Mining Management Exploration Activities

Northern Territory of Australia – *Mining Management Act 2001*

It is recommended that the Mining Management Plan (MMP) is completed in conjunction with the user guide available on the <u>Northern Territory Government website</u>.

Section 1 – Project Details

Project Name Provide new or existing project name	Ngalia Basin Uranium Project

Authorisation Number Insert existing authorisation number, where applicable	1160-01
---	---------

Operator Name Use ASIC-ABR registered name (if a company), or name of the applicant	Eclipse Metals Ltd.
Operator ABN and ACN numbers	ABN 85 142 366 541

Location and Access Details Include brief description of the location, access details, and distance to nearest town or community

Target Commodity Details Include target mineral commodities	Uranium, vanadium, strontium

Mining Activities Summarise the mining activities (exploration) to be the subject of the proposed Authorisation or Variation. Drilling programs over a maximum of four years are supported and encouraged and can be staged. Please refer to the guidelines for further information.	The target deposit styles are palaeochannel-hosted and Bigryli-type U-V. Gravity and historic airborne EM data have been used to define palaeochannels and a combination of shallow (< 100 m) aircore drilling and passive seismic surveying is planned to confirm the presence of palaeochannels, to detail the subsurface structure and to identify any U mineralisation that might be present. Drilling is proposed in September 2023 on two or more traverse lines that are perpendicular to the long axis of the inferred palaeochannel. Passive seismic surveys will take place along these and additional east-west lines.
--	---

Proposed Schedule Include start and finish dates of ground disturbing work	1 – 31 st September 2023
· ·	

Mining Interest and Land Ownership

List the mining interests (titles), the title holder name/s, the title expiry date and the Property name/Land holder (e.g., pastoralist or Aboriginal land trust) for each title.

Title Number	Title Holder	Expiry Date	Underlying Property Name or Land Holder
EL24808	Eclipse Metals Ltd.	9/08/2023	Mt Doreen Station Portion 1947/Crown Point Pastoral
			Department of Infrastructure, Planning & Logistics (road reserve excluded from portion 1947)
EL32080	Eclipse Metals Ltd.	22/08/2025	Mt Doreen Station Portion 1947/Crown Point Pastoral
			Central Desert Regional Council (road reserve excluded from portion 1947)

Please note a Land Access Agreement (LAA) is required for disturbance proposed on Pastoral Properties on Exploration Licence (EL).

Organisational Structure

Position Title	Name
Managing Director	Carl Popal
Exploration Manager	Andy Wilde
Radiation Safety Officer	Radiation Services WA

Section 2 – Operator Self-Assessment of Environmental Risk

The purpose of this self-assessment is to ensure Operators complete a project risk assessment of potential environmental impacts and are aware of other legislative obligations from various Agencies. As a result of this self-assessment, further information may be required in the form of a management plan to enable full assessment of the MMP. If you have any queries please contact a Mining Officer prior to submitting the MMP. Useful resources to assist with this self-assessment are provided in the User Guide.

Environmental considerations

ASSESSMENT ASPECT	YES or NO	ACTIONS REQUIRED (if answered YES)	APPENDED INFORMATION (e.g. evidence of consultation with DEPWS and/or management plan where required).
Step 1: Are there any threatened flora and fauna species or habitats of significance that may occur in the proposed work area?	Yes	No threatened species were assessed to have a HIGH likelihood of occurring in the project area/site, therefore a 'significant impact assessment' was not undertaken for threatened species (see Low Ecological report). Significant species (including threatened species) assessed to have a medium or high likelihood of occurring in the project area are: Australian Bustard, Brush-tailed Mulgara, Princess Parrot, Grey Falcon, and Great Desert Skink . Low Ecological assess that the project is highly unlikely to affect the Australian Bustard, Brush- tailed Mulgara and the Grey Falcon at the local population level or to change the state or national status of the species. If an active skink warren is spotted, project activities will be re-routed around it. Breeding habitats of the Princess parrot such as large hollow bearing trees and River Red Gum lined watercourses are absent from the project area and therefore risk mitigation is not required.	Assessment by Low Ecological Services PL. Copy of report attached.
Step 2: Are there any known declared weeds within the proposed work area?	Νο	Although no invasive flora was observed during the on-site survey, weed identification and hygiene management practices, including vehicle wash or blow down will be implemented during the proposed drilling operations. Contractors will be inducted in weed identification.	See above
Step 3: Will you be using water from bores or other sources for the operation?	No	Drilling operations (aircore) will require minimal water usage. Any water required for drilling will be sourced from Bigryli camp as well as drinking water.	

ASSESSMENT ASPECT	YES or NO	MANAGEMENT REQUIREMENTS
Step 4: Is your project likely to have a significant impact on the environment?	No	Please refer to assessment by Low Ecological Services PL. The drilling program will employ a small aircore rig mounted on a Toyota Landcruiser that requires no prior access or pad preparation.
Step 5: Are there Aboriginal sacred sites in the Project area?	Yes	AAPA records show two recorded sites and one restricted works area within Eclipse' tenements. Neither occurs within the area of proposed drilling. Please refer to the attached AAPA Request for Information reports.
Step 6: Are there archaeological and heritage sites in the Project area?	No	A search conducted by the NT Government Heritage Branch revealed "no nominated, provisionally declared or declared heritage places or objects within the subject area".

Environmental assessment and cultural considerations

Section 3 – Amendments

As per Section 41(3) of the *Mining Management Act*, an MMP reviewed and amended under Section 41(1)(a) is to have amendments made since the previous MMP submission clearly identified.

Section	Amendment

Delete or add rows as required

Section 4 – Activities Proposed for this MMP only

Provide relevant EL numbers

Mining Interests (i.e. titles)	EL24808	EL32080	EL	EL
Number and type of proposed exploration drill holes	Approx. 5 aircore holes	Approx. 5 aircore holes		
Maximum depth of proposed holes (m)	50 – 100 m	50 – 100 m		
Number and size of drill pads to be cleared (Length: m x Width: m)	Not Required	Not Required		
Total area of drill pads to be cleared (ha)	Not Required	Not Required		
Number of proposed water bores	0	0		
Is drilling likely to encounter groundwater in multiple or confined aquifers? (Y, N, unsure) If answering yes, please provide the number of exploration holes where this is likely to occur	Unsure	Unsure		
Number of costeans	0	0		
Volume to backfill costeans (Length: m x Width: m x Depth: m)	0	0		
Number of bulk sample pits	0	0		
Volume to backfill bulk sample pits (Length: m x Width: m x Depth: m)	0	0		
Bulk sample pits approved under <i>Mineral Titles Act</i> ? (Y or N). If Yes provide approval	0	0		
Line/track clearing: (length m x width m)	Not Required	Not Required		

Mining Interests (i.e. titles)	EL24808	EL32080	EL	EL
Area of proposed line/track clearing (ha)	Not Required	Not Required		
Camp area to be cleared (ha)	0	0 0		
Camp Infrastructure (i.e. demountable, tents) Please provide a complete list with measurements as required in the security calculation	The existing Bigryli camp will be utilised for the duration of the proposed work program.			
Other	0	0		
Total proposed area of disturbance (ha)	0	0		

Staging approach based on disturbance can be proposed and will be considered by the Department.

Section 5 – Previous Disturbance (for existing Authorisations only)

The 'Disturbance Tracking' spreadsheet must be completed and attached to the MMP submission to complete this section. The spreadsheet is available on the departmental web page where this template is located.

Section 6 – Environmental Management

By checking these shaded boxes, you are agreeing to implement the following minimum environmental management standards on the project area. Where boxes have been left unchecked, justification is required.

6.1	X	Blade-up approach for clearing will be used (i.e. no windrows, leave root stock and topsoil)	
6.2	X	Significant vegetation will be avoided during clearing (i.e. large trees, specimens providing habitat or food sources, riparian vegetation, and threatened species)	
6.3	X	Vegetation clearing during, and immediately after rainfall events, will be avoided	
6.4	X	Vegetation clearing will be kept to the minimum required to safely traverse vehicles and drill rigs along tracks and drill pads	
6.5	X	Where blade-up techniques cannot be employed, topsoil and vegetation will be stockpiled appropriately for rehabilitation purposes	
6.6	X	All employees and contractors will be trained and inducted in relation to the management of environmental risks in the work area, including weeds, waterways, threatened species, soil erosion, sacred sites and heritage areas	
6.7	X	Sumps will be lined or tanks of appropriate size to contain water, sediment and drilling fluids encountered during drilling, will be used	
6.8	X	Sumps, drill holes, and fuel stores will be located away from environmentally significant areas and water courses	
6.9	X	Excavations (sumps, costeans and pits) will be appropriately ramped to allow fauna egress	
6.10	X	Drill holes will be securely capped immediately after drilling	
6.11	X	Vehicle hygiene measures will be employed to prevent the introduction and spread of invasive species and pathogens when mobilising vehicles and equipment from one location to another	
6.12	X	Hydrocarbon spills will be minimised using liners and drip trays under machinery, and appropriately sized spill-kits available in the event of a spill	
6.13	X	Hazardous substances (including hydrocarbons) will be stored and handled in accordance with relevant Australian Standards	
6.14	X	Hydrocarbons will be stored in lined and bunded areas	
6.15	X	Waste will be stored securely while on-site to minimise windblown rubbish and access by feral animals	
6.16	X	Waste will be removed off-site and disposed of at an appropriate waste management facility	
6.17	X	All environmental incidents will be reported to the Department in accordance with Section 29 of the <i>Mining Management Act</i> .	
6.18	X	Acid and Metalliferous Drainage (AMD) and Potentially Acid Forming (PAF) material derived from drilling cuts will be managed to avoid AMD and PAF related issues on site.	

6.19	X	Radioactive/NORM drill cuttings will be managed to avoid radiation related issues on site.
6.20	X	Dust management will be implemented on site.

Justification and alternative management measures:

Refer radiation management plan attached. Refer dust management proposed by McLeod drilling

Section 7 – Rehabilitation and Closure

By checking these shaded boxes, you are agreeing to implement the following minimum rehabilitation standards on the project area. Where boxes have been left unchecked, justification is required.

A refund of security related to completed rehabilitation on site requires the submission of a rehabilitation report including photographs, an updated security calculation and updated disturbance tracking spreadsheet to the Department.

7.1	X	Drill holes will be plugged below ground level at a minimum depth of 0.4 metres and soil mounded to prevent subsidence, within 6 months of completion of drilling.		
7.2	Χ	Drill holes encountering multiple or confined aquifers will be grouted with concrete.		
7.3	X	Drill samples/spoil will be returned down drill holes, buried in sumps, or removed from site.		
7.4	X	All drill hole and access markers including flagging tape, wooden markers and star pickets will be removed from site.		
7.5	X	Cut and fill drill pads will be re-contoured to be consistent with the surrounding terrain.		
7.6	X	Drill pads and compacted areas along the contour (on sloping ground) will be ripped/scarified of and tracks will be cross-ripped (zig-zag).		
7.7	X	Tracks will be rehabilitated, including pushing in all windrows, unless otherwise agreed in writing by the land holder or appropriate third party.		
7.8	X	Appropriate erosion and sediment controls will be installed where erosion is evident or likely to occur.		
7.10	X	Access through watercourses will be removed and banks restored.		
7.11	X	All previously disturbed areas will be stable, with no evidence of active soil erosion.		
7.12	X	All excavations will be backfilled within 6 months of their completion.		
7.13	X	All water bores will be decommissioned unless otherwise agreed in writing by the land holder or appropriate third party.		
7.14	X	All rubbish and infrastructure will be removed from site.		
7.15	Χ	Topsoil will be replaced and vegetation re-established.		
7.16	X	Contaminated soils (e.g. hydrocarbon or hazardous chemicals) will be rehabilitated or removed from site.		
7.17	Χ	Monitoring will be undertaken following the wet season or a significant rainfall event.		

Justification and alternative management measures:

Section 8 – Required Attachments

8.1	X	Initial Application for Authorisation or variation of Authorisation (only if details on the form have subsequently changed).		
8.2	-	Nomination of Operator Form, where required		
8.3		Security Calculation Spreadsheet		
8.4		Evidence of Land Access Agreement if operating on an Exploration Licence (EL) on Pastoral Lease (e.g. two-ways exchange of email)		
8.5	-	Disturbance tracking spreadsheet (for existing Authorisations)		
8.6		Spreadsheet with coordinates of proposed drill holes or polygons of target areas		
8.7		KML/shape files/track logs of proposed tracks, camp sites and proposed drill holes or polygons of target areas		
8.8		Map(s) of the work area(s) showing:		
		1. title boundaries and title numbers		
		2. current and proposed drill holes, or polygons of target areas		
		3. current and proposed tracks		
		4. rehabilitated areas		
		5. camp sites		
		6. heritage sites or significant environmental areas		
		7. environmental constraints		
8.10		Radiation Management Plan (if applicable)		
8.12		Document(s) being appended in relation to Section 2 (if any):		
		Low Ecological Services P/L, 2022, Ngalia Basin Drilling Program Environmental Assessment Report EL 24808 Northern Territory, 78 pp.		
		AAPA Request for Information Reports		
		McLeod Drilling Dust Management Document		

Eclipse Metals Limited



Ngalia Basin Drilling Program Environmental Assessment Report

EL 24808

Northern Territory

October 2022

Prepared By

Low Ecological Services P/L PO Box 3130, Alice Springs, NT 0871 Ph: (08) 89 555 222 Fax: (08) 89 555 722 Email: <u>lowecol@lowecol.com.au</u>







DISCLAIMER

This document has been prepared by Low Ecological Services (LES) for Eclipse Metals Ltd. LES has prepared this document using the skill and care expected from professional scientists to provide factual and technical information and reasonable solutions to identified risks. It does not constitute legal advice.

DOCUMENT CONTROL

DOCUMENT DETAILS

Name of Document:	Ngalia Basin Drilling Program Exploration Mining Management Plan
Authors:	Kristen Grant, Elli Fagan, Bill Low,
Client:	Eclipse Metals Limited
Name of Project:	Ngalia Basin (EL24808) Exploration Drilling Program

DOCUMENT CONTROL

Approvals	Name	Signature	Date
Originator:	Low Ecological Services P/L	hitch	March, 2022
	Eclipse Metals		
Reviewer:	Low Ecological Services P/L	with	December, 2022
	Eclipse Metals		
Approver:	Eclipse Metals		November, 2022

REVISION DETAILS

Date	Revision	Details	Name	Company
19/03/2021	V0 (Draft)	Initial draft document	Kristen Grant	Low Ecological Services
06/02/2022	Draft	Revised Draft	Elli Fagan	Low Ecological Services
06/03/2022	Draft	Revised Draft	Bill Low	Low Ecological Services
07/10/2022 26/11/2022 12/12/2022	Draft Final	Final Report Minor revisions Minor revisions	Bill Low/Elli Fagan	Low Ecological Services

PREFACE

All information on proposed operations contained in this document has been supplied by Eclipse Metals.

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1 PROJECT DETAILS

Project Name	Ngalia Basin Exploration Drilling Program
Authorisation Number	NA – New Authorisation
Operator Name	Eclipse Metals Limited

1.1 Project Location and Description

Eclipse metals intends to undertake an exploration drilling program targeting Uranium and Vanadium in exploration lease EL24808 (Cusacks's Bore) in 2021. EL24808 is located in the northwestern part of the Ngalia Basin wholly within the Mount Doreen Pastoral Lease (NT Portion 1947) in the Northern Territory. Native Title determined over Mt Doreen Station in 2013 [http://www.nntt.gov.au/searchRegApps/NativeTitleRegisters/Pages/NNTR details.aspx?NNTT Fil eno=DCD2013/002] EL24808 is accessible from Alice Springs via the Stuart Highway, turning left 20km north of Alice, travelling for 295km northwest on the Tanami Road past Yuendumu, then turning left on the Vaughan Springs Property Access Rd towards Cusacks Bore for 40km. EL24808 is approximately 66 km from Yuendemu and 355km from Alice Springs via road.

Past exploration effort has identified a significant paleochannel system within EL24808 which is the target of Eclipse's proposed 2021 drilling program. Five (5) drill holes are proposed using a rotary core (RC) drill rig. Target depth for dill holes is likely to be 100-200m. The project will require clearing of approximately 3.47 km of new access tracks and clearing and levelling of five (5) 20m x 20m drill pads. Groundwater extraction is not required for the proposed drilling project. Upon completion of the drilling program, tracks and drill sites will be rehabilitated. Figure 1 shows the project layout.

Eclipse proposes to undertake the drilling program in 2023, with post closure and rehabilitation works proposed to be completed before the wet season in 2023.

Eclipse Metals Ltd EL24808

Ngalia Basin Drilling Program Exploration Mining Management Plan



Figure 1: Project location/layout map



Figure 2: Project location layout relative to current Native Title Register, Mt Doreen Pastoral Lease

2 ENVIRONMENTAL CONTEXT AND CONSIDERATIONS

This section provides information on the environmental context of the exploration project and includes a project risk assessment of potential environmental impacts. It covers environmental and cultural considerations.

A desktop landscape, flora and fauna survey of the project area was undertaken; broadly characterising the ecology and landscape to determine if the project is likely to have significant impacts on threatened species and the surrounding environment. This included a desktop review of existing information to develop an inventory of threatened flora and fauna, habitat and weeds recorded in or likely to be present in the study area. This section presents the results of the desktop assessment and an initial assessment of the likelihood of threatened species to be in the project area and possible risks to threatened species from the proposed drilling project.

A 20km buffer was used for the flora and fauna desktop search as shown in 3 below.

A review of Aboriginal sacred sites and Archaeological and heritage sites and water resource usage for the project are included.



Figure 3: Locality map showing study area (EL24808) and 20km search radius

2.1 Climate

The climate of the Burt Plains Bioregion is arid, with annual rainfall between 300 and 400 mm and high temperature extremes. The closest weather station to the study area with complete climate statistics is at Yuendumu, 60 km to the east of EL24808. Climate statistics for the period 1952-2019 from Yuendumu (<u>Climate statistics for Australian locations (bom.gov.au</u>)) are shown in 4. On average, Yuendumu experiences its highest rainfall (mean 71.6 mm) in January and lowest rainfall (mean 7.4 mm) in August, with an annual average rainfall of 377.8 mm. Mean minimum temperature at Yuendemu ranges from 6.4°C in July to 22.5°C in January, while mean maximum temperatures range from 22.2°C in June and July to 36.5°C in January (Bureau of Meteorology, 2021).



Figure 4: Mean monthly rainfall and mean monthly minimum and maximum temperature at Yuendemu (Bureau of Meteorology, 2021).

2.2 Bioregions

The Interim Biogeographic Regionalisation of Australia (IBRA) is a classification system of geographically distinct bioregions based on common climate, geology, landform, native vegetation, and species information (Department of Sustainability, Environment, Water, Population and Communities, 2012).

The project area occurs within the Yuendumu subregion of the Burt Plain Bioregion (Figure 5). The Burt plain bioregion transitions to the Great Sandy Desert Bioregion (Mackay subregion) approximately 2 km to the south of the project area and the Tanami Bioregion occurs approximately 38 km to the north (Figure 5). The Burt Plain bioregion is a complex of uplands and extensive plains with several separate internal drainage units. The basic topographic land units are rocky hills, foothills, sand plains, alluvial plains and watercourses. This area is very remote, with a small population and no large settlements. Approximately 80% of this 73,605 km² Bioregion is pastoral leasehold and extensively grazed, while 15% is Aboriginal freehold land. The Burt Plain bioregion is considered an underrepresented bioregion in the national reserve system and is within the group of bioregions with less than 10% protection by area. (Department of Agriculture Water and the Environment, 2021).

