limit to be implemented across the Project area. > Inductions include information regarding fauna species. > Vehicles to drive to conditions (e.g. dawn and dusk).	Low

7.2.6 Predicted Outcome and Conclusions

Implementation of the Project will directly impact terrestrial ecosystems primarily through the direct, but progressive clearing of native vegetation and habitat loss. After the application of mitigation measures, the Project will result in the direct loss of 368.86 ha of native vegetation and subsequently, associated fauna habitat. This constitutes potential habitat for conservation significant species, although only a single listed species, the Merten's Water Monitor has been recorded in the Project area, despite numerous extensive survey efforts. Considering the widespread vegetation types across the region, it is unlikely to have a significant impact on terrestrial fauna that utilise the Eucalyptus woodland and Eucalyptus open forest habitat. The extent to which fauna will be impacted is expected to be at a local scale and is not considered to result in a significant impact to the available habitat or population of any species listed in Section 7.2.1.3. Additionally, PGO will undertake progressive rehabilitation where practicable to restore fauna habitat and vegetation community structure.

Other potential risks to the terrestrial ecosystem values associated with the Project have been identified, along with the consideration of mitigation measures and assessment of residual impacts. The Project presents opportunities to gain a better understanding of the terrestrial ecological values that are in the area; and may be able to contribute to the management of introduced and feral species, including weed management, and the control of wild dogs, pigs and cats. Risks to the terrestrial biodiversity and ecological values through clearing of native vegetation, adverse impacts to fauna and reduced air quality will remain. These impacts will be unavoidable during the construction and operation of the Project. It is the intention of PGO to carry out activities that relate to these impacts in an approved and controlled manner, through the issuance of the environmental approval under the EP Act and associated conditions.

The potential risks from uncontrolled discharges, weeds, waste, fires and poor closure will remain throughout the Project. However the likelihood and/or consequence of these risks are considered to be sufficiently low through the application of the controls applied in accordance with the environmental decision framework.

The environmental objective identified in the ToR (NT EPA 2021b) for terrestrial ecology is to protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning. The identified habitat for the Project is well represented in the area, and the implementation of the Project is not determined to cause significant decline to the habitat and environmental values at the local scale.

Considering the assessment of residual impacts, and the application of mitigation and monitoring committed by PGO, it is concluded that impacts on Terrestrial Ecosystems are manageable, such that the ToR objective for this factor is able to be met.

7.2.7 Assumptions

The key assumptions made in assessing potential impacts on Terrestrial Ecosystems are:

- The cumulative impact considerations have assumed Toms Gully Mine progresses into construction and operation simultaneously with the Project;
- The analysis assumes that the Project will largely align with the anticipated construction and operational schedule;
- The WRD and TSF landform designs and open pit lake closure designs will provide for effective long-term prevention and/or containment of AMD;
- Riparian ecosystems are unlikely to be impacted by the proposal if AMD is effectively prevented and/or contained;

- Rehabilitation of the mine site will occur to make the site safe and stable; however, it has been assumed that habitat values will not fully return to the area due to the long-term presence of the mining landforms; and
- The management and monitoring actions will be undertaken in alignment with the Toms Gully Mine Project ensuring a coordinated and holistic approach the management of terrestrial ecological values.