The characteristics of the nearby Great Sandy Desert and Tanami Bioregions are summarised in Table 1 below.

Bioregion		Landform	Soils	Vegetation
Great	Sandy	Flat landscapes with few	Shallow sands with saline	Triodia hummock grassland with areas of
Desert		watercourses in which large,	loams near salt lakes.	low open woodland and Mulga tall open
		saline lakes occur. Some low		shrubland. Samphire low open shrubland
		ranges.		fringes salt lakes.
Tanami		Quaternary sandplains overlying	Mainly red sands and red	Mixed open shrubland of Acacia,
		Permian and Proterozoic strata	sandy loams with alluvial	Corymbia and Hakea over Triodia
		that are occasionally exposed as	and calcareous deposits	hummock grassland.
		hills and ranges.	throughout.	

Table 1: Description of the Great Sandy Desert and Tanami Bioregions (Baker, et al., 2005).



Figure 5: Bioregions of the area (Baker, et al., 2005)

2.3 Land Systems and Land Units

There is no fine scale land unit mapping for the study area. Broad land systems have been mapped by Perry et al. (1962) at a scale of 1:1,000,000 (Figure 5). The study area is south of rugged sandstone ranges (Hann land system) and consists mainly of stable red earth alluvial plains (Bushy Park land system), and flat or gently undulating sand plain (Singleton land system), with a small area of active alluvial fans with sandy plains in the north (Wooduck land system) according to Perry et al. (1962). Four (4) of the proposed exploration drill holes and associated proposed access tracks are within Bushy Park land system. Drill Hole 5 is currently located in the area of transition from the Bushy Park land system to the Singleton land system and the proposed access tracks to these drill sites traverse the bushy park land system from the Vaughan Springs Property Access Road to the north.

Major features of these Land Systems are outlined in Table 2.

Table 2	– Land systems (of and adjacent to	the study area (P	'erry, iviandbutt, Li	tchfield, & Quinian, 19	62).

awaa (Dawwy Maababaytt Litabfiald 8 Quint

Land System	Geology	Topography	Soils
Bushy Park	Pre-Cambrian metamorphic and igneous rocks of Proterozoic to Quaternary age	Depositional surfaces: stable alluvial plains; gradients 1 in 500 to 1 in 1000.	Quaternary soils; Red Earths

Eclipse Metals Ltd EL24808

Ngalia Basin Drilling Program Exploration Mining Management Plan

Singleton	Quarternary aeolian sand. Overlying Pre-Cambrian metamorphic and igneous rocks and sedimentary rocks of Proterozoic to Quarternary age.	Depositional surfaces: flat or gently undulating sand plain; surface drainage absent or disorganized.	On sand plain and swales red clayey sands and red sands, in north west coarse textured red earths. On sand rises red sands. On alluvial flats red earths.
Woodduck	Quaternary wash derived mainly from sandstone.	Active alluvial slopes flanking larger drainage channels: scalded surfaces up to 1 mile wide. Some sandplains, inter-drainage sectors, and channels.	Course textured soils including red clayey sands and alluvial soils.
Hann	Sandstone, quartzite, siltstone and conglomerate.	Erosional weathered land surfaces; mountain ridges and uplands and tributary slopes; drainage with prominent transverse elements and closely spaced, branching head channels.	Very little soil on outcrops. Red clayey sands and coarse alluvial soils on alluvial plains and floodplains.



Figure 6: Land systems of and adjacent to the project area (Perry et al. 1962)

2.4 Surface Topography and Hydrology

The study area is situated on the divide of the Mackay Basin and Burt Basin as defined by the Australian Water Resources Commission (Duguid, et al., 2005). The larger northern portion of EL24808 falls within the Mackay Basin and the smaller southern portion of EL24808 falls within the Burt Basin. The project area is within the Mackay Basin as shown in Figure below.

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Ngalia Basin Drilling Program Exploration Mining Management Plan

The Mackay Basin is characterised by its large area (approximately the western third of the NT and neighbouring WA), very low relief and drainage systems characterised by saline channels and saline lakes. There are few major rivers, with minor creeks associated locally with relief such as the Truer and Petermann Ranges. The Burt Basin to the south of the project area is 38,800 km^2.

The study area is situated in the plains in the upper catchment of the Gum Creek; a tributary of Patamingala Creek (Figure 6). Runoff from the sandstone ranges to the northwest of the study area collect in Gum creek which runs to the north along the northeast boundary of EL24808 outside of the EL. Two streams collect runoff from the alluvial plains in the north of the EL and flow north out of the EL before collecting in an ephemeral claypan (mapped as a water body in NR Maps) and Gum Creek. There are no watercourses in the southern two thirds of the EL. The proposed drill sites and access tracks are within this area of the EL with no mapped watercourses. The creek systems in the area are all ephemeral in nature and flow only in response to infrequent, large rainfall events, terminating in floodout systems within the Burt Plain and Tanami bioregion.



Figure 7. Elevation and hydrology of the project area and surroundings

2.5 Geology

Geology of the study area has been mapped by the Geological Map of the Northern Territory (Ahmad, 2000). This mapping was carried out at a scale of 1:2,500,000 and shows the study area falls within one geological

unit 'C' (Figure 7), as described in **Error! Reference source not found.** Geological units -P101, A6, -P103, and 9 occur in neighbouring areas, but are not present within the study area.

Table 3. Geological uni	its present within and sur	ounding the project area, a	as described by Ahmad (2000).
-------------------------	----------------------------	-----------------------------	-------------------------------

Map Code	Rock Type	Formation	Description
С	Sedimentary	-	Sandstone, conglomerate, siltstone, shale
-P101	Sedimentary	Vaughn Springs Quartzite, Albinia Formation	Quartzite, sandstone, conglomerate, shale, dolostone
A6	Metamorphic	Reynolds Range group, Harts Range group	Gneiss, calc-silicate, amphibolite, quartzite
-P103	Sedimentary	Mount Doreen Formation	Sandstone, dolostone, limestone, diamictite
g9	Plutonic	-	Granite/gneiss



Figure 8. Geological mapping of the NT within and surrounding the project area. (Ahmad, 2000).

2.6 Soils

Soil types within the NT have been mapped using the Atlas of Australian Soils (mapped by Bureau of Rural Sciences after Commonwealth Scientific and Industrial Research Organisation, 1991; described by Northcote (1968)). However, the currently accepted classification system is the Australian Soil Classification (ASC) (Isbell

& National Committee on Soil and Terrain, 2016). A conversion from the Atlas of Australian Soils to the Australian Soil Classification was developed by Ashton and McKenzie (2001).

Soil unit My106 covers much of EL24808, while the south-western edge of EL24808 is mapped as soil unit AB31, and the north-western edge of EL24808 is mapped as soil unit BA25 (Figure 9). The majority of the project area is mapped as My106 soil type. Drill hole 5 is in the area of transition from My106 to AB31 soil type, with Drill hole 5 mapped as AB31 soil type. Proposed tracks run through areas of soil type My106. Soil types are described in Table 4Table 4 below. Figure 9 also shows slopes greater than 2% as mapped in NR Maps (NT Gov 2021). As shown in Figure 8, the proposed works are located in areas mapped with less than 2% slope.

Table 4. Description of soil types within and surrounding the project area from the Australian Soils Atlas (Northcote, 1968) and the Australian Soil Classification (Isbell & National Committee on Soil and Terrain, 2016), as converted by Ashton and McKenzie (2001).

Мар	Australian Soil Atlas	Australian Soil Classification		
Code				
Му106	Outwash plains and fans: chief soils are red earths (Gn2.12) and red earthy sands (Uc5.21), but some yellow earths (Gn2.2) and (Gn2.6) together with yellow earthy sands (Uc5.22) may occur in the less well- drained sites.	 Kandosol: Soils which lack strong texture contrast, have massive or only weakly structured B horizons, and are not calcareous throughout. Soils other than Hydrosols which have all of the following: B2 horizons in which the major part is massive or has only a weak grade of structure. A maximum clay content in some part of the B2 horizon which exceeds 15% (ie. heavy sandy loam, SL+). Do not have a tenic B horizon. Do not have clear or abrupt textural B horizons. Are not calcareous throughout the solum, or below the A1 or Ap horizon or to a depth of 0.2m if the A1 horizon is only weakly developed. 		
AB31	Flat to gently undulating sand plains with some low broad sand rises and intervening swales; some small alluvial flats; some clay pans; and some stone-covered ridges: chief soils are red earthy sands (Uc5.21) on the plains and swales. Associated are red siliceous sands (Uc1.23) on the sand rises. Small areas of sandy red earths such as (Gn2.12) occur on the plains, in the swales, and on the alluvial flats. Other soils include shallow (< 12 in.) stony (Uc1.23) on the stone-covered ridges.	 Tenosol: Soils with generally only weak pedologic organisation apart from the A horizons. Soils that do not fit the requirements of any other soil orders and generally with one or more of the following: A peaty horizon. A humose, melacic or melanic horizon, or conspicuously bleached A2 horizon, which overlies a calcrete pan, hard unweathered rock or other hard materials; or partially weathered or decomposed rock or saprolite, or unconsolidated mineral materials. A horizons which meet all the conditions for a peaty, humose, melacic or melanic horizon except the depth requirement, and directly overlie a calcrete pan, hard unweathered rock or other hard materials; or partially weathered or decomposed rock or saprolite, or unconsolidated mineral materials. A horizons which have more than a weak development of structure and directly overlie a calcrete pan, hard unweathered or decomposed rock or other hard materials; or partially weathered or decomposed rock or saprolite, or unconsolidated mineral materials. A horizons which have more than a weak development of structure and directly overlie a calcrete pan, hard unweathered rock or other hard materials; or partially weathered or decomposed rock or saprolite, or unconsolidated mineral materials. An A2 horizon which overlies a calcrete pan, hard unweathered rock or other hard materials; or partially weathered or decomposed rock or saprolite, or unconsolidated mineral materials. Either a tenic B horizon, or a B2 horizon with 15% clay (SL) or less1, or a transitional horizon (C/B) occurring in fissures in the parent rock or saprolite which contains between 10 and 50% of B horizon material (including pedogenic carbonate). A ferric or bauxitic horizon >0.2 m thick. 		

BA25	Steep ranges and ridges with narrow valleys on sandstones, quartzites, and conglomerates; considerable areas of bare rock outcron: chief soils are shallow	Rudosol: Soils that have negligible pedologic organisation. They are usually young soils in the sense that soil forming factors have had little time to pedologically modify parent rocks or sediments. The component soils can obviously vary widely in terms of texture and depth; many are stratified and some are highly saline.
	stony sands (Uc1.4) and (Uc1.2). Minor areas of other soils including (Gn2.12) and (Uc5.21) occur.	Soil with negligible (rudimentary) pedologic organisation apart from (a) minimal development of an Al horizon or (b) the presence of less than 10% of B horizon material (including pedogenic carbonate) in fissures in the parent rock or saprolite. The soils are apedal or only weakly structured in the A1 horizon and show no pedological colour changes apart from the darkening of an A1 horizon. There is little or no texture or colour change with depth unless stratified or buried soils are present.

Note: ASC conversion is of chief soils in the ASA description (highlighted bold).



Figure 9. Soil units as mapped by the Atlas of Australian Soils (Bureau of Rural Sciences, 1991) within and surrounding the project area.

2.7 Sites of Conservation Significance and Sites of Botanical Significance

Sites of Conservation Significance (SoCS) are identified as important sites for biodiversity that need further protecting; in the NT there are 67 SoCS. The 67 areas include sites both of national and of international significance. The project area is not within any SoCS, with the nearest SoCS (Newhaven Lakes) approximately 32 km south of the project area.

Sites of Botanical Significance (SoBS) are defined as areas that have botanical features distinguishing them from the surrounding landscape, and that are important in terms of the presence of significant plant communities, the presence of species type localities, the integrity of the ecosystems present and the diversity of plant taxa and plant communities present (White, Albrecht, Duguid, Latz, & Hamilton, 2000).

The project area is not within any SoBS, with the nearest SoBS (Lake Bennet) approximately 46 km south of the project area.

2.8 Vegetation and Flora Desktop Assessment

Broad scale vegetation unit mapping was used to broadly characterise the vegetation of the project area, and two desktop searches were carried out to determine the likelihood of the presence of threatened species, and significant weeds.

- 1. A search of the NT flora atlas of records located within 20 km of the project area, and
- 2. An EPBC Protected Matters report for an area within 20 km of the project area.

2.81 Vegetation Units

Vegetation units of the Northern Territory have been broadly mapped at a scale of 1:1,000,000 and described by Wilson et al. (1990). The project area (drill sites and access roads) is within two vegetation units; 65 and 81 (Figure 10). A third vegetation unit is present north of the project area within EL24808. These vegetation units are described below and in Table 5.

Vegetation unit 68 is widespread in the NT, present across approximately 11,759 km² of land in the Burt Plains, Channel Country, Great Sandy Desert, MacDonnell Ranges, and Tanami Bioregions. This community occurs mainly on mountain ranges to the north and east of Alice Springs. Vegetation unit 65 is mapped across 40,029 km² of the NT and occurs extensively throughout the arid areas south of Tennant Creek. The most extensively mapped areas occur on plains below hills and mountains surrounding the Central Ranges. Vegetation unit 81 is mapped across 20,038 km² of the NT and is found on gently undulating sand plains, with some areas of dunes, mainly north and south of the west MacDonnell Ranges and extending to the Western Australian border at Kintore (Wilson, et al, 1990).

Vegetation Unit	Broad vegetation Classification	Structural formation	Fine vegetation description
65	ACACIA WITH GRASS UNDERSTOREY	TALL OPEN-SHRUBLANDS	A. aneura (Mulga) tall open-shrubland with Eragrostis eriopoda (Woolly butt) open-grassland understorey.
68	ACACIA WITH GRASS UNDERSTOREY	TALL OPEN-SHRUBLANDS	A. kempeana (Witchetty Bush) Acacia tall open- shrubland with Cassia, Eremophila (Fuchsia) open- shrubland understorey.
81	HUMMOCK GRASSLANDS	TALL SHRUBLANDS	Triodia basedowii (Hard Spinifex) hummock grassland with Acacia tall sparse-shrubland overstorey.

Table 5: Details of vegetation units of the project area	as described by Wilson et al. 1990
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Figure 10: Vegetation units of the project area as described by Wilson et al. (1990)

2.82 Flora species of conservation significance

The Protected Matter Search Tool (PMST) report of the study area (EL24808) plus a 20 km buffer surrounding the study area identified no flora species of conservation significance.

Flora records in the NT Flora Atlas Database in a 20 km radius of the project area include 197 records of 115 flora species. There were no records of threatened flora species. There was one record of a significant flora species (Eremophila youngii subsp. lepidota) due to its TPWCA conservation status of 'data deficient'.

There is limited information on this species in NT, more records exist in Western Australia where it is found on stony red sandy loam, flats plains, floodplains, sometimes semi-saline, clay flats (FloraBase, 2021).

This species was previously recorded in same vegetation unit, in different soil type, within the Woodduck land system nearby to ephemeral creeks on the flat floodplain. Likely to occur in the Woodduck land system in the north of EL and lower likelihood of occurring in the project area but still possible.

2.83 Threatened Ecological Communities

No threatened ecological communities were identified within 20 km of the study area (EL24808) according to the PMST Report.

2.84 Introduced Flora 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 identify strategies and actions to control the species. Landholders and managers are ultimately responsible for managing WoNS, and the State/Territory government is responsible for overall legislation and administration (Department of Sustainability, Environment, Water, Population and Communities, 2012).

In the NT, a plant is declared a weed under the *Weed Management Act* if it has been identified for control, eradication or prevention of entry into the NT. 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, declared weeds are classed as either:

- Class A to be eradicated;
- Class B growth and spread to be controlled; or
- Class C not to be introduced into the NT.

The PMST report of the study area (EL24808) plus a 20 km buffer surrounding the study area identified three introduced species considered by the states or territories to be a threat to biodiviersity as likely to occur or habitat likely to occur: Buffel Grass (*Cenchrus ciliaris*), Prickly Pears (Cylindropuntia spp.), and Prickly Pears (Opuntia spp.). None of these were listed as WoNS in the PMST report, however both prickly pears species are NT declared Class A weeds.

Three introduced flora species were identified in the NT Flora Atlas as occurring within the 20km buffer of EL24808 (Table 6). It is probable that additional introduced species such as rubber bush and other weeds associated with pastoral lands occur; given the land use history of the area.

Family	Scientific name	Common name	NT Flora Atlas Records	Declared Weed in NT
POACEAE	Cenchrus ciliaris	Buffel grass	2	No
POACEAE	Chloris virgata	Chloris, Feathertop Rhodes Grass, Furry Grass, Feather Finger-grass	2	No
CACTACEAE	Cylindropuntia imbricata	Cylindropuntia, Devils Rope Cactus, Chain-link Cactus	1	Yes (Class A)

Table 6. Introduced flora and weed species occurring within 20 km of EL24808.

As part of the overall environmental management plan for the site, a weed management strategy should ensure the areas where the works are proposed remain free of weeds. Invasive weed species such as Buffel Grass (*Cenchrus ciliaris*), and Lovegrass (Eragrostis cylindriflora) are present on the roads into the site, consequently, all vehicles need to ensure they are not carrying seeds to the site during works or rehabilitation. It is also important that earth moving equipment is cleaned before being brought to the site and between drill sites if weeds are present. With appropriate mitigation techniques, such as vehicle wheel washing, invasive species will have a low likelihood of occurrence following the proposed works. Efforts should be made to keep pristine areas weed free and eradicate weeds in all other areas involved with the project. Ongoing monitoring of disturbed areas for early detection of weed presence is recommended.

2.85 Reconnaissance Flora and Vegetation Survey

Due to the typical nature of Bushy Park land systems, the composition and variety of vegetation did not range significantly. During the survey, however, the density of vegetation increased when transversing north. Plant communities progressed from sparse low open-forest to more dense woodlands. In addition, ground layer species was exceedingly more diverse at sites 1-3, in comparison to 1 and 2. All drillhole sites are located within Bushy Park or Singleton Lsnd Systems, where ground layer vegetation is most prevelant. All sites suggested fire disturbance, estimated more than 2 years ago. Significant regrowth of native species and evidence of burnt branches were clear indicators of this. Numbers of fallen logs in addition to the ground cover formed suitable habitat for ground-dwelling repitles and small mammals such as lizards, goannas and hopping mice.

Due to the use of land, trampling from cattle and other invasive species is evident. The reduction in herd numbers in pastoral grazing activities has demostrated the successful rehabilitation of low-lying species of flora throughout most sites.

No invasive species were observed at any site during the survey.

Table 7: Land systems/plant communities observed at each drillhole site

Site description and location details			
Bushy Park, Low Open-Forest	DH Site 1		
Mulga Bushland, Low Open-Forest	DH Site 2		
Bushy Park LS, low Open-Woodland/Tall Open-shrubland	DH Site 3		
Bushy Park LS, Low Woodland/Low Open-Woodland	DH Site 4		
Bushy Park/Singleton LS, low Open-Woodland	DH Site 5		

2.9 Fauna Desktop Assessment

To broadly characterise the fauna of the project area and to determine the likelihood of the presence of threatened species, and pest species two desktop searches were carried out.

- 3. A search of the NT fauna atlas of records located within 20 km of the project area, and
- 4. An EPBC Protected Matters report for an area within 20 km of the project area.

The EPBC Protected matters search was conducted on 1st March 2021 using the polygon boundary of EL24808 and applying a 20km buffer.

2.91 Native Fauna

The NT fauna atlas search returned 395 records of 82 species of native fauna in a 20 km radius of EL24808 (DEPWS, 2021). This included 2 amphibian, 61 bird, 13 mammal and 6 reptile species. A list of these species

is provided in Error! Reference source not found.. (Geospatial resources | Department of Environment, Parks nd Water Security)

2.92 Fauna Species of Conservation Significance

Fauna records from the NT Fauna Atlas display 4 fauna species of conservation significance that have been previously recorded in a 20 km radius of the project area. Two recorded species are classified as threatened; Mala (Lagorchestes hirsutus) and Brush Tailed Mulgara (Dasycercus blythi). The records of Mala are those reintroduced at the fenced Newhaven Reserve south of EL24808 rather than observations in the wild. There are 3 records of Brush-tailed Mulgara from the 1970-80s in the area. Other species listed under the TPWC Act include the Australian Bustard (Ardeotis australis) listed as Near-Threatened (NT). The rainbow bee-eater is of conservation significance due to being a migratory species but is listed as least concern (LC) in the NT.

Table 8: Conservation significant fauna previously recorded within 20 km of the project area.

Species	Common Name	NTPWC Status	EPBC Status	NT Fauna Atlas Records
Ardeotis australis	Australian Bustard	NT	Not listed	7
Dasycercus blythi	Brush-tailed Mulgara	VU	Not listed	3
Lagorchestes hirsutus	Mala	EW	EN	4
Merops ornatus	Rainbow Bee-eater	LC	Migratory Species	9

NT = Near Threatened, VU = Vulnerable, EN = Endangered, EW = Extinct in the Wild, LC = Least Concern.

A map of record of conservation significant fauna (including threatened species) is shown in Figure.

The PMST report listed 23 EPBC Act listed species; 9 threatened species, 9 migratory species, and 14 marine species (all migratory species are the same as the marine species) that may occur, are likely to occur, or have habitat within the search area.

Table 5. Fauna species instea anaer the Er De Act instea within a 20 kin radius of EE24000	Table 9: Fauna s	species listed under	the EPBC Act listed	within a 20 km radiu	s of EL24808.
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Species	Common name	Conservation Status EPBC Act	Likelihood of occurrence
Calidric forruginog	Curlow Sandainar	Critically Endangered 1.2	Species or species habitat may
culluris jerrugineu			occur within area
Enuthrotriorchic radiatus	Rod Coshawk	Vulperable	Species or species habitat may
	Neu Goshawk	Vullerable	occur within area
Ealco hypoleucos	Grev Falcon	Vulnerable	Species or species habitat
Fuico hypoleucos		Vullerable	likely to occur within area
Pazanarus accidentalis	Night Parrot	Endangered	Species or species habitat may
rezoporus occidentaris		Lindangered	occur within area
Polutelis alexandrae	Brincoss Barrot	Vulnorable	Species or species habitat
Polytells diexulturue		Vullerable	likely to occur within area
Postratula australis	Australian Dainted Spine	Endangered ²	Species or species habitat may
	Australian Fainted Shipe	Lindangered	occur within area
Macrotis lagotis	Greater Bilby	Vulnerable	Species or species habitat may
Wider of is Tagotis		Vullerable	occur within area
Petrogale lateralis	Warru, Central Australian Rock-	Vulnerable	Species or species habitat may
centralis	wallaby	Vullerable	occur within area
Lionholis kintorai	Great Desert Skink, Tjakura,	Vulnorable	Species or species habitat
	Warrarna, Mulyamiji	Vullerable	likely to occur within area
Anus pacificus	Eark tailed Swift	Listed Migratory Species	Species or species habitat
Apus pucificus		(Marine) ²	likely to occur within area

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Species	Common name	Conservation Status EPBC Act	Likelihood of occurrence
Motacilla cinaraa	Grov Wagtail	Listed Migratory Species	Species or species habitat may
	Grey Wagtan	(Terrestrial) ²	occur within area
Motacilla flava	Xollow Wagtail	Listed Migratory Species	Species or species habitat may
		(Terrestrial) ²	occur within area
Actitic hypoloucos	Common Sandainar	Listed Migratory Species	Species or species habitat may
Actilis hypoleucos	Common Sandpiper	(Wetland) ²	occur within area
Calidric acuminata	Sharp tailed Sandpiper	Listed Migratory Species	Species or species habitat may
		(Wetland) ²	occur within area
Calidric malanatas	Postoral Sandainar	Listed Migratory Species	Species or species habitat may
Culturis metanolos		(Wetland) ²	occur within area
Charadrius vorodus	Oriental Blover, Oriental Dettoral	Listed Migratory Species	Species or species habitat may
Chardanas vereaus	Offential Plover, Offential Dotterer	(Wetland) ²	occur within area
Claroola maldivarum	Oriental Bratingolo	Listed Migratory Species	Species or species habitat may
Giureola malaivaram		(Wetland) ²	occur within area
Ardoa alba	Groat Egrat White Egrat	Listed Marine Species	Species or species habitat
Ardeu dibu	Great Egret, white Egret	Listed Marine Species	likely to occur within area
Ardon ibis	Cattle Forat	Listed Marine Species	Species or species habitat may
Arueu IDIS		Listed Marine Species	occur within area
Chrysososowy osculans	Black eared Cuckes	Listed Marine Species	Species or species habitat may
Chrysococcyx osculans		Listed Marine Species	occur within area
Merops ornatus	Rainbow Bee-eater	Listed Marine Species	Species or species habitat may
		Listed Marine Species	occur within area

Notes: Listed threatened species are highlighted in light red in the table above. 1 = Also listed migratory species. 2 = Also listed marine species.

A copy of the full EPBC Protected Matters Report is provided as Appendix 1.

A likelihood analysis of potential occurrence in the project area was performed with the results displayed in 10.



Figure 11. Records of fauna species of conservation significance recorded in the NT Fauna Atlas within 20 km of the project area (displayed by TPWC Act status). Note, multiple species are often recorded at each point, coded to highest listing level.

Table 10. Fauna species of conservation significance occurring, or potentially occurring, within a 20 km buffer of EL24808, identified by the EPBC Protected Matters Search Tool (PMST) and the NT Fauna Atlas, Species are rated on their likelihood of occurring within the project areas.

		Sta	itus	Threat		Likelihood of
Scientific name	Common name	TPWC	EPBC	ened	Habitat	Occurrence in
Mammals						Project Area
Dasycercus blythi	Brush-tailed Mulgara	VU	(Not Listed)	Yes	Principle habitat is mature Triodia hummock grasslands on sand plains, often influenced by the presence of better watered areas such as palaeochannels.	Medium
					[South of project area is spinifex grassland on sandplains which is principal habitat for Mulgara. This part of project area unburnt since 2011. Past records in 1970-1980s ~1.6km east of the project area and ~15km northeast of the project area.]	
Lagorchestes hirsutus	Mala	EW	EN	Yes	Extinct in the wild in NT. NT Fauna Atlas records were for reintroduced individuals in fenced Newhaven reserve.	Nil
Macrotis lagotis	Greater Bilby	VU	VU	Yes	Sandy soils covered by hummock grasslands dominated by spinifex and low shrub cover dominated by Acacia or Melaleuca.	Low
					[Suitable habitat type exists in the south of the project area (drill pads 3, 4 & 5) where there is spinifex grassland on sandplain with acacia shrubland. No past records in the area but limited survey work has been done in this area.]	
Petrogale lateralis centralis	Warru, Central Australian Rock-wallaby	(NL)	VU	Yes	Grassland feeding habitat in close proximity to cliff, rock pile, talus or escarpment refuges. Rock cliffs and steep substrates are essential for breeding and shelter. [Rocky ranges surrounding EL24808 and nearby grassland to the ranges are suitable habitat. This habitat type is not	Low/Nil
Reptiles					present in the open plan of the project area.j	

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Liopholis kintorei	Great Desert Skink	VU	VU	Yes	 Western arid zone of the NT, from the Uluru area north to Rabbit Flat in the Tanami Desert. Red sandplains and sand ridges with a dominant vegetation of Triodia grassland with scattered shrubs and trees. In the Tanami. Also occurs in paleodrainage lines with termite mounds and Melaleuca shrubs. [No past records in the area. South of project area is spinifex grassland on sandplains which may be suitable habitat. Sand dunes/ridges do not extend up to the project area from sandplains to the south.] 	Low (bushy park) Medium (Singleton)
Birds						
Ardeotis australis	Australian bustard	NT	(Not Listed)	No	Grassland, including tussock grassland, Triodia hummock grassland, grassy woodland and low shrublands. It will also use denser vegetation, when this has been temporarily opened up by recent burning. [Suitable habitat in project area and has been recorded in the past within EL24808.]	High
Merops ornatus	Rainbow Bee-eater	LC	Migrat ory	No	Most often found in open forests, woodlands and shrublands, and cleared areas, usually near water. It will be found on farmland with remnant vegetation and in orchards and vineyards. It will use disturbed sites such as quarries, cuttings and mines to build its nesting tunnels. [no waterways or semi-permanent water sources in or near the project area.]	Low
Calidris ferruginea	curlew sandpiper	VU	CR	Yes	Forage in coastal brackish lagoons, intertidal mud and sand flats, estuaries, saltmarshes and occasionally on inland freshwater wetlands. [No habitat within project area.]	Low
Erythrotriorchis radiatus	Red Goshawk	VU	VU	Yes	Generally occurs in taller forests characteristic of higher rainfall areas, but there are some isolated recent records from central Australia. The preferred habitat is tall open	Low

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					eucalypt forest and riparian areas (including paperbark forest and gallery forests). [Preferred habitats not in project area.]	
Falco hypoleucos	grey falcon	VU	VU	Yes	Lightly timbered and un-timbered lowland plains that are crossed by tree-lined watercourses, but frequents other habitats including grassland and sand dune habitats.	Medium
					[Suitable habitats more likely to the north of the project area, however project area include grassland which may also be frequented by this species. No records in 20km buffer search area]	
Pezoporus occidentalis	night parrot	CR	EN	Yes	Arid and semi-arid areas with dense, low vegetation such as Triodia grasslands on stony or sandy substrates. Samphire and chenopod shrublands on floodplains, claypans and the margins of salt lakes might also be important.	Low
					[Sandplains with triodia in south of project area. Not sure of density of triodia. Southern part of project area unburnt since 2011 so spinifex somewhat mature. No records in area.]	
Polytelis alexandrae	princess parrot	VU	VU	Yes	Sand dunes and sand plains supporting open savannah woodlands and shrublands with scattered stands of larger trees (especially E. gongylocarpa, Corymbia chippendalei and Allocasuarina decaisneana). Ground vegetation is usually dominated by Triodia grassland. Breeding habitat requires large, hollow bearing trees and may include E. camaldulensis lined watercourses.	Low
					[Project area is grassland and shrubland without stands of larger trees. Breeding habitat such as large hollow bearing trees and River Red Gum lined watercourses absent from the project area.]	
Rostratula australis	Australian painted snipe	VU	EN	Yes	Shallow, grassy, freshwater swamps, claypans and seasonally flooded grasslands.	Low
					[Possible habitat to the north of EL24808. Habitats not in project area.]	
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Other migratory and marine	Refer Table 9.	Refer	Refer	No	Migratory and Marine species as per Table 9 (not already	Low
species identified in search		Table	Table		listed above), are not likely to occur and/or are not at risk	
area (refer Table 9)		9.	9.		from proposed project activities.	

Notes: EX: extinct, EW: extinct in the wild, CR: critically endangered, EN: endangered, VU: vulnerable, NT: near threatened, LC: least concern, NL: not listed.

2.93 Introduced Fauna Species

Eight introduced fauna species were identified by the EPBC PMST as potentially occurring within 20 km of EL24808, and six introduced fauna species were recorded by the NT Fauna Atlas within this area. Species are listed in Table 1.

Table 11: Introduced fauna species identified as occurring or potentially occurring within 20 km of the project area, by the EPBC Protected Matters Search Tool (PMST) or the NT Fauna Atlas.

Scientific name	Common name	PMST	NT Fauna Atlas	NT Fauna Atlas Records
Bos taurus	Domestic cattle	х	-	-
Camelus dromedarius	Dromedary camel	х	X	9
Canis lupus familiaris	Domestic dog	Х	-	-
Equus caballus	Horse	Х	X	2
Felis catus	Domestic cat	Х	X	1
Mus musculus	House mouse	х	x	2
Oryctolagus cuniculus	Rabbit	X	X	10
Vulpes vulpes	Red fox	X	X	1

2.94 Reconnaissance Fauna Survey

A diverse range of fauna activity was observed at each drillhole location whilst conducting the reconnaissance survey. Due to high temperatures throughout the survey period, fauna siting's were minimum throughout the day however evidence of native inhabitancy was widespread due to the quantity of tracks and scat and various burrows found within the survey locations. The majority of fauna observed were bird (n=13) or reptile species. A full species list for each drillhole site is provided in Appendix in addition to incidental observations taken at and between sites.

Due to the absence of natural water sources in and surrounding the survey area, many bird species were observed however the presence or ground evidence of larger mammals was less to none. This was more evident at drillholes 4 and 5. Leading North (1 and 2), the native vegetation structure grew denser, the majority identified as mulga bushland. More visual evidence of larger fauna was observed within this area, including a mob of emus and larger birds of prey (buzzard). During the survey, fallen logs and vegetative debris, termite mounds and large species of tree (Witchetty tree and Mulga bush) provided a means of shelter and protection from the sun/heat and safeguard from prey species during extreme conditions of the day. This was mostly evident through the large number of burrows, nests and tracks of reptiles, birds, and small mammals i.e. goannas, desert dragons, lizards and hopping mice.

As the Drillhole sites are situated throughout Mt Doreen Station, the area of survey is pastoral land. The nature and use of land resulted in a greater frequency of non-native fauna (scats and tracks) with majority including livestock, feral camel, fox, and cat. In addition, other tracks and scats of other non-native fauna were also observed (including horse) however much less prevalent within the areas of survey.

2.10 Fire History

According to North Australia and Rangelands Fire Information (NAFI) fire history mapping for years 2000 to 2021:

- Most of EL24808 was burnt in 2002, with only the northeast portion remaining unburnt.
- The southwestern part of EL24808 was burnt again in 2011.
- Fires have since occurred further south on the southern boundary area of EL 24808 in 2016 and 2019.

Drill hole 1 is located within the area that has remained unburnt since at least the year 2000.

Drill hole 3 is located within area that was last burnt in 2002.

Drill Holes 2, 4 and 5 are located within area that was last burnt in 2011.



Figure 12: Fire History of the Project Area According to NAFI (2021)

2.11 Water Resource Usage

The proposed drilling project will utilise Rotary Core (RC) drilling which does not require water, consequently, it is anticipated no water will be used from bores or other sources for the drilling operations. However, if aquifers are intersected during drilling this may require use of drilling mud in order to get drilling samples. If water is required in order to obtain drilling samples, or for dust control for drill pads or tracks it may be obtained from highway maintenance bores with approval or Yuendumu. Alternatively, if it is agreeable to the pastoralist, water use from pastoral bores may be negotiated. In negotiations with the pastoral lessees, if a substantial water source is intersected, we would case the hole so the pastoralist could fit it out as a producing bore if desired.

Water for drinking and general use by people on site will be carted in by truck or trailer from Alice Springs or Yuendumu as required.

2.12 Aboriginal Sacred Sites

In 2017, for the purposes of undertaking a detailed gravity and passive seismic survey of EL24808, Eclipse sought completed Sacred Site Clearance Certification from the CLC, which the CLC stated it had completed for Cauldron Energy, a predecessor company to Eclipse, on EL24808. Certification was received from the CLC on the 5th of September 2018 confirming that no exclusion zones or restricted work areas fall within EL24808. However, there are exclusion zones within neighbouring ELs and on tracks that may be used to access EL24808 (Eclipse EL24808 Annual Report, 2020). Access has been planned accordingly.

Currently there is no registered sacred sites or restricted areas within EL24808.

2.13 Archaeological And Heritage Sites

A search of the Northern Territory Government Heritage Register was undertaken for NT Portion 1947 (Mt Doreen Station) on 17/02/2021. The search results returned no sites or non-public sites for the search area.

3 RISK ASSESSMENT OF POTENTIAL IMPACTS

Project activities with the potential to impact on the environment include:

- Clearing vegetation from tracks and drill pads, and drill pad preparation
- Drilling activities
- Closure and rehabilitation activities and unsuccessful rehabilitation

Risks of significant flora and fauna impacts are discussed below, and a project risk assessment is presented in Table .

3.1 Threatened Species

The risk of the proposed exploration activities impacting on threatened species is considered here. It should be noted that limited survey has been done in this area and data is not adequate to interpret changes in fauna and flora over time that might relate to environmental impacts.

The NT Government Exploration Mining Management Plan User Guide (2021) recommends that a 'significant impact assessment' should be undertaken if threatened species are assessed to have a high likelihood of occurring in the project area/site. No threatened species were assessed to have a **HIGH** likelihood of occurring in the project area/site, therefore a 'significant impact assessment' was not undertaken for threatened species.

3.2 Significant Species

Significant species (including threatened species) assessed to have a medium or high likelihood of occurring in the project area are discussed below in relation to threatening processes and possible impacts from project activities.

The **Brush-tailed Mulgara** (*Dasycercus blythi*) is listed as vulnerable in the TPWC Act. This species is principally found in mature spinifex hummock grasslands and in paleo-drainage systems or drainage lines in sandplain or sand dune habitats. The southern portion of the project area is consistent with this habitat type. The proposed exploration includes the clearing of vegetation for access tracks to RC drilling pads and could adversely impact individual brush tailed mulgara occupying the project area. If an active burrow is spotted, project activities/tracks should be re-routed around it. As the project works cover a small area, and habitat suitable for brush-tailed mulgara is widespread across the proposed area and more widely at the regional scale, the project is highly unlikely to affect the brush-tailed mulgara at the local population level or change the state or national status of the species.

The **Great Desert Skink** (Liopholis kintorei) is listed as vulnerable in the TPWC Act and the EPBC Act. This species is principally found in the western arid zone of the NT, from the Uluru area north to Rabbit Flat in the Tanami Desert. Red sandplains and sand ridges with a dominant vegetation of Triodia grassland with scattered shrubs and trees. Also in the Tanami. Also occurs in paleodrainage lines with termite mounds and Melaleuca shrubs. The southern portion of the project area has sandplain which may be suitable habitat. No past records in the area. The proposed exploration includes the clearing of vegetation for access tracks to RC drilling pads and could adversely impact individual great desert skinks occupying the project area. If an active warren is spotted, project activities/tracks should be re-routed around it. As the project works cover a small

area, and habitat suitable for brush-tailed mulgara is widespread to the south of the proposed area and more widely at the regional scale, the project is highly unlikely to affect the great desert skink at the local population level or change the state or national status of the species.

The **Australian Bustard** (Ardeotis australis) is listed as Near Threatened in the TPWC Act. This species is principally found in Grassland, including tussock grassland, Triodia hummock grassland, grassy woodland and low shrublands. It will also use denser vegetation, when this has been temporarily opened up by recent burning. Suitable habitat is present in project area and Australian Bustards have been recorded in the past within EL24808. Australian bustards are generally ground dwelling birds but can also fly. They nest on the ground generally in open areas and breed any time of the year in northern Australia. The proposed exploration includes the clearing of vegetation for access tracks to RC drilling pads and human activity which may adversely impact or disturb individual Australian Bustards occupying the project area. If a nesting bustard is spotted, project activities/tracks should be re-routed around it. As the project works cover a small area, and habitat suitable for Australian Bustards is widespread across the proposed area and more widely at the regional scale, the project is highly unlikely to affect the Australian Bustard at the local population level or change the state or national status of the species.

The **Grey Falcon** (Falco hypoleucos) is listed as vulnerable in the TPWC Act and the EPBC Act. This species is principally found in lightly timbered and un-timbered lowland plains that are crossed by tree-lined watercourses, but frequents other habitats including grassland and sand dune habitats. Suitable habitats are more likely to the north of the project area, however project area includes grassland which may also be frequented by this species. Breeds June to November usually nesting high in leafy eucalypt on watercourse or waterhole. The proposed exploration includes the clearing of vegetation for access tracks to RC drilling pads and could adversely impact individual grey falcons occupying the project area. Falcons are highly mobile and large eucalypts and riparian areas will not be cleared in this project therefore nesting trees will not be impacted. As the project works cover a small area, and nesting habitat trees will not be impacted, the project is highly unlikely to affect the grey falcon at the local population level or change the state or national status of the species.

Table 12: Environmental Risk Assessment

Hazard/Event	Identification		Init	ial Ri	sk	Risk Prevention and Mitigation Measures	Res	idual	Risk	Acceptability
						(Target = ALARP)				Reason
Hazard / Event / Activity	Potential Impact	Causes or potential sources	Severity	Likelihood	Risk Rating		Severity	Likelihood	Risk Rating	
Ignition of Uncontrolled Fire	Loss of vegetation, destruction of fauna habitat, fauna injury or death.	Ignition from vehicle exhaust on dry grass. Fire escape from camp fire. Ignition from cigarettes.	3	1	6- Mod	 Adequate firefighting equipment maintained and located on-site; personnel trained in its use. No open flames outside of designated areas. Assign designated smoking areas with appropriate bins for cigarette disposal. Don't park vehicles or machines over areas of dry grass. 	2	1	2 - Low	
Vegetation Clearing of Access Tracks and Drill Pads	Loss of flora and fauna	Direct clearing of vegetation for access and drilling.				 Obtain relevant regulatory approvals for land clearing Clearing of vegetation to be restricted to the minimum required to enable safe access and drilling, and to be within defined boundaries. Measures to retain mature trees or habitat trees where possible 				No Threatened flora species identified in area. No threatened fauna species with high likelihood of occurrence in area. Localised loss of flora, and habitat for fauna, where the removal of grasses and shrubs is required to create tracks and drill pads.
Introduction and spread of weeds Introduction of exotic fauna	Habitat quality reduction, reduction in biodiversity value, reduction in food availability for native fauna	Vehicle and machine movements. Cleared/disturbed areas allow weeds to establish before native vegetation establishes.				 Clearing of vegetation to be restricted to the minimum required to enable safe access and drilling, and to be within defined boundaries. Equipment/vehicle hygiene practices to minimise the introduction or spread of weeds or soil borne diseases to the project area. Tracks to avoid weed infestations and any weed infestations identified in project works area to be managed/treated appropriately. Contractors to be inducted in weed identification. 				

Hazard/Event	Identification		Init	ial Ri	sk	Risk Prevention and Mitigation Measures	Res	idual	Risk	Acceptability
Hazard / Event / Activity	Potential Impact	Causes or potential sources	Severity	Likelihood	Risk Rating	(Target = ALARP)	Severity	Likelihood	Risk Rating	Keason
Spillage of fuels during project works	Spillage of fuels causing contamination of ecosystem, soils, surface waters and/or ground waters, knock on effects to flora and fauna	Vehicles and machinery fuel and re-fuelling, generator fuel and re-fuelling.				 Store hydrocarbon fuels according to the requirements of AS1940-2004 - The storage and handling of flammable and combustible liquids Appropriate spill kits to be kept adjacent to storage area Locate fuel stores away from sensitive areas. 				
Introduction of exotic fauna	Habitat quality reduction, reduction in biodiversity value, reduction in food availability for native fauna	Brought in on vehicles, machinery, equipment including camp equipment/facilities.				 Inspection of machinery (including motor vehicles) and equipment prior to entering project areas. Waste storage facilities to be designed and located to restrict fauna access. Fauna, including pest species, will not be fed. 				
Elevated Dust, Noise, Light and human activity from exploration activities	Impact/disturbance to flora and fauna	Bulldust can be created on susceptible soils through increased traffic travel. General project activity and facilities/equipment.				 Adopt speed limits on site for all vehicles. Limit Project lighting to minimum safe levels. Minimise driving at night and dusk and dawn. Plan activities to reduce number of vehicle trips on tracks within project area. 				Limited project duration and small project area.
Vehicle Collision with Fauna	Fauna death or injury	Unpredictable movement of animals. Vehicles travelling at high speeds. Vehicles travelling at dawn or dusk or in times of poor visibility.	3	3	9 - Mod	 Limit vehicle activities and events to daylight hours when fauna is more visible. Minimise driving during dawn and dusk. Adopt speed limits on site for all vehicles. 	2	2	4 - Low	Due to the unpredictable nature of fauna there is still a possibility that a fauna collision may occur. However, the likelihood has been reduced.

Hazard/Event Identification		Init	ial Ri	sk	Risk Prevention and Mitigation Measures	Res	idual	Risk	Acceptability
					(Target = ALARP)				Reason
Hazard / Potential Impact Event / Activity	Causes or potential sources	Severity	Likelihood	Risk Rating		Severity	Likelihood	Risk Rating	
Erosion and sedimentatio n due to vegetation clearing and land surface disturbance Ongoing damage to ecosystems, contamination of surface water, hinder rehabilitation and revegetation.	Flooding. Vegetation removal Vehicle disturbance. Bulldust can be created on susceptible soils through increased traffic travel. Cattle tracking along tracks after closure/rehabilitation (project on pastoral land). Clearing when soil moisture conditions inappropriate. Site preparatory works can result in the removal of topsoil and the formation of windrows. Windrows can channel water and create erosion unless done appropriately. Topsoil can be lost in areas where vegetation is removed through wind and water process.	4	3	12- Mod	 Clearing of vegetation to be restricted to the minimum required to enable safe access and drilling, and to be within defined boundaries. Blade up clearing of tracks with bulldozer where practical rather than grading. Only drive on designated tracks. Construct tracks away from drainage lines and depressions and do not alter natural flow paths and drainage features. Maintain tracks and roads. Rehabilitate cleared and disturbed areas as soon as practicable – establish erosion management controls. Adopt speed limits on site for all vehicles. Plan activities to reduce number of vehicle trips on tracks within project area. Monitored and manage cattle tracking along rehabilitated tracks after closure/rehabilitation. Works should be done a month after significant rainfall, otherwise will destroy the ground/soil. Where blade-up techniques cannot be employed, topsoil and vegetation will be stockpiled appropriately for remediation purposes and placed in a manner to avoid channelling runoff which can cause erosion. 	2	2	4- Low	Flat plain, no significant drainage features in the project area, small areas being cleared. What existing erosion is present on existing tracks in the area? This is a good indication of potential for erosion for new tracks.

Ngalia Basin Drilling Program Exploration Mining Management Plan

Hazard/Event	Identification		Initi	ial Ri	sk	Risk Prevention and Mitigation Measures (Target = ALARP)	Resi	idual	Risk	Acceptability Reason
Hazard / Event / Activity	Potential Impact	Causes or potential sources	Severity	Likelihood	Risk Rating		Severity	Likelihood	Risk Rating	
General waste escapes to environment or is accessed by fauna	Contamination of ecosystem, potential injury or death to fauna	Poor waste management practices or storage facilities.				 Secure waste management at camp and at drill sites. Waste storage facilities to be designed and located to restrict fauna access. All waste transported and disposed off-site. 				
Inadequate or ineffective rehabilitation of exploration sites, including drill holes, pads, tracks, etc	Potential injury of fauna, adverse effect on ecosystem	Poor rehab work not done to guidelines. Inexperienced contractor does rehab. Cattle use rehabilitated areas within pastoral property. Weather/climate following rehab.				 All drill holes and drill pads will be capped/plugged and backfilled according to the relevant Northern Territory guidelines. Tracks and drill pads rehabilitated as per relevant Northern Territory guidelines. Monitoring after rehabilitation to ensure objectives are met including monitoring and managing cattle tracking along rehabilitated tracks after closure/rehabilitation. 				

With the proposed risk prevention and mitigation measures outlined in the table above, and implementation of the environmental management standards and remediation standards presented is Sections 5 and 6 in this MMP, the project will not have a significant impact on the environment.

4 RECOMMENDATIONS AND CONCLUSION

Through appropriate desktop and reconnaissance survey, Low Ecological Services has been able to identify and address both present and potential flora and fauna within the proposed project area. Although no threatened species are present in the drilling locations, potential for species occurrence is demonstrated in suitable habitat throughout the area.

Recommendations to avoid impact or disturbance of native flora and fauna, including direct interference and/or damage to the structural integrity of environment within and surrounding the proposed drill locations are to be taken seriously. The following points highlight both areas of general and more pointed practice. Low Ecological Services (LES) offers the following recommendations to complement Eclipse Metals in addition to the environmental risk mitigation measures implemented:

- To reduce likelihood of erosion within and surrounding the proposed drillhole sites (including road access and potential detours), wherever possible, the crossing of sand dunes/mounds or significant habitat structures (i.e., termite mounds) should be avoided to reduce impact. Figure 12 below, has been provided by LES which illustrates a change to the original route proposed by Eclipse Metals (i.e., includes the use of old station roads which aid in minimising additional vegetation damage by vehicle movement).
- To reduce impacts to underground sand structures (i.e., termite nests and burrow systems) and crusted topsoils, tyre pressure should be decreased to spread weight of vehicles and speed limits be enforced.
- Although no invasive flora was observed during the on-site survey, weed identification and hygiene management practices, including vehicle wash or blow down should be implemented during the proposed drilling operations. This is most important when navigating through and between areas of convenience, in order to prevent the introduction of weeds, spread of weeds in the area, and transport of weeds off site. Contractors to be inducted in weed identification.
- All crew members are to be trained in or provided with written materials which aid in identifying both threatened and invasive species within and surrounding the area of proposed drilling.
- Train crew to recognise individual characteristics of Significant species (including threatened species) with a medium or high likelihood of occurring within the project area. This specifically refers to the burrows and ground movements associated with the Brush-tailed Mulgara and Great Desert Skink. To avoid potential or direct harm, changes to vehicle routes should be minimised, and when necessary, detours put in place if species occurrence is documented.
- All native wildlife including snakes and arachnid are recognised as protected by law and all effort to avoid interaction should be practiced.

- In the case of injured fauna, contact numbers of local wildlife carers within surrounding areas must be known in order to provide immediate advice and/or assistance to injured wildlife. It is also recommended that basic training be provided to assist crew members in dealing with injury (i.e. keep handling to a minimum to avoid stress of animal)
- To avoid fauna injury and future incidence, all drill holes and drill pads will be capped/plugged and backfilled according to the relevant Northern Territory guidelines.
- Avoidance of contamination through secure waste management practice at camp and at drill sites. Waste storage facilities to be designed and located accordingly to restrict fauna access. All waste transported and disposed off-site.



Figure 13: Recommended Access Routes to Drillhole Sites

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6 APPENDICES

Appendix 1. EPBC Act Protected Matters Report

Australian Government

Department of Agriculture, Water and the Environment

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 01/03/21 17:22:20

Summary Details Matters of NES Other Matters Protected by the EPBC Act Extra Information Caveat Acknowledgements



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2015

Coordinates Buffer: 20.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	9
Listed Migratory Species:	9

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A <u>permit</u> may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	14
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	1
Regional Forest Agreements:	None
Invasive Species;	11
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Calidris ferruginea	Oritically Endensered	Consist of operation hebitat
Curiew Sandpiper [856]	Critically Endangered	Species or species habitat
		may occur within area
Erythrotriorchis radiatus		
Red Goshawk [942]	Vulnerable	Species or species habitat
		may occur within area
False humalauses		
Falco hypoleucos	Vulnorable	Creation or opposing hebitat
Grey Falcon [929]	vuinerable	likely to occur within area
		intery to occur within area
Pezoporus occidentalis		
Night Parrot [59350]	Endangered	Species or species habitat
		may occur within area
Deb della alevandera		
Polytells alexandrae	Mula sashi s	Consider an end size habitat
Princess Parrot, Alexandra's Parrot [758]	vuinerapie	Species or species nabitat
		intery to occur within area
Rostratula australis		
Australian Painted Snipe [77037]	Endangered	Species or species habitat
	_	may occur within area
Managala		
Mammais		
Greater Bilby [282]	Vulnerable	Spaciae or epociae habitat
Greater Diby [202]	vuinerable	may occur within area
		may occar within area
Petrogale lateralis centralis		
Warru, Central Australian Rock-wallaby [90831]	Vulnerable	Species or species habitat
		may occur within area
Pontilos		
Liopholis kintorei		
Great Desert Skink, Tiakura, Warrama, Mulvamiii	Vulnerable	Species or species habitat
[83160]	Valiforabio	likely to occur within area
		2
Listed Migratony Species		[Descurse Information]
Listed Wigratory Species		
 Species is listed under a different scientific name on t Name 	Threatened	Species list.
Name Migratony Marine Birde	Inreatened	Type of Presence
Anue pecificue		
Fork-tailed Swift [678]		Species or species habitat
rom-tailed Switt [010]		likely to occur within area
		anony to obtain manin arota
Migratory Terrestrial Species		

Name	Threatened	Type of Presence
Motacilla cinerea		
Grey Wagtail [642]		Species or species habitat may occur within area
<u>Motacilla flava</u> Yellow Wagtail [644]		Species or species habitat
		may occur within area
Migratory Wetlands Species		
Common Sandniner [50300]		Spaciae or epaciae habitat
Common Sandpiper [38309]		may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius veredus		
Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum		
Oriental Pratincole [840]		Species or species habitat may occur within area
Other Matters Protected by the EPBC Act		
Other Matters Protected by the EPBC Act Listed Marine Species * Species is listed under a different scientific name on Name	the EPBC Act - Threatened Threatened	[<u>Resource Information</u>] d Species list. Type of Presence
Other Matters Protected by the EPBC Act Listed Marine Species * Species is listed under a different scientific name on Name Birds	the EPBC Act - Threatened Threatened	[<u>Resource Information</u>] d Species list. Type of Presence
Other Matters Protected by the EPBC Act Listed Marine Species * Species is listed under a different scientific name on Name Birds Actitis hypoleucos	the EPBC Act - Threatened Threatened	[<u>Resource Information</u>] d Species list. Type of Presence
Other Matters Protected by the EPBC Act Listed Marine Species * Species is listed under a different scientific name on Name Birds Actitis hypoleucos Common Sandpiper [59309]	the EPBC Act - Threatened Threatened	[Resource Information] d Species list. Type of Presence Species or species habitat may occur within area
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Other Matters Protected by the EPBC Act Listed Marine Species * Species is listed under a different scientific name on Name Birds Actitis hypoleucos Common Sandpiper [59309] Apus pacificus Fork-tailed Swift [678]	the EPBC Act - Threatened	[Resource Information] d Species list. Type of Presence Species or species habitat may occur within area Species or species habitat likely to occur within area
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Other Matters Protected by the EPBC Act Listed Marine Species * Species is listed under a different scientific name on Name Birds Actitis hypoleucos Common Sandpiper [59309] Apus pacificus Fork-tailed Swift [678] Ardea alba Great Egret, White Egret [59541]	the EPBC Act - Threatened	[Resource Information] d Species list. Type of Presence Species or species habitat may occur within area Species or species habitat likely to occur within area Species or species habitat likely to occur within area
Other Matters Protected by the EPBC Act Listed Marine Species * Species is listed under a different scientific name on Name Birds Actitis hypoleucos Common Sandpiper [59309] Apus pacificus Fork-tailed Swift [678] Ardea alba Great Egret, White Egret [59541] Ardea ibis	the EPBC Act - Threatened	[Resource Information] d Species list. Type of Presence Species or species habitat may occur within area Species or species habitat likely to occur within area Species or species habitat likely to occur within area
Other Matters Protected by the EPBC Act Listed Marine Species * Species is listed under a different scientific name on Name Birds Actitis hypoleucos Common Sandpiper [59309] Apus pacificus Fork-tailed Swift [678] Ardea alba Great Egret, White Egret [59541] Ardea ibis Cattle Egret [59542]	the EPBC Act - Threatened	[Resource Information] d Species list. Type of Presence Species or species habitat may occur within area Species or species habitat likely to occur within area Species or species habitat likely to occur within area
Other Matters Protected by the EPBC Act Listed Marine Species * Species is listed under a different scientific name on Name Birds Actitis hypoleucos Common Sandpiper [59309] Apus pacificus Fork-tailed Swift [678] Ardea alba Great Egret, White Egret [59541] Ardea ibis Cattle Egret [59542] Calidris acuminata	the EPBC Act - Threatened	[Resource Information] d Species list. Type of Presence Species or species habitat may occur within area Species or species habitat likely to occur within area Species or species habitat likely to occur within area
Other Matters Protected by the EPBC Act Listed Marine Species * Species is listed under a different scientific name on Name Birds Actitis hypoleucos Common Sandpiper [59309] Apus pacificus Fork-tailed Swift [678] Ardea alba Great Egret, White Egret [59541] Ardea ibis Cattle Egret [59542] Calidris acuminata Sharp-tailed Sandpiper [874]	the EPBC Act - Threatened Threatened	[Resource Information] d Species list. Type of Presence Species or species habitat may occur within area Species or species habitat likely to occur within area Species or species habitat likely to occur within area Species or species habitat may occur within area
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Name	Threatened	Type of Presence
Charadrius veredus		
Oriental Plover, Oriental Dotterel [882]		Species or species habitat
		may occur within area
Chrysococcyx osculans		
Black-eared Cuckoo [705]		Species or species habitat
		may occur within area
		may occar mannared
Glareola maldivarum		
Oriental Pratinaala (840)		Species or species hebitat
Offental Platificole [040]		Species of species habitat
		may occur within area
Merone ornatus		
Deinhaus Des setes (070)		Consider an environ highlight
Rainbow Bee-eater [670]		Species or species nabitat
		may occur within area
Matacilla sinama		
Motacilia cinerea		
Grey Wagtail [642]		Species or species habitat
		may occur within area
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat
		may occur within area
Rostratula benghalensis (sensu lato)		
Painted Snipe [889]	Endangered*	Species or species habitat
	-	may occur within area
Eutor Information		
Extra Information		
Extra Information State and Territory Reserves		[Resource Information 1
Extra Information State and Territory Reserves		[Resource Information]
Extra Information State and Territory Reserves Name		[Resource Information] State
Extra Information State and Territory Reserves Name Southem Tanami		[Resource Information] State NT
Extra Information State and Territory Reserves Name Southem Tanami		[Resource Information] State NT
Extra Information State and Territory Reserves Name Southem Tanami Invasive Species		[Resource Information] State NT [Resource Information]
Extra Information State and Territory Reserves Name Southem Tanami Invasive Species Weeds reported here are the 20 species of nationa	l significance (WoNS), alc	[Resource Information] State NT [Resource Information] ong with other introduced plants
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Extra Information State and Territory Reserves Name Southem Tanami Invasive Species Weeds reported here are the 20 species of nationa that are considered by the States and Territories to following feral animals are reported: Goat, Red Fox Landscape Health Project, National Land and Wate Name Mammals Bos taurus Domestic Cattle [16] Camelus dromedarius Dromedary, Camel [7] Canis lupus familiaris Domestic Dog [82654] Equus caballus Horse [5] Felis catus Cat. House Cat. Demestic Cat. [40]	l significance (WoNS), alc pose a particularly signifi , Cat, Rabbit, Pig, Water er Resouces Audit, 2001. Status	Image:

Name	Status	Type of Presence
		habitat likely to occur within
Mus musculus		arca
House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus		
Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Vulpes vulpes		
Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Cenchrus ciliaris		
Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area
Cylindropuntia spp.		
Prickly Pears [85131]		Species or species habitat likely to occur within area
Opuntia spp.		
Prickly Pears [82753]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, solls, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers
- The following groups have been mapped, but may not cover the complete distribution of the species:
 - non-threatened seabirds which have only been mapped for recorded breeding sites
 - seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-22.266766 131.133326,-22.266711 131.166676,-22.31671 131.216685,-22.366647 131.216669,-22.366605 131.166688,-22.349962 131.13332,-22.316695 131.100062,-22.283341 131.100021,-22.266766 131.133326

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

Office of Environment and Heritage, New South Wales -Department of Environment and Primary Industries, Victoria -Department of Primary Industries, Parks, Water and Environment, Tasmania -Department of Environment, Water and Natural Resources, South Australia -Department of Land and Resource Management, Northern Territory -Department of Environmental and Heritage Protection, Queensland -Department of Parks and Wildlife, Western Australia -Environment and Planning Directorate, ACT -Birdlife Australia -Australian Bird and Bat Banding Scheme -Australian National Wildlife Collection -Natural history museums of Australia -Museum Victoria -Australian Museum -South Australian Museum -Queensland Museum -Online Zoological Collections of Australian Museums -Queensland Herbarium -National Herbarium of NSW -Royal Botanic Gardens and National Herbarium of Victoria -Tasmanian Herbarium -State Herbarium of South Australia -Northern Territory Herbarium -Western Australian Herbarium -Australian National Herbarium, Canberra -University of New England -Ocean Biogeographic Information System -Australian Government, Department of Defence Forestry Corporation, NSW -Geoscience Australia -CSIRO -Australian Tropical Herbarium, Cairns -eBird Australia -Australian Government - Australian Antarctic Data Centre -Museum and Art Gallery of the Northern Territory -Australian Government National Environmental Science Program -Australian Institute of Marine Science -Reef Life Survey Australia -American Museum of Natural History -Queen Victoria Museum and Art Gallery, Inveresk, Tasmania -Tasmanian Museum and Art Gallery, Hobart, Tasmania -Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Species	Common name	Number of records within search area
Acanthagenys rufogularis	Spiny-cheeked Honeyeater	14
Acanthiza apicalis	Inland Thornbill	2
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	2
Acanthiza uropygialis	Chestnut-rumped Thornbill	1
Accipiter cirrocephalus	Collared Sparrowhawk	1
Anas gracilis	Grey Teal	1
Anthus novaeseelandiae	Australasian Pipit	1
Aquila audax	Wedge-tailed Eagle	3
Ardea pacifica	White-necked Heron	2
Ardeotis australis	Australian Bustard	7
Artamus cinereus	Black-faced Woodswallow	7
Artamus minor	Little Woodswallow	1
Artamus personatus	Masked Woodswallow	9
Barnardius zonarius	Australian Ringneck	6
Cacomantis pallidus	Pallid Cuckoo	6
Certhionyx variegatus	Pied Honeyeater	3
Cincloramphus cruralis	Brown Songlark	2
Colluricincla harmonica	Grey Shrike-thrush	8
Coracina novaehollandiae	Black-faced Cuckoo-shrike	8
Corvus orru	Torresian Crow	5
Cracticus nigrogularis	Pied Butcherbird	11
Cracticus torquatus	Grey Butcherbird	2
Ctenophorus isolepis	Central Military Dragon	2
Ctenophorus nuchalis	Central Netted Dragon	1
Ctenotus pantherinus	Leopard Ctenotus	1
Cyclorana maini	Main's Frog	2
Daphoenositta chrysoptera	Varied Sittella	1
Dasycercus blythi	Brush-tailed Mulgara	3
Dicaeum hirundinaceum	Mistletoebird	1
Egretta novaehollandiae	White-faced Heron	2
Emblema pictum	Painted Finch	2
Epthianura tricolor	Crimson Chat	4
Eurostopodus argus	Spotted Nightjar	3
Falco berigora	Brown Falcon	11
Falco cenchroides	Nankeen Kestrel	3
Falco longipennis	Australian Hobby	1
Falco peregrinus	Peregrine Falcon	1
Gavicalis virescens	Singing Honeyeater	18
Geopelia cuneata	Diamond Dove	8
Geopelia placida	Peaceful Dove	3
Gowidon longirostris	Long-nosed Dragon	1
Grallina cyanoleuca	Magpie-lark	2
Gymnorhina tibicen	Australian Magpie	5
Hamirostra melanosternon	Black-breasted Buzzard	3
Lagorchestes hirsutus	Mala	4
Lalage tricolor	White-winged Triller	9
Leggadina forresti	Central Short-tailed Mouse	1
Lichmera indistincta	Brown Honeyeater	7

Appendix 2. NT Fauna Atlas full list of species recorded within 20km of EL24808

Maalia Da	cin Drilling	Drogram	Evoloration	Mining	Management	Dlan
ingalia Da		s riugiaili	LAPIOI ation	wiining	wanagement	ran

Malurus leucopterus	White-winged Fairy-wren	1
Manorina flavigula	Yellow-throated Miner	17
Melanodryas cucullata	Hooded Robin	1
Melithreptus gularis	Black-chinned Honeyeater	1
Melopsittacus undulatus	Budgerigar	13
Merops ornatus	Rainbow Bee-eater	9
Ninox boobook	Australian Boobook	1
Notaden nichollsi	Desert Spadefoot Toad	1
Notomys alexis	Spinifex Hopping-mouse	3
Nymphicus hollandicus	Cockatiel	2
Ocyphaps lophotes	Crested Pigeon	10
Oreoica gutturalis	Crested Bellbird	12
Osphranter robustus	Common Wallaroo	9
Osphranter rufus	Red Kangaroo	33
Pachycephala rufiventris	Rufous Whistler	5
Petrochelidon nigricans	Tree Martin	2
Pomatostomus temporalis	Grey-crowned Babbler	4
Psephotellus varius	Mulga Parrot	2
Pseudantechinus macdonnellensis	Fat-tailed Pseudantechinus	3
Pseudomys desertor	Desert Mouse	2
Pseudomys hermannsburgensis	Sandy Inland Mouse	4
Ptilotula keartlandi	Grey-headed Honeyeater	12
Ptilotula penicillata	White-plumed Honeyeater	2
Rhipidura albiscapa	Grey Fantail	2
Rhipidura leucophrys	Willie Wagtail	13
Smicrornis brevirostris	Weebill	1
Sminthopsis crassicaudata	Fat-tailed Dunnart	2
Sminthopsis macroura	Stripe-faced Dunnart	4
Sminthopsis youngsoni	Lesser Hairy-footed Dunnart	1
Tachyglossus aculeatus	Short-beaked Echidna	2
Taeniopygia guttata	Zebra Finch	16
Tiliqua multifasciata	Centralian Blue-tongue	2
Todiramphus pyrrhopygius	Red-backed Kingfisher	1
Varanus acanthurus	Ridge-tailed Monitor	1

Species	Number of records within search area	
Abutilon malvifolium	Abutilon	1
Abutilon otocarpum	Abutilon, Keeled Lantern-bush, Desert Chinese Lantern, Desert Lantern	2
Acacia acradenia	3	
Acacia adoxa var. adoxa	Acacia, Wattle	1
Acacia adsurgens	Acacia, Whipstick Wattle, Sugar Brother, Wattle	2
Acacia calcicola	Acacia, Northern Myall, Myall Gidgee, Wattle	1
Acacia cuthbertsonii	Acacia, Silver Witchetty, Pirli, Wattle	2
Acacia cuthbertsonii subsp. cuthbertsonii	Acacia, Silver Witchetty, Pirli, Wattle	4
Acacia estrophiolata	Acacia, Ironwood, Southern Ironwood, Wattle	2
Acacia holosericea	Acacia, Silver Wattle, Silver Leaf Wattle, Silver- leaved Wattle, Candelabra Wattle, Soap Bush, Wattle	1
Acacia kempeana	Acacia, Witchetty Bush, Wattle	5
Acacia ligulata	Acacia, Umbrella Bush, Dune Wattle, Small Cooba, Wattle	2
Acacia monticola	Acacia, Hill Turpentine, Red Wattle, Wattle	2
Acacia pruinocarpa	Acacia, Black Gidgee, Black Wattle, Wattle	3
Acacia sericophylla	Acacia, Dogwood, Wirewood, Wattle	2
Acacia tenuissima	Acacia, Broom Wattle, Minyana, Narrow-leaved Wattle, Wattle	1
Acacia validinervia	Acacia, Blue Wattle, Wattle	2
Amaranthus interruptus	Amaranthus, Native Amaranth	1
Anacampseros australiana	Anacampseros	1
Anemocarpa saxatilis	Anemocarpa, Hill Sunray	1
Aristida nitidula	Aristida, Flat-awned Three-awn, Three-awn, Wiregrass	1
Aristida obscura	Aristida, Brush Three-awn, Brush Wiregrass, Three-awn, Wiregrass	1
Atalaya hemiglauca Atalaya, Whitewood		2
Bonamia pannosa	Bonamia, Large Bonamia	1
Bothriochloa ewartiana	Bothriochloa, Desert Bluegrass, Forest Bluegrass	1
Bulbostylis turbinata	Bulbostylis	1
Calandrinia balonensis	Calandrinia, Broad-leaf Parakeelya	4
Capparis spinosa subsp. nummularia	Capparis, Caper Bush, Wild Passionfruit, Nipan	1
Carissa lanceolata	Carissa, Conkerberry, Conkle Berry, Currant Bush, Kungsberry Bush	1
Clerodendrum floribundum	Clerodendrum, Smooth Clerodendrum, Smooth Spiderbush, Lollybrush, Lolly Bush	1
Corymbia deserticola subsp. mesogeotica	Corymbia, Desert Bloodwood	1
Cremnothamnus thomsonii	Cremnothamnus, Cliffside Daisy, Thomsons Daisy	1
Cucumis argenteus		1
Cullen graveolens	Cullen, Native Lucerne	1
Cymbopogon ambiguus	Cymbopogon, Lemon-scented Grass, Native Lemon Grass, Scent Grass, Scented Oil-grass	1

Appendix 3. NT Flora Atlas full list of species recorded within 20km of EL24808

Cyperus blakeanus	Cyperus, Nutgrass	1
Cyperus centralis	Cyperus, Nutgrass	1
Cyperus iria	Cyperus, Variable Sedge, Nutgrass	1
Dichanthium sericeum subsp. sericeum	Dichanthium, Silky Bluegrass, Queensland Bluegrass, Slender Queensland Bluegrass	1
Dicrastylis exsuccosa	Dicrastylis, Rusty Sand-sage	1
Dicrastylis gilesii	Dicrastylis	1
Digitaria ctenantha	Digitaria, Comb Finger Grass	1
Digitaria longiflora	Digitaria	1
Enchylaena tomentosa	Enchylaena, Ruby Saltbush, Sturts Saltbush, Plum Puddings, Berry Cottonbush	2
Enneapogon clelandii	Enneapogon, Conetop Nine-awn, Clelands Nine- awn	1
Enneapogon eremophilus	Enneapogon	1
Enneapogon oblongus	Enneapogon, Rock Nine-awn, Purple-head Nine- awn	2
Enteropogon acicularis	Enteropogon, Curly Windmill Grass, Umbrella Grass, Spider grass	2
Eragrostis elongata	Eragrostis, Clustered Lovegrass, Close-headed Lovegrass, Lovegrass	1
Eragrostis laniflora	Eragrostis, Hairy-flowered Woollybutt, Lovegrass	1
Eragrostis olida	Eragrostis, Lovegrass	2
Eragrostis tenellula	Eragrostis, Delicate Lovegrass, Lovegrass	1
Eragrostis xerophila	Eragrostis, Knottybutt Neverfail, Lovegrass	1
Eremophila gilesii	Eremophila, Mulga Fuchsia, Giles Desert Fuchsia, Turkey Bush	1
Eremophila gilesii subsp. gilesii	Eremophila, Mulga Fuchsia, Giles Desert Fuchsia, Turkey Bush	2
	Eremophila Native Euchsia Latrobes Desert	
Eremophila latrobei	Fuchsia, Georgina Poison Bush	4
Eremophila latrobei Eremophila youngii subsp. lepidota	Fuchsia, Georgina Poison Bush Eremophila	4
Eremophila latrobei Eremophila youngii subsp. lepidota Eriachne mucronata	Fuchsia, Georgina Poison Bush Eremophila Eriachne, Mountain Wanderrie Grass, Wanderrie Grass	4 1 1
Eremophila latrobei Eremophila youngii subsp. lepidota Eriachne mucronata Eucalyptus gamophylla	Fuchsia, Georgina Poison Bush Eremophila Eriachne, Mountain Wanderrie Grass, Wanderrie Grass Eucalyptus, Blue Mallee, Twin Leaf Mallee, Twin- leaved Mallee, Blue-leaved Mallee, Warilu	4 1 1 4
Eremophila latrobei Eremophila youngii subsp. lepidota Eriachne mucronata Eucalyptus gamophylla Eucalyptus normantonensis	Fuchsia, Georgina Poison Bush Eremophila Eriachne, Mountain Wanderrie Grass, Wanderrie Grass Eucalyptus, Blue Mallee, Twin Leaf Mallee, Twin- leaved Mallee, Blue-leaved Mallee, Warilu Eucalyptus, Normanton Box	4 1 1 4 1
Eremophila latrobei Eremophila youngii subsp. lepidota Eriachne mucronata Eucalyptus gamophylla Eucalyptus normantonensis Eucalyptus pachyphylla	Fuchsia, Georgina Poison Bush Eremophila Eriachne, Mountain Wanderrie Grass, Wanderrie Grass Eucalyptus, Blue Mallee, Twin Leaf Mallee, Twin- leaved Mallee, Blue-leaved Mallee, Warilu Eucalyptus, Normanton Box Eucalyptus, Red-bud Mallee	4 1 1 4 1 4 4
Eremophila latrobei Eremophila youngii subsp. lepidota Eriachne mucronata Eucalyptus gamophylla Eucalyptus normantonensis Eucalyptus pachyphylla Euphorbia biconvexa	Fuchsia, Georgina Poison Bush Eremophila Eriachne, Mountain Wanderrie Grass, Wanderrie Grass Eucalyptus, Blue Mallee, Twin Leaf Mallee, Twin- leaved Mallee, Blue-leaved Mallee, Warilu Eucalyptus, Normanton Box Eucalyptus, Red-bud Mallee Euphorbia	4 1 1 4 1 4 1 1
Eremophila latrobei Eremophila youngii subsp. lepidota Eriachne mucronata Eucalyptus gamophylla Eucalyptus normantonensis Eucalyptus pachyphylla Euphorbia biconvexa Euphorbia centralis	Fuchsia, Georgina Poison Bush Eremophila Eriachne, Mountain Wanderrie Grass, Wanderrie Grass Eucalyptus, Blue Mallee, Twin Leaf Mallee, Twin- leaved Mallee, Blue-leaved Mallee, Warilu Eucalyptus, Normanton Box Eucalyptus, Red-bud Mallee Euphorbia Euphorbia	4 1 1 4 1 4 1 1 1
Eremophila latrobei Eremophila youngii subsp. lepidota Eriachne mucronata Eucalyptus gamophylla Eucalyptus normantonensis Eucalyptus pachyphylla Euphorbia biconvexa Euphorbia centralis Euphorbia inappendiculata var. queenslandica	Fuchsia, Georgina Poison Bush Eremophila Eriachne, Mountain Wanderrie Grass, Wanderrie Grass Eucalyptus, Blue Mallee, Twin Leaf Mallee, Twin- leaved Mallee, Blue-leaved Mallee, Warilu Eucalyptus, Normanton Box Eucalyptus, Red-bud Mallee Euphorbia Euphorbia Euphorbia	4 1 1 4 1 4 1 1 1 1 1
Eremophila latrobei Eremophila youngii subsp. lepidota Eriachne mucronata Eucalyptus gamophylla Eucalyptus normantonensis Eucalyptus pachyphylla Euphorbia biconvexa Euphorbia centralis Euphorbia inappendiculata var. queenslandica Euphorbia tannensis	Fuchsia, Georgina Poison Bush Eremophila Eriachne, Mountain Wanderrie Grass, Wanderrie Grass Eucalyptus, Blue Mallee, Twin Leaf Mallee, Twin- leaved Mallee, Blue-leaved Mallee, Warilu Eucalyptus, Normanton Box Eucalyptus, Red-bud Mallee Euphorbia Euphorbia Euphorbia Euphorbia Euphorbia	4 1 1 4 1 4 1 1 1 1 1 1
Eremophila latrobei Eremophila youngii subsp. lepidota Eriachne mucronata Eucalyptus gamophylla Eucalyptus normantonensis Eucalyptus pachyphylla Euphorbia biconvexa Euphorbia centralis Euphorbia inappendiculata var. queenslandica Euphorbia tannensis Euphorbia tannensis	Fuchsia, Georgina Poison Bush Eremophila Eriachne, Mountain Wanderrie Grass, Wanderrie Grass Eucalyptus, Blue Mallee, Twin Leaf Mallee, Twin- leaved Mallee, Blue-leaved Mallee, Warilu Eucalyptus, Normanton Box Eucalyptus, Red-bud Mallee Euphorbia Euphorbia Euphorbia Euphorbia Euphorbia, Caustic Bush, Desert Spurge, Bottle Tree Caustic Euphorbia, Caustic Bush, Desert Spurge, Bottle Tree Caustic	4 1 1 4 1 4 1 1 1 1 1 1 1 1 1
Eremophila latrobei Eremophila youngii subsp. lepidota Eriachne mucronata Eucalyptus gamophylla Eucalyptus normantonensis Eucalyptus pachyphylla Euphorbia biconvexa Euphorbia centralis Euphorbia centralis Euphorbia inappendiculata var. queenslandica Euphorbia tannensis Euphorbia tannensis Euphorbia tannensis Euphorbia tannensis subsp. eremophila	Fuchsia, Georgina Poison Bush Eremophila Eriachne, Mountain Wanderrie Grass, Wanderrie Grass Eucalyptus, Blue Mallee, Twin Leaf Mallee, Twin- leaved Mallee, Blue-leaved Mallee, Warilu Eucalyptus, Normanton Box Eucalyptus, Red-bud Mallee Euphorbia Euphorbia Euphorbia Euphorbia Euphorbia, Caustic Bush, Desert Spurge, Bottle Tree Caustic Euphorbia, Caustic Bush, Desert Spurge, Bottle Tree Caustic Euphorbia, Blue Periwinkle, Tropical Speedwell	4 1 1 4 1 4 1 1 1 1 1 1 1 1 2
Eremophila latrobei Eremophila youngii subsp. lepidota Eriachne mucronata Eucalyptus gamophylla Eucalyptus normantonensis Eucalyptus pachyphylla Euphorbia biconvexa Euphorbia centralis Euphorbia centralis Euphorbia inappendiculata var. queenslandica Euphorbia tannensis Euphorbia tannensis	Fuchsia, Georgina Poison Bush Eremophila Eriachne, Mountain Wanderrie Grass, Wanderrie Grass Eucalyptus, Blue Mallee, Twin Leaf Mallee, Twin- leaved Mallee, Blue-leaved Mallee, Warilu Eucalyptus, Normanton Box Eucalyptus, Red-bud Mallee Euphorbia Euphorbia Euphorbia Euphorbia Euphorbia, Caustic Bush, Desert Spurge, Bottle Tree Caustic Euphorbia, Caustic Bush, Desert Spurge, Bottle Tree Caustic Euphorbia, Blue Periwinkle, Tropical Speedwell Fimbristylis, Fringe-rush	4 1 1 4 1 4 1 1 1 1 1 1 2 1
Eremophila latrobei Eremophila youngii subsp. lepidota Eriachne mucronata Eucalyptus gamophylla Eucalyptus normantonensis Eucalyptus pachyphylla Euphorbia biconvexa Euphorbia centralis Euphorbia inappendiculata var. queenslandica Euphorbia tannensis Euphorbia tannensis	Fuchsia, Georgina Poison Bush Eremophila Eriachne, Mountain Wanderrie Grass, Wanderrie Grass Eucalyptus, Blue Mallee, Twin Leaf Mallee, Twin- leaved Mallee, Blue-leaved Mallee, Warilu Eucalyptus, Normanton Box Eucalyptus, Red-bud Mallee Euphorbia Euphorbia Euphorbia Euphorbia Euphorbia, Caustic Bush, Desert Spurge, Bottle Tree Caustic Euphorbia, Caustic Bush, Desert Spurge, Bottle Tree Caustic Euphorbia, Caustic Bush, Desert Spurge, Bottle Tree Caustic Evolvulus, Blue Periwinkle, Tropical Speedwell Fimbristylis, Fringe-rush Fimbristylis, Iukarrara	4 1 1 4 1 4 1 1 1 1 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1
Eremophila latrobei Eremophila youngii subsp. lepidota Eriachne mucronata Eucalyptus gamophylla Eucalyptus normantonensis Eucalyptus pachyphylla Euphorbia biconvexa Euphorbia centralis Euphorbia centralis Euphorbia inappendiculata var. queenslandica Euphorbia tannensis Euphorbia tannensis	Fuchsia, Georgina Poison Bush Eremophila Eriachne, Mountain Wanderrie Grass, Wanderrie Grass Eucalyptus, Blue Mallee, Twin Leaf Mallee, Twin- leaved Mallee, Blue-leaved Mallee, Warilu Eucalyptus, Normanton Box Eucalyptus, Red-bud Mallee Euphorbia Euphorbia Euphorbia Euphorbia Euphorbia, Caustic Bush, Desert Spurge, Bottle Tree Caustic Euphorbia, Caustic Bush, Desert Spurge, Bottle Tree Caustic Evolvulus, Blue Periwinkle, Tropical Speedwell Fimbristylis, Fringe-rush Fimbristylis, Iukarrara Goodenia, Pinnate Goodenia, Mountain Primrose	4 1 1 4 1 4 1 1 1 1 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1
Eremophila latrobei Eremophila youngii subsp. lepidota Eriachne mucronata Eucalyptus gamophylla Eucalyptus normantonensis Eucalyptus pachyphylla Euphorbia biconvexa Euphorbia centralis Euphorbia centralis Euphorbia inappendiculata var. queenslandica Euphorbia tannensis Euphorbia tannensis	Fuchsia, Georgina Poison Bush Eremophila Eriachne, Mountain Wanderrie Grass, Wanderrie Grass Eucalyptus, Blue Mallee, Twin Leaf Mallee, Twin- leaved Mallee, Blue-leaved Mallee, Warilu Eucalyptus, Normanton Box Eucalyptus, Red-bud Mallee Euphorbia Euphorbia Euphorbia Euphorbia Euphorbia, Caustic Bush, Desert Spurge, Bottle Tree Caustic Euphorbia, Caustic Bush, Desert Spurge, Bottle Tree Caustic Euphorbia, Caustic Bush, Desert Spurge, Bottle Tree Caustic Evolvulus, Blue Periwinkle, Tropical Speedwell Fimbristylis, Fringe-rush Fimbristylis, Iukarrara Goodenia, Pinnate Goodenia, Mountain Primrose Goodenia, Stick Hand-flower	4 1 1 4 1 4 1 1 1 1 1 1 1 1 1 1 1 1 1

Ngalia	Basin	Drilling	Program	Exploration	Mining	Management	Plan

Heliotropium cunningnamii	Heliotropium	1
Hibiscus sturtii var. grandiflorus	Hibiscus, Sturts Hibiscus, Sturt's Hibiscus, Hill Hibiscus	1
Hibiscus sturtii var. platychlamys	Hibiscus, Sturts Hibiscus, Sturt's Hibiscus, Hill Hibiscus	1
Indigofera cornuligera subsp. cornuligera	Indigofera	1
Ipomoea costata	Ipomoea, Bush Potato, Potato Vine, Desert Yam	1
Iseilema dolichotrichum	Iseilema, Rough-stemmed Flinders Grass, Flinders Grass	1
Iseilema membranaceum	Iseilema, Small Flinders Grass, Flinders Grass	1
Isoetes muelleri	Isoetes, Quillwort	1
Isotropis winneckei	Isotropis	1
Lechenaultia striata	Lechenaultia, Fanflower	1
Marsdenia australis	Marsdenia, Bush Banana, Lungkwa, Doubah	2
Minuria integerrima	Minuria Smooth Minuria	1
Nicotiana benthamiana	Nicotiana, Native Tobacco, Wild Tobacco	1
	Oldenlandia	1
		1
Olearia ferresii		Ζ
Oxychloris scariosa	Oxychloris, Winged Chloris, Winged Windmill Grass	1
Pandorea doratoxylon	Pandorea, Spearwood, Wonga Vine, Spearbush	2
Paspalidium rarum	Paspalidium, Rare Paspalidium, Bunch Paspalidium	1
Plectranthus intraterraneus	Plectranthus, Purple Spur-flower	1
Pluchea dentex	Pluchea, Bowl Daisy	1
Portulaca oleracea	Portulaca, Pigweed, Common Purslane, Munyeroo	2
Pterocaulon serrulatum var. velutinum	Pterocaulon, Fruit-salad Bush, Apple Bush	1
Ptilotus obovatus	Ptilotus, Smoke Bush, Silver Bush, Silver Tails	1
Ptilotus obovatus var. obovatus	Ptilotus, Smoke Bush, Silver Bush, Silver Tails	1
Ptilotus schwartzii	Ptilotus, Horse Mulla Mulla	3
Rhagodia spinescens	Rhagodia, Spiny Saltbush, Hedge Saltbush	4
Rostellularia adscendens var. latifolia		1
Salsola australis	Salsola, Buckbush, Rolypoly, Tumbleweed, Prickly Saltwort, Soft Rolypoly	2
Santalum lanceolatum	Santalum, Sandalwood, Plumbush, Wild Plum, Plumwood, Northern Sandalwood	1
Scaevola spinescens	Scaevola, Spiny Fanflower, Prickly Fanflower, Incense Bush	2
Sclerolaena costata	Sclerolaena	2
Sclerolaena lanicuspis	Sclerolaena, Woolly Copper Burr	4
Sclerolaena patenticuspis	Sclerolaena, Spear-fruit Copper Burr	2
Senna artemisioides subsp. helmsii	Senna, Cassia, Blunt-leaf Cassia, Crinkled Cassia	2
Senna artemisioides subsp. oligophylla	Senna, Cassia, Oval-leaf Cassia, Limestone Cassia	4
Senna artemisioides subsp. quadrifolia	Senna, Cassia	2
Seringia elliptica	Keraudrenia	1

Ngalia	Basin	Drilling	Program	Exploration	Mining	Management Pl	an
0			- 0 -				

Sida fibulifera	Sida, Silver Sida, Pin Sida	2
Solanum sturtianum	Solanum, Thargomindah Nightshade, Sturts Nightshade	1
Sporobolus actinocladus	Sporobolus, Katoora, Ray Grass	1
Sporobolus australasicus	Sporobolus, Australian Dropseed, Fairy Grass	1
Sporobolus blakei	Sporobolus	1
Stenopetalum nutans	Stenopetalum, Nodding Thread-petal, Spunk Weed	1
Templetonia hookeri	Templetonia	1
Tephrosia lasiochlaena	Tephrosia	1
Thyridolepis xerophila	Thyridolepis	1
Trema tomentosa var. aspera	Trema, Peach-leaved Poison Bush, Poison Peach, Native Peach	1
Triodia hubbardii	Triodia, Hubbards Spinifex, Spinifex	1
Triodia pungens	Triodia, Soft Spinifex, Gummy Spinifex, Spinifex	4
Triodia spicata	Triodia, Spike-flowered Spinifex, Spinifex	2
Triumfetta maconochieana	Triumfetta	1
Triumfetta micracantha	Triumfetta	1
Urochloa gilesii var. gilesii	Urochloa, Hairy-edged Armgrass	1
Urochloa piligera	Urochloa, Hairy Armgrass, Hairy Summer Grass, Green Summer Grass	1
Vittadinia eremaea	Vittadinia, Plains Fuzzweed	1

Appendix 4. Environmental Risk Assessment Methodology

Risk Assessment Methodology

This section describes the environmental risk assessment for potential events that may impact the environment during project activities.

The purpose of the risk assessment is to identify hazards and develop risk-reducing measures to prevent and mitigate impacts from project activities. The assessment also outlines recommended management actions that help to reduce the risk to ALARP.

Environmental risk assessment consists of five basic steps:

- 1. Hazard/Event identification;
- 2. Risk analysis;
- 3. Risk evaluation;
- 4. Risk management; and
- 5. Residual risk analysis.

These steps are described briefly below.

Hazard Identification

Hazard/Event identification involves identifying the sources of risk, i.e. those activities or incidents that could result in an environmental impact.

Risk Analysis

Risk analysis determines the likelihood of an activity or event occurring, <u>and</u> the consequences of that activity or event on the environment. The risk ranking matrix (Figure below), was used to assess the consequence and likelihood of all identified hazards/events. The matrix is based on six classifications of severity and six classifications for the likelihood of a hazard/event.

Risk Evaluation

Risk evaluation prioritises the risks i.e. determines if the risk of an activity or incident is acceptably low, or if management actions are required to reduce the risk to ALARP. The risk evaluation presented in Table below takes existing safeguards and management measures into consideration i.e. represents the residual risk with existing or planned safeguards in place.

Risk Management

Risk management prescribes management measures to mitigate the identified environmental risks in addition to general environmental and other management policies.

Residual Risk Analysis

Residual risk is the risk rating once additional management measures have been implemented; this rating is ALARP.

		Low Risk	Moderate	High Rick	Likelihood – Probability of Harm / Loss					
		LOW MISK	Risk	Thgi Nisk	1	2	3	4	5	6
		Environmenta	al Impact		Unlikely / Unknown Not expected to occur	Remote Potential May occur only in exceptional circumstances	Possible Could occur at some time	Probable Expected to occur at some time	Frequent Likely to occur regularly	Highly Likely Ever present; occurs in most circumstances
	1	Alteration/disturbance within the limits of natural variability; effects not transmitted or accumulating; resources not impaired. Minimal pollution effect, contained locally.			1	2	3	4	5	6
-	2	Temporary alteration/disturbance beyond natural variability; effects confined to site and not accumulating; resources temporarily affected. Minor pollution, slight or negligible impact, negligible remedial or recovery work. Short term, localised and insignificant impacts to habitat or populations. Rapid recovery – measured in hours.			2	4	6	8	10	12
	з	Alteration/dis an ecosystem accumulating impact and outside assist Incidental cha of biota in changes to Recovery pe months.	sturbance of a c n; effects not tr Pollution with recovery wo ance to contain anges to abunda affected area; overall ecologi riod measured	omponent of ansmitted or some onsite rk; possible	3	6	9	12	15	18
	4	Alterations to component recoverable; transmitted/a Significant po and recovery a detectable factors. Reco months.	o one or more e levels, but effects accumulating. ollution with o work. Impact th effect in loca overy period r	cosystems or which are can be ffsite impact nat will cause il ecosystem measured in	4	8	12	16	20	24
	5	Irreversible a ecosystems o effects can be lost sustaina Massive site Detrimental significant e factors. Reco years.	alteration to o or several comp e transmitted, a ability of mos impact and rea effect that w ffect on loca overy period r	ne or more onent levels; ccumulating; t resources. covery work. <i>i</i> ill cause a l ecosystem measured in	5	10	15	20	25	30
	6	Irreversible a ecosystems o effects can be lost sustaina Massive pollu work. Large su likely to cause local ecosyst quality, nu structure an	alteration to o or several comp e transmitted, a ability of mos tion with signific cale detrimental e a highly signific tem factors su trient flow, d food webs,	ne or more onent levels; ccumulating; t resources. cant recovery effect that is cant effect on ch as water community biodiversity,	6	12	18	24	30	36

Low Ecological Services P/L 2021

SEVERITY – Consequence of Harm / Loss

Ngalia Basin Drilling Program Exploration Mining Management Plan

habitat availability and population structure. Long term recovery period measured in decades			
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Risk assessment matrix used in compilation of detailed risk assessment presented in

Appendix 5: Site Description of Habitat and Vegeation attributes observed during on-gorund survey

		-	-					
Site No.: 772	Survey nun	ey number; 220221 Quad. size			ize: 30x	:30 50x50 other:		
Date: 21/02/2022 0			Observer: L	.ES				
Site description & location details: Halfway between start of track and DH5				Landform pattern: Plain				
Zone:	GPS AMG:		E		Ν	Datum:		
Precision:	Precision:			GPS elevation:				
Topographic position: Mid Slope			Photo re	Photo ref. no.: Tablet				
Land unit: Bushy Pa	on off plair	n off plain Patch size (ha): <1			5-50 50-500 500+			
Edge: ecotone or cl	osest distanc	e: 5km	Road Ty	Road Type in Vicinity: 1 2 3 4 (Station road)				
Perm. Water: 0 <50)m 50-500m	0.5-5km >5kr	m Curr. wa	Curr. water: 0 <50m 50-500m 0.5-5km >5km				
Climate: 1 = Dry, plant stress 2 = Dry, no plant stress 3 = Recent rain, no vegetation response 4 = Recent rain, noticeable vegetation response								
Disturbance: 0 = no visible impact 1 = disturbance present but negligible impact 2 = low level of disturbance throughout quadrat, or moderate level in patches in the quadrat 3 = moderate level of disturbance throughout quadrat, or high level in patches in the quadrat 4 = high level of disturbance throughout quadrat, or major level in patches in the quadrat 5 = major impact affecting all of quadrat								
Fire impact: 0 1 2 3 4 5 Last fire: this year last year 2+ years ago long unburn Rabbit damage: 0 1 2 3 4 5 Camels: 0 1					ago long unburnt (5+) Camels: 0 1 2 3 4			
		-		5				
Weeds: 0 1 2 3 4	5	Other: 0 1	2345 de	3 4 5 describe:				
Bare soil (%):	35 %	Vegetation I	Litter (%):	10	% Ro	sk type		
Rock cover (%):	0 %	Ground Veg	etation (%):	55	% Sar	idstone		
Outcrop: 0 %	Rock / sto	ne: 0%	Bare ground	l: 100	% Oth Met	Conglomerate Other sedimentary: Metamorphic Granite		
Pebbles (<0.6cm): Small stones (0.6-20 Stones (2-6cm): Small rocks (6-20cm Rocks (20-60cm): Big rocks (60cm-2m Boulders (>2m): Outcrop / slab:	cm): 0 <2 0 <2 n): 0 <2 1): 0 <2 1): 0 <2 0 <2 0 <2	2-10 10-20 2 2-40 10-20 2 2-10 10-20 2	20-50 50-70 20-50 50-70 20-50 50-70 20-50 50-70 20-50 50-70 20-50 50-70 20-50 50-70 20-50 50-70	70-90 >90 70-90 >90 70-90 >90 70-90 >90 70-90 >90 70-90 >90 70-90 >90 70-90 >90	Qua D Lim D Bas D Col D Oth D Litt	Quartzite Limestone Basalt Colluvium Other:		
Soil texture: sand Soil colour: Red	sandy loam	loam loamy	clay clay loar	n clay cr	racking o	ay peat rock other:		

Site Description : Habitat and vegetation attributes. (Taken from Neave et al. (2004)).

Soil depth (cm): 0 <10 10-40 ≥40 Soil pH - surface: 7cm:							
Soil crust, termites, log habitat and vegetation strata structure							
Crust present: no bl	Crust cove	er (%): 25	Crust pH: ~7				
Termite mounds (no.):	ı): -	Profile: tower dome underground					
Number of fallen logs >15cm diameter in the quadrat: 1 > 15 15 > 7cm							
Vegetation community: Percentage foliage cover of tallest plant layer (Circle one)							
Life form and height of tallest stratum	Dense (70-100%	6)	Mid-dense (30-70%)	Sparse (10-30%)		Very sparse (<10%)	
Trees > 30 m	Tall closed-fo	orest T	all open-forest	Tall woodland		Tall open-woodland	
Trees 10-30 m	Closed-fore	est	Open -forest	pen -forest Wo		Open-woodland	
Trees 5-10 m	Low closed-fo	forest Lo	ow open-forest	Low w	/oodland	Low open-woodland	
Shrubs 2-8 m Close		rub	Open-scrub	Tall shrubland		Tall open-shrubland	
Shrubs 0-2 m Closed -		ath	Open-heath Low		hrubland	Low open-shrubland	
Three most domin	nant specie	es:					
Overstorey		Midstorey			Lower storey		
1. Acacia aneura (ACAN) 1. Ac			icia kempeana (ACKE)		 Senna artemisioides subsp. Helmsii (SE ART) 		
2. Acacia estrophiolata (ACES) 2. Ac			icia aneura (ACAN)		2. Sclerolaena bicornis (SCBI)		
3.	3	3. Acacia adsurgens (ACAD)			3. Aristida Contorta (ARCO)		

Strata	Dominant species (record in order of dominance)	Average ht. (m) of strata	Cover (%) of strata (% cover classes)			
Emergent tree layer:	 Acacia aneura (ACAN) 	8	<10 10-30 30-70 >70			
Upper shrub layer:	 Acacia kempeana (ACKE) Acacia aneura (ACAN) Acacia adsurgens (ACAD) Eremophila latrobei (ERLA) 	4	<u>≪10</u> 10-30 30-70 >70			
Lower shrub layer:	 Senna artemisioides subsp. Helmsii (SE ART) Sclerolaena bicornis (SCBI) Aristida Contorta (ARCO) 	1	<10 10-30 <u>30-70</u> >70			
Ground layer:	 Senna artemisioides subsp. Helmsii (SE ART) Scleroloena bicornis (SCBI) Aristida Contorta (ARCO) Abutilon otocarpum (ABOT) Portulaca oleracea (POOL) Eragrostis eriopoda (ERER) Evolvulus alsinoides (EVAL) Trianthema triquetra (TRTR) Cleome viscosa (CLVI) Ptilotus arthrolasius (PTR) 	0.4	<10 10-30 <u>30-70</u> >70			

Site Description : Habitat and vegetation attributes. (Taken from Neave et al. (2004)).

Site No.: 773	Survey num		Quad. size: 30x30 50x50 other:											
Date: 21/02/2022			Observer: L	ES										
Site description & l	ocation detail	s:			Landfo	rm pattern:								
DH5, Bushy Park LS	/ Singleton LS			Plain										
Zone:	GPSAMG:		E		N	Datum:								
Precision:			GPS elev	GPS elevation:										
Topographic position	on: Mid Slope		Photo re	Photo ref. no.: Tablet										
Land unit: SI LS/ Bu Park LS	Land unit: SI LS/ Bush Run: on off Park LS			Patch size (ha): <1 1-5 5-50 50-500 500+										
Edge: ecotone or cl	osest distance	: 2km	Road Ty	Road Type in Vicinity: 1 2 3 4 (Station Road)										
Perm. Water: 0 <50)m 50-500m	0.5-5km >5kn	Curr. wat	Curr. water: 0 <50m 50-500m 0.5-5km >5km										
Climate: 1 = Dry, plant stress 2 = Dry, no plant stress 3 = Recent rain, no vegetation response = Recent rain, noticeable vegetation response														
0 = no visible impact 1 = disturbance present but negligible impact 2 = low level of disturbance throughout quadrat, or moderate level in patches in the quadrat 3 = moderate level of disturbance throughout quadrat, or high level in patches in the quadrat 4 = high level of disturbance throughout quadrat, or major level in patches in the quadrat 5 = major impact affecting all of quadrat														
Fire impact: 0 1 2	345	Last fire: t	his year last	year 2+	years ag	o long unburnt								
Rabbit damage: 0 1 2 3 4 5 Introduced I			herbivores: 0	rbivores: 0 1 2 3 4 5 Camels: 0 1 2 3 4 5 5										
Weeds: 0 1 2 3 4 5 Other: 0 1			2345 des	3 4 5 describe:										
Bare soil (%):	30 %	Vegetation Litter (%):		10	% Roc	Rock type								
Rock cover (%):	0 %	Ground Veg	etation (%):	60	% San	dstone								
Outcrop: 0 %	Rock / stor	ne: 0 %	Bare ground	: 100	% Othe Meta Grai	Other sedimentary: Metamorphic Granite								
Pebbles (<0.6cm): 0 <2 2-10 10-20 2 Small stones (0.6-2cm): 0 <2 2>40 10-20 2			20-50 50-70 7 20-50 50-70 7	1-50 50-70 70-90 >90 Quartzite 1-50 50-70 70-90 >90 Limestone										
Stones (2-6cm): 0 <2 2-10 10-20 2 Small rocks (6-20cm): 0 <2 2-10 10-20 2		20-50 50-70 7 %9-50 50-70 7	'0-90 >90 'n.an >an	Coll	Colluvium									
Rocks (20-60cm): 0 <2 2-10 10-20 2			20-50 50-70 7	50 50-70 70-90 >90 Other:										
Big rocks (60cm-2m): 0 <2 2-10 10-20 2			20-50 50-70-7	Q-90 >90		`								
Boulders (>2m):	Boulders (>2m): 0 <2 2-10 10-20 2		20-50 50-70 7	0-90-290	Lith	Lithology:								
Outcrop / slab: 0 <2 2-10 10-20 20-50 50-70 70-90 >90														
Soil texture: sandy loam loamy clay clay loam clay cracking clay peat rock other: Soil colour: Red (Sandy clay loam)														
_														
---	--	---	----------------------	--	--	-----------------------------------	------------------------	---	--------------	----------------	--	------------	-----------------------	-------
;	Soil depth (cm):	0 <	<10	10-40	>40		Soil pH	- sur	face:	~	7.	cm:		
-	Soil crust, termit	es, lo	g hal	bitat ar	nd vege	tation	strata s	truct	ure					
(Crust present:	no	blac	k gre	en d	ear	Crust	cove	er (%):	25	%	Crust p	oH: ~7	
	Termite mounds	(no.):	3		Max. h	t. (m):	: 1.2		Profile	: to	wer o	dome	undergro	ound
1	Number of fallen	logs	>15c	m dian	neter in	the q	uadrat:	0 > 1	5cm	8 > 7	cm			
	Vegetation community: (Circle one)	Vegetation community: (Circle one)				Percei	ntage foli	age co	over of t	allest	plant l	ayer		
	Life form and hei of tallest stratum	Life form and height Den of tallest stratum (70-10		Dens (70-10	e 0%)	N	/lid-dense (30-70%)	2	S (1	parse 0-309	⊧ ≤)	v	Very sparse (<10%)	
	Trees > 30 m		Tal	l closed	-forest	Tall	open-for	est	Tall v	wood	land	Tall o	pen-woo	dland
	Trees 10-30 m		C	losed-f	orest	0	pen -fores	st	We	oodla	nd	Ope	en-woodl	and
	Trees 5-10 m		Lov	v closed	-forest	Low	open-for	rest	Low	wood	land	Low o	pen-woo	dland
	Shrubs 2-8 m		C	losed -s	crub	0	pen-scrut	ь	Talls	shrub	land	Tall o	pen-shru	bland
	Shrubs 0-2 m		C	losed -h	neath	0	pen-heat	h	Low	shrub	land	Low o	pen-shru	bland
	Three most dominant species:										-			
ļ	Overstorey				Mids	torey	·		Lower storey					
	 Acacia aneura (. 	ACAN)			1. Acad	tia kem	peana (AC	CKE) 1. Senna artemisioides subsp. Helmsii (SE ART)						
	2. Acacia estrophic	olata (A	CES)		2. Acc	icia ane	eura (ACA)	V)		2.	Sclerola	iena bicor	nis (SCBI)	
	3.				3. Acad	ria adsu	urgens (AC	CAD) 3. Aristida Contorta (ARCO)						
	Strata	Dom (reco	inan rd in	t speci order (ies of domin	ance)		Average ht. (m) of strata			Cover (%) of strata (% cover classes)			
	Emergent tree layer:		Ac	cacía an	eura (ACi	tN)			8		<10	10-30	30-70	>70
l	Upper shrub ayer:	-	Ac Ac Ac El	cacia kei cacia an cacia ad remophi	npeana (. eura (AC: surgens (. la latrobi	ACKE) AN) ACAD) si (ERLJ	1)	4 <11			<10	10-30	30-70	>70
Lower shrub layer: Scierolaena bicorri Aristida Contorta				emisioide a bicorni ontorta (J	s subsp. is (SCBI ARCO)	. Helmsli)		1		<10	10-30	30-70	>70	
Ground layer: Senna artemisioides subsp. H (SE ART) Scierolaena bicornis (SCBI) Aristida Contorta (ARCO) Abutilon otocarpum (ABOT) Portulaca oleracea (POOL) Eragrostis eriopoda (ERER) Evolvulus alsinoides (EVAL) Trianthema triquetra (TRTR) Cleome viscosa (CLVI)				. Helmsli T)) R) L) TR)		0.4	_	<10	10-30	30-70	>70			

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Ptilotus arthrolasius (PTR)

Site Description : Habitat and vegetation attributes. (Taken from Neave et al. (2004)).

Site No.: 775	Survey nun	nber; 220221		Quad. size: 30x30 50x50 other:					
Date: 21/02/2022			Observer: L	.ES					
Site description & I Bushy Park LS	ocation detai	ls:	•		Landfo Plain	orm pattern:			
Zone:	GPS AMG:		E		N	Datum:			
Precision:			GPS elev	vation:					
Topographic positi	on: Mid Slope	2	Photo re	f. no.: Tal	blet				
Land unit: Bushy Pa LS	ark Run:	on off plai	n Patch siz	ze (ha): ᠂	<1 1-5	5-50 50-500 <u>500+</u>			
Edge: ecotone or d	osest distanc	e: 0.5km	Road Ty	pe in Vici	nity: 1	2 3 4 (Station Road)			
Perm. Water: 0 <5	0m 50-500m	0.5-5km >5k	m Curr. wa	ter: 0 <5	0m 50-8	500m 0.5-5km >5km			
Climate: 1 = Dry, p 4 = Recent rain, noti	olant stress ceable vegeta	2 = Dry, no pla tion response	ant stress 3 =	= Recent r	ain, no v	regetation response			
0 = no visible impact 1 = disturbance pres 2 = low level of distu 3 = moderate level of 4 = high level of distu 5 = major impact affe Fire impact: 0 1 2 Rabbit damage: 0	0 = no visible impact 1 = disturbance present but negligible impact 2 = low level of disturbance throughout quadrat, or moderate level in patches in the quadrat 3 = moderate level of disturbance throughout quadrat, or high level in patches in the quadrat 4 = high level of disturbance throughout quadrat, or major level in patches in the quadrat 5 = major impact affecting all of quadrat Fire impact: 0 1 2 3 4 5 Last fire: this year last year 2+ years ago long unburnt Rabbit damage: 0 1 2 3 4 5								
Weeds: 0 1 2 3 4	5	Other: 0 1	2345 de	2345 describe:					
Bare soil (%):	35 %	Vegetation	Litter (%):	20	% Roo	k type			
Rock cover (%):	0 %	Ground Veg	etation (%):	45	% San	dstone			
Outcrop: 0 %	Rock / sto	ne:0%	Bare ground	i: 100	% Oth Met Gra	glomerate el sedimentary: amorphic nite			
Pebbles (<0.6cm): Small stones (0.6-2 Stones (2-6cm): Small rocks (6-20cm Rocks (20-60cm): Big rocks (60cm-2m Boulders (>2m): Outcrop / slab:	20-50 50-70 20-50 50-70 20-50 50-70 20-50 50-70 20-50 50-70 20-50 50-70 20-50 50-70 20-50 50-70	0-50 50-70 70-90 >90 Quartzite 0-50 50-70 70-90 >90 Limestone 0-50 50-70 70-90 >90 Basalt Colluvium 0-50 50-70 70-90 >90 Difference Colluvium 0-50 50-70 70-90 >90 Other: Other: 0-50 50-70 70-90 >90 Other: Other:							
Soil texture: sand Soil colour: Red	sandy loam	loam loamy	clay clay loar Sandy Clay	n clay cr Loam	racking o	lay peat rock other:			

Soil depth (cm): 0	Soil depth (cm): 0 <10 10-40 >40 Soil pH - surface: ~7cm:							
Soil crust, termites, lo	og habitat a	nd veget	ation	strata stru	cture			
Crust present: no	black gr	een cle	ar	Crust cov	er (%):	60 %	Crust pH: ~7	
Termite mounds (no.)	: 2	Max. ht.	(m):	0.3	Profile	tower	dome underground	
Number of fallen logs >15cm diameter in the quadrat: 2 >15cm 8 > 7cm								
Vegetation community: Percentage foliage cover of tallest plant layer (Circle one)						layer		
Life form and height of tallest stratum	Dense (70-100%)		Mi (3	Mid-dense (30-70%) (iparse 0-30%)	Very sparse (<10%)	
Trees > 30 m	Tall closed-forest		Tall o	pen-forest	Tall	woodland	Tall open-woodland	
Trees 10-30 m	Closed-forest		Op	en -forest	Woodland		Open-woodland	
Trees 5-10 m	Low closed	i-forest	Low	open-forest	Low woodland		Low open-woodland	
Shrubs 2-8 m	Closed -	scrub	Ор	en-scrub	Talls	shrubland	Tall open-shrubland	
Shrubs 0-2 m	Closed -	heath	Op	en-heath	Low	shrubland	Low open-shrubland	
Three most domi	nant spe	cies:						
Overstorey Midsto			rey			Lower s	storey	
1. Acacia aneura (ACAN)	1. Acacia	aneu	aneura (ACAN) 1. Sida platycalyx (SIPL)			tycalyx (SIPL)		
2. Acacia estrophiolata (ACES) 2. Acacia			i kemp	eana (ACKE)	 Sclerolaena cornishiana (SCCO) 			
3. Eucalyptus gamophylla (EUGA) 3. Eremophi				sturtii (ERST) 3. Sclerolaena bicornis (SCBI)				

Strata	Dominant species	Average ht.	Cove	er (%) of	strata	
	(record in order of dominance)	(iii) or strata	(% co	over clas	ses)	
Emergent tree	Acacia aneura (ACAN)	8	-10	40.00	aa 7a	- 70
layer:	Acacia estrophiolata (ACES)		<10	10-30	30-70	>/0
	Eucalyptus gamophylla (EUGA)					
Upper shrub	Acacia kempeana (ACKE)	2				
layer:	Acacia aneura (ACAN)		<10	10-30	30-70	>70
	Eremophila sturtii (ERST)					
Lower shrub	Aristida Contorta (ARCO)	0.5		10-30	30-70	>70
layer:	Sclerolaena bicornis (SCBI)		<10			
Ground layer:	Aristida Contorta (ARCO)	0.4			30-70	>70
	Sclerolaena bicornis (SCBI)		<10	10-30		
	Sida platycalyx (SIPL)					
	Sclerolaena cornishiana (SCCO)					
	Portulaca oleracea (POOL)					
	Eragrostis eriopoda (ERER)					
	Trianthema triquetra (TRTR)					
	Enneapogon polyphyllus (ENPO)					
	Evolvulus alisinoides (EVAL)					

Site Description : Habitat and vegetation attributes. (Taken from Neave et al. (2004)).

Site No.: 777	Survey nun	nber; 220221		Quad. size: 30x30 50x50 other:					
Date: 21/02/2022			Observer: L	.ES					
Site description & I Bushy Park	ocation deta	ils:			Landfo Plain	rm pattern:			
Zone:	GPS AMG:		E		N	Datum:			
Precision:	GPS elev	ation:							
Topographic positi	on: Mid Slope	2	Photo re	f. no.: Tab	olet				
Land unit: Bushy Pa	n Patch siz	te (ha): ⊲	1 1-5	5-50 50-500 500+					
Edge: ecotone or d	losest distanc	e: 1km	Road Ty	pe in Vici	nity: 1	2 3 4 (none)			
Perm. Water: 0 <5	0m 50-500m	0.5-5km >5ki	m Curr. wa	ter: 0 <5	0m 50-5	00m 0.5-5km >5km			
Climate: 1 = Dry, g 4 = Recent rain, noti	Climate: 1 = Dry, plant stress 2 = Dry, no plant stress 3 = Recent rain, no vegetation response 4 = Recent rain, noticeable vegetation response								
0 = no visible impact 1 = disturbance present but negligible impact 2 = low level of disturbance throughout quadrat, or moderate level in patches in the quadrat 3 = moderate level of disturbance throughout quadrat, or high level in patches in the quadrat 4 = high level of disturbance throughout quadrat, or major level in patches in the quadrat 5 = major impact affecting all of quadrat Eire impact: 0, 1, 2, 3, 4, 5, Last fire: this year, last year, 2+ years ago, long unburght									
Rabbit damage: 0	12345	Introduced	herbivores: (rbivores: 0 1 2 3 4 5 Camels: 0 1 2 3 4 5					
Weeds: 0 1 2 3 4	5	Other: 0 1	2345 de	3 4 5 describe:					
Bare soil (%):	20 %	Vegetation	Litter (%):	10 9	% Roc	k type			
Rock cover (%):	0 %	Ground Veg	etation (%):	70	% San	dstone			
Outcrop: 0 %	Rock / sto	ne: 0%	Bare ground	: 100	% Othe Meta Gran	glomerate r sedimentary: amorphic nite			
Pebbles (<0.6cm): Small stones (0.6-2 Stones (2-6cm): Small rocks (6-20cm Rocks (20-60cm): Big rocks (60cm-2m Boulders (>2m): Outgrop (slab):	20-50 50-70 20-50 50-70 20-50 50-70 20-50 50-70 20-50 50-70 20-50 50-70 20-50 50-70 20-50 50-70	1-70 70-90 >90 Quartzite 1-70 70-90 >90 Limestone 1-70 70-90 >90 Basalt Colluvium 1-70 70-90 >90 Other: Other: 1-70 70-90 >90 Other:							
Soil texture: sand	sandy loam	loam loamy	clay clay loan	n clay cr	acking c	lay peat rock other:			
Soll colour: Red			(Sandy Cl	ay Loam) ·	– little s	ano			

Soil depth (cm): 0	<10 10-40	>40	1	Soil pH - su	rface:	~7	cm:	
Soil crust, termites, lo	og habitat ar	nd vegeta	tion	strata stru	cture			
Crust present: no	black gre	en clea	ar	Crust cov	er (%):	90 %	Crust pH: 7.5	
Termite mounds (no.)	: 0	Max. ht.	(m):	0	Profile	tower	dome underground	
Number of fallen logs >15cm diameter in the quadrat: 5 > 15cm, 21 > 7cm								
Vegetation community: (Circle one)	Pe	rcent	age foliage c	over of t	allest plant	layer		
Life form and height of tallest stratum	Dense (70-100%)		M (3	Mid-dense S (30-70%) (1		iparse 0-30%)	Very sparse (<10%)	
Trees > 30 m	Tall closed-	ed-forest Ta		open-forest	Tall woodland		Tall open-woodland	
Trees 10-30 m	Closed-forest		Op	en -forest	W	oodland	Open-woodland	
Trees 5-10 m	Low closed-forest		Low	open-forest	Low woodland		Low open-woodland	
Shrubs 2-8 m	Closed -scrub		Op	en-scrub	Tall shrubland		Tall open-shrubland	
Shrubs 0-2 m	Closed -h	eath	Op	en-heath	Low	shrubland	Low open-shrubland	
Three most domi	nant spec	ies:						
Overstorey		Midsto	rey			Lower s	storey	
1. Acacia aneura (ACAN) 1.					1. Aristida Contorta (ARCO)			
2. Acacia kempeana (ACKE) 2. Carissa la				volata (CALA)	ta (CALA) 2. Sclerolaena cornishiana (SC			
3. 3.						3. Portulaca oleracea (POOL)		

Strata	Dominant species (record in order of dominance)	Average ht. (m) of strata	Cover (%) of strata (% cover classes)
Emergent tree layer:	Acacia aneura (ACAN)	10	<10 10-30 30-70 >70
Upper shrub layer:	Acacia kempeana (ACKE) Carissa lanceolata (CALA)	5	<10 10-30 30-70 >70
Lower shrub layer:		1.5	<10 10-30 30-70 >70
Ground layer:	Aristida Contorta (ARCO) Scierolaena cornishiana (SCCO) Portulaca oleracea (POOL) Boerhavia coccinea (BOCO)	0.3	<10 <u>10-30</u> 30-70 >70

Site Description : Habitat and vegetation attributes. (Taken from Neave et al. (2004)).

Site No.: 779	Survey num	ber; 220221		Quad. si	ze : 30x	30 50x50 other:		
Date: 21/02/2022			Observer: L	.ES				
Site description & I	ocation detai	ls:	•		Landfe	orm pattern:		
DH2, Mulga								
Zone:	GPSAMG:		E		N	Datum:		
Precision:			GPS ele	vation:				
Topographic positi	on: Lower		Photo re	f. no.: Tal	blet			
Land unit: Bushy Pa	n Patch si	ze (ha): ᠂	<1 1-5	5-50 50-500 500+				
Edge: ecotone or c	losest distance	e: 5km	Road Ty	pe in Vici	nity: 1	2 3 4 (none)		
Perm. Water: 0 <5	0m 50-500m	0.5-5km >5ki	m Curr. wa	ter: 0 <5	0m 50-	500m 0.5-5km >5km		
Climate: 1 = Dry,	plant stress	2 = Dry, no pla	ant stress 3 :	= Recent r	ain, no v	vegetation response		
4 = Recent rain, noti	ceable vegeta	tion response						
Disturbance: 0 = no visible impact 1 = disturbance present but negligible impact 2 = low level of disturbance throughout quadrat, or moderate level in patches in the quadrat 3 = moderate level of disturbance throughout quadrat, or high level in patches in the quadrat 4 = high level of disturbance throughout quadrat, or major level in patches in the quadrat								
Fire impact: 0 1 2	3 4 5	Last fire: f	his vear last	tvear 2+	veers s	ao long unburnt		
Rabbit damage: 0	12345	Introduced	herbivores: (01234	4 5	Camels: 0 1 2 3 4 5		
Weeds: 0 1 2 3 4	5	Other: 0 1	2345 de	scribe:				
Bare soil (%):	10 %	Vegetation	Litter (%):	5 %	Roo	ck type		
Rock cover (%):	0 %	Ground Veg	etation (%):	85 %	, Sar	idstone		
Outcrop: 0 %	Rock / stor	ne: 0 %	Bare ground	1: 100 %	6 Oth Met	nglomerate el sedimentary: amorphic nite		
Pebbles (<0.6cm):	0~2	2-10 10-20 3	20-50 50-70	70-90 >90	Que	artzite		
Small stones (0.6-2	cm): 0 <2	2-10 10-20 2	20-50 50-70	70-90 >90 70-00 >00	Bas	estone alt		
Small rocks (6-20cr	20-50 50-70	70-00 >00	(Col	luvium				
Rocks (20-60cm):	20-50 50-70	70-90 >90	Oth	er:				
Big rocks (60cm-2n	20-50 50-70	70-90 >90		$\langle \rangle$				
Boulders (>2m):	20-50 50-70	70-90 >90	1 144	alogu:				
Outcrop / slab:	0 <2	2-10 10-20 2	20-50 50-70	70-90 >90		lology.		
Soil texture: sand Soil colour: Grey/F	sandy loam Red	loam loamy	clay clay loar	m clay cr	acking o	clay peat rock other:		

Soil depth (cm): 0	D >40	s	ioil pH - su	rface:	<7	cm:			
Soil crust, termites, lo	g habitat a	nd veget	ation	strata stru	cture				
Crust present: no	black gr	een cle	ar	Crust cov	ver (%):	100 %	Crust pH:		
Termite mounds (no.):	Termite mounds (no.): 2 Max. ht. (: tower	dome underground		
Number of fallen logs	Number of fallen logs >15cm diameter in the quadrat: : 0 > 15 3 > 7cm								
Vegetation community: Percentage foliage cover of tallest pl (Circle one)						allest plant	layer		
Life form and height of tallest stratum	Dense (70-100%)		Mi (3	d-dense 0-70%)	Sparse (10-30%)		Very sparse (<10%)		
Trees > 30 m	Tall closed-forest		Tall o	ll open-forest Tall w		woodland	Tall open-woodland		
Trees 10-30 m	Closed-forest		Ope	en -forest	Woodland		Open-woodland		
Trees 5-10 m	Low closed	ed-forest Lo		pen-forest	Low woodland		Low open-woodland		
Shrubs 2-8 m	Closed -	-scrub		en-scrub	Tall shrubland		Tall open-shrubland		
Shrubs 0-2 m	Closed -I	heath	Ор	en-heath	Low	shrubland	Low open-shrubland		
Three most domi	nant spe	cies:							
Overstorey		Midsto	orey			Lower storey			
1. Acacia aneura (ACAN)	1. Acacia	1. Acacia aneura (ACAN)			1. Aristida Contorta (ARCO)				
2. Acacia kempeana (ACF	2. Acacia	Acacia kempeana (ACKE)			2. Abutilon otocarpum (ABOT)				
3.				3. Aristida inaequiglumis (ARIN)					

Strata	Dominant species	Average ht. (m) of strata	Cover (%) of strata				
	(record in order of dominance)		(% cover classes)				
Emergent tree	Acacia aneura (ACAN)	10	<10	10-30	30-70	>70	
layer:	Acacia kempeana (ACKE)		~10	10-00	00-70	-10	
Upper shrub	Acacia aneura (ACAN)	3	<10	10-30	20.70	>70	
layer:	Acacia kempeana (ACKE)		~10	10-30	30-70	210	
Lower shrub	Aristida inaequiglumis (ARIN)	1	~10	10.20	30-70	>70	
layer:	Aristida Contorta (ARCO)		~10	10-30		-70	
Ground layer:	Aristida Contorta (ARCO)	0.5	~10	10.20		> 70	
	Aristida inaequiglumis (ARIN)		~10	10-30	30-70	210	
	Abutilon otocarpum (ABOT)						
	Digitaria coenicola (DICO)						
	Digitaria brownii (DIBR)						
	Sida platycalyx (SIPL)						

Site Description : Habitat and vegetation attributes.	(Taken from Neave et al. (2004)).
---	-----------------------------------

Site No.: 781	Survey num	iber; 220221		Quad. size: 30x30 50x50 other:				
Date: 21/02/2022			Observer: L	.ES				
Site description & I	ocation detai	ils:			Landfe	orm pattern:		
Bushy Park DH1					Dense	Mulga Patch		
Zone:	GPSAMG:		E		N	Datum:		
Precision:			GPS elev	vation:				
Topographic positi	on: Lower Sk	pe	Photo re	f. no.: Tal	blet			
Land unit: Bushy Pa	ark Run:	on off plair	Patch siz	ze (ha):	<1 1-5	5-50 50-500 500+		
Edge: ecotone or cl	osest distanc	e: 400m	Road Ty	pe in Vici	nity: 1	2 3 4 (none)		
Perm. Water: 0 <50	0m 50-500m	0.5-5km >5kr	m Curr. wa	ter: 0 <5	0m 50-	500m		
Climate: 1 = Dry, p 4 = Recent rain, notic	Climate: 1 = Dry, plant stress 2 = Dry, no plant stress 3 = Recent rain, no vegetation response 4 = Recent rain, noticeable vegetation response							
0 = no visible impact 1 = disturbance present but negligible impact 2 = low level of disturbance throughout quadrat, or moderate level in patches in the quadrat 3 = moderate level of disturbance throughout quadrat, or high level in patches in the quadrat 4 = high level of disturbance throughout quadrat, or major level in patches in the quadrat 5 = major impact affecting all of quadrat								
Fire impact: 0 1 2	345	Last fire: t	his year last	year 2+	years ag	o long unburnt (25yrs)		
Rabbit damage: 0	12345	Introduced	herbivores: (rbivores: 0 1 2 3 4 5 Camels: 0 1 2 3 4 5 5				
Weeds: 0 1 2 3 4	5	Other: 0 1	2345 de	3 4 5 describe:				
Bare soil (%):	10 %	Vegetation I	Litter (%):	10 9	6 Roo	k type		
Rock cover (%):	0 %	Ground Veg	etation (%):	80 9	6 San	dstone		
Outcrop: 0 %	Rock / sto	ne: 0%	Bare ground	l: 100 9	% Oth Met Gra	giomerate el sedimentary: amorphic nite		
Pebbles (<0.6cm):	0~2	2-10 10-20 2	20-50 50-70	70-90 >9	0 Qua	artzite		
Small stones (0.6-2 Stones (2.6cm):	cm): 0 <2	2-10 10-20 2	20-50 50-70	70-90 >9(70.00 >0(D Lim Bas	estone alt		
Small rocks (6-20cm): 0 <2 2-10 10-20 Small rocks (6-20cm): 0 <2 2-10 10-20			20-50 50-70	70-90 >9	Col	uvium		
Rocks (20-60cm):	20-50 50-70	70-90 >9	0 Oth	er:				
Big rocks (60cm-2n	20-50 50-70	70-90 >9	D	$\langle \rangle$				
Boulders (>2m):	20-50 50-70	70-90 >9	Lith	ology:				
Outcrop / slab:	2-10 10-20 2	20-50 50-70	70-90 >9	0				
Soil texture: sand sandy loam loam loamy clay clay loam clay cracking clay peat rock other:								
Soil colour: Red/G	rey		(little sand	d)				

Soil depth (cm): 0	<10 10-40	>40	4	60il pH - su	rface:	7	cm:		
Soil crust, termites, lo	g habitat a	nd vege	tation	strata stru	cture				
Crust present: no	black gr	een d	lear	Crust cov	ver (%):	75 %	Crust pH: 7		
Termite mounds (no.):	. 7	Max. h	t. (m):	0.2	Profile	: tower	dome underground		
Number of fallen logs >15cm diameter in the quadrat: 1 > 15 6 > 7cm									
Vegetation community: (Circle one)	Percent	age foliage o	over of t	allest plant	layer				
Life form and height of tallest stratum	Dens (70-10	;e 0%)	Mi (3	id-dense 30-70%)	Sparse (10-30%)		Very sparse (<10%)		
Trees > 30 m	Tall closed	Tall closed-forest Ta			Tall	woodland	Tall open-woodland		
Trees 10-30 m	Trees 10-30 m Closed-fo			en -forest	w	oodland	Open-woodland		
Trees 5-10 m	Low closed	l-forest	Low	open-forest	Low woodland		Low open-woodland		
Shrubs 2-8 m	Closed -	scrub	Ор	en-scrub	Talls	shrubland	Tall open-shrubland		
Shrubs 0-2 m	Closed -	heath	Ор	en-heath	Low	shrubland	Low open-shrubland		
Three most domi	nant spe	cies:							
Overstorey		Midst	torey			Lower s	storey		
1. Acacia aneura (ACAN) 1. A			iya hem	iglauca (ATHI	THE) 1. Eragrostis eriopoda (ERER)				
2. Acacia estrophiolata (;	ACES)	2. Acad	ia estro	phiolata (ACE	5)	2. Sida platycalyx (SIPL)			
3. 3. Acacia an				ra (ACAN)		3. Aristida	3. Aristida inaequiglumis (ARIN)		

Strata	Dominant species	Average ht.	Cover (%) of strata				
Strata	(record in order of dominance)	(m) of strata	(% cover classes)				
Emergent tree	Acacia aneura (ACAN)	9					
layer:	Acacia estrophiolata (ACES)		<10	10-30	30-70	>70	
Upper shrub	Atalaya hemiglauca (ATHE)	4	-				
layer:	Acacia aneura (ACAN)		<10	10-30	30-70	>70	
	Acacia estrophiolata (ACES)						
	Eremophila freelingii (ERFR)						
Lower shrub	Eragrostis eriopoda (ERER)						
layer:	Eremophila latrobei (ERLA)		<10	10-30	30-70	>70	
Ground layer:	Aristida Contorta (ARCO)	0.3					
	Digitaria brownii (DIBR)		<10	10-30	30-70	>70	
	Sida platycalyx (SIPL)						
	Aristida inaequiglumis (ARIN)						

Site Description : Habitat and vegetation attributes. (Taken from Neave et al. (2004)).

Site No.: 783	Survey nur	n ber ; 220221		Quad. si	d. size: 30x30 50x50 other:			
Date: 21/02/2022			Observer: I	LES				
Site description & I Singleton-Wide oper	ocation deta 1 grassland	ils:			Landfo Sandpl	orm pattern: ain		
Zone:	GPSAMG:		E		N	Datum:		
Precision:			GPS ele	vation:				
Topographic positi	on: Mid Slop	e	Photo re	f. no.: Ta	blet			
Land unit: Singletor	n Run:	on off plair	n Patch si	ze (ha):	<1 1-5	5-50 50-500 500+		
Edge: ecotone or c	losest distand	æ: 4km	Road Ty station a	pe in Vici	nity: 1 d)	2 3 4 (aboriginal		
Perm. Water: 0 <5	0m 50-500m	0.5-5km >5ki	m Curr. wa	ter: 0 <5	i0m 50-5	500m 0.5-5km >5km		
Climate: 1 = Dry, plant stress 2 = Dry, no plant stress 3 = Recent rain, no vegetation response 4 = Recent rain, noticeable vegetation response								
Disturbance: 0 = no visible impact 1 = disturbance present but negligible impact 2 = low level of disturbance throughout quadrat, or moderate level in patches in the quadrat 3 = moderate level of disturbance throughout quadrat, or high level in patches in the quadrat 4 = high level of disturbance throughout quadrat, or major level in patches in the quadrat 5 = major impact affecting all of quadrat Fire impact: 0 1 2 3 4 5 Last fire: this year last year 2+ years ago long unburnt								
-				5				
Weeds: 0 1 2 3 4	5	Other: 0 1	2345 de	scribe:	_			
Bare soil (%):	15 %	Vegetation	Litter (%):	15	% Roo	k type		
Rock cover (%):	0 %	Ground Veg	etation (%):	70	% San	dstone glomerate		
Outcrop: 0 %	Rock / sto	ne: 0%	Bare ground %	l: 100	Oth Met Gra	el sedimentary: amorphic nite		
Pebbles (<0.6cm): Small stones (0.6-2 Stones (2-6cm): Small rocks (6-20cr Rocks (20-60cm): Big rocks (60cm-2r Boulders (>2m): Outcrop / slab:	20-50 50-70 20-50 50-70 20-50 50-70 20-50 50-70 20-50 50-70 20-50 50-70 20-50 50-70 20-50 50-70 20-50 50-70	70-90 >9(70-90 >9(70-90 >9(70-90 >9(70-90 >9(70-90 >9(70-90 >9(70-90 >9(70-90 >9(0 Qua 0 Lim 0 Bas 0 Coll 0 Oth 0 D Lith	Quartzite Limestone Basalt Colluvium Other: Lithology:				

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Soil texture: sand sandy loam loam loamy clay clay loam clay cracking clay peat rock other: Soil colour:													
Soil depth (cm):	0	<10 10-40	>40	s	oil pH	- sur	face:	7	_	cm:			
Soil crust, termites, log habitat and vegetation strata structure													
Crust present:	Crust present: no black green clear Crust cover (%): 60 % Crust pH: 7												
Termite mounds	5 (no.):	: 5	Max. h	nt. (m):	0.1		Profile: (slab)	: to	wer	dome	undergro	ound	
Number of faller	n logs	>15cm dia	meter i	n the q	uadrat	: 0 >	15cm						
Vegetation community: Percentage (Circle one)				age foli	age o	over of t	allest	plant	layer				
Life form and he of tallest stratum	ight 1	Dens (70-10	;e 0%)	Mi (3	d-dense 0-70%)	2	Sparse Very sparse (10-30%) (<10%)			e			
Trees > 30 m		Tall closed	-forest	Tall o	pen-for	est	Tall v	voodla	and	Tall o	Tall open-woodland Open-woodland Low open-woodland		
Trees 10-30 m	Trees 10-30 m Closed-forest			Ope	n -fores	st	Wo	odlan	d	Ope	en-woodla	and	
Trees 5-10 m Low close			l-forest	Low o	pen-for	est	Low	woodl	and	Low o	pen-woo	dland	
Shrubs 2-8 m Closed			scrub	Op	en-scrut	5	Tall shrubland Tall open-shrub			bland			
Shrubs 0-2 m		Closed -	neath	Оре	en-heat	h	Low shrubland shrubland/gras			sland			
Three most	domi	nant spe	cies:										
Overstorey	- (000	P)	Midsi 1 Acros	torey	abulla (A	Lower storey							
2 Acasia aneura	a (cooi	rj	2 Euro	sta stenoj	amonhui	la (EBCA) 2 Brilatus nobustashaus (DTDO)				1)			
3.	(nanty		3. Ipon	nea costa	ta (IPCC	na (2.1 1)	July	3. c	alandı	inia balo	nensís (CA	BA)	
Strata	Dom (reco	inant spec	ies of domir	nance)		Ave (m)	erage ht of strat	t. ta	Cove (% c	er (%) of	f strata sses)		
Emergent tree layer:	None patch Coryn	e – Eucalyp hes (Fire do nbia opaca (C	t patche minant (00P)	s, Acac commu	ia nity)		5		<10	10-30	30-70	>70	
	Acaci	a aneura (AC/	AN)										
Upper shrub layer:	Acacia Eucal	a stenophylla yptus sessilis ((ACST) (EUSE)				2		<10	10-30	30-70	>70	
Lower shrub layer:	Ipome Eucal Eucal Calan	ea costata (IP yptus sessilis) yptus gamopi drinia balone	CO) (EUSE) tylla (EUC nsis (CAB	5A) (A)			1		<10	10-30	30-70	>70	
	101010	and an and a second compared to	and the set	,									

Ground layer:	Aristida holothera (ARHO)	0.5	~10	10.20	30.70	>70
	Ptilotus polystachyus (PTPO)		<10	10-30	30-70	270
	Calandrinia balonensis (CABA)					
	Euphorbia drummondii (EUDR)					
	Triodia pungens (TRPU)					
	Rulingia loxophylla (RULO)					
	Eragrostis eriopoda (ERER)					

Site Description	: Habitat and vegetation	attributes. (Taken	from Neave et al.	(2004))
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Site No.: 784	Survey num	ber ; 220221		Quad. size: 30x30 50x50 other:				
Date: 21/02/2022			Observer: l	.ES				
Site description & I	ocation detai	ls:			Landfo	orm pattern:		
Eclipse EL32080 wp	t 784				Sandp	lain		
Zone:	GPSAMG:		E		N Datum:			
Precision:			GPS ele	GPS elevation:				
Topographic positi	on: Top		Photo re	f. no.: Ta	blet			
Land unit: Singleton	Patch si	ze (ha):	<1 1-5	5-50 50-500 500+				
Edge: ecotone or d	osest distanc	e:	Road Ty	pe in Vici	nity: 1	2 🛐 4 (Nyrripi hwy)		
Perm. Water: 0 <50	0m 50-500m	0.5-5km >5kr	n Curr. wa	ter: 0 <5	0m 50-	500m 0.5-5km >5km		
Climate: 1 = Dry, plant stress 2 = Dry, no plant stress 3 = Recent rain, no vegetation response 4 = Recent rain, noticeable vegetation response								
Disturbance: 0 = no visible impact 1 = disturbance present but negligible impact 2 = low level of disturbance throughout quadrat, or moderate level in patches in the quadrat 3 = moderate level of disturbance throughout quadrat, or high level in patches in the quadrat 4 = high level of disturbance throughout quadrat, or major level in patches in the quadrat 5 = major impact affecting all of quadrat								
Fire impact: 0 1 2	345	Last fire: t	his year las	tyear 24	⊦years a	go long unburnt		
Rabbit damage: 0	12345	Introduced I	nerbivores:	rbivores: 0 1 2 3 4 5 Camels: 0 1 2 3 4 5 5				
Weeds: 0 1 2 3 4	5	Other: 0 1	2345 de	scribe:				
Bare soil (%):	15 %	Vegetation I	.itter (%):	10	% Roo	:k type		
Rock cover (%):	0 %	Ground Veg	etation (%):	75	% San	dstone		
Outcrop: 0 %	Rock / stor	ne: 0%	Bare ground	i: 100	% Oth Met Gra	glomerate er sedimentary: amorphic nite		
Pebbles (<0.6cm):			20-50 50-70 20-50 50-70 20-50 50-70 20-50 50-70 20-50 50-70 20-50 50-70 20-50 50-70 20-50 50-70 20-50 50-70	50 50-70 70-90 >90 Quartzite 50 50-70 70-90 >90 Basalt Colluvium 50 50-70 70-90 >90 Basalt Colluvium 50 50-70 70-90 >90 Both the second se				
Soil texture: sand Soil colour: Red	sandy loam	loam loamy	clay clay loar	m clay c	racking o	alay peat rock other:		

Soil depth (cm): 0 <10 10-40 >40					Soil pH	- sur	face:	7	, _	_cm:		
Soil crust, termi	tes, lo	g habitat a	nd vege	etation	strata	struc	ture					
Crust present:	по	black gr	een c	lear	Crust	cov	er (%):	50	%	Crust	pH: 7	
Termite mounds	5 (no.):	: 3	Max. h	t. (m):	5		Profile	to:	wer	dome	undergr	ound
Number of faller	Number of fallen logs >15cm diameter in the quadrat: 0>15cm											
Vegetation community: (Circle one)	Percentage foliage cover of tallest plant layer											
Life form and height of tallest stratum (7			ie 0%)	M (3	id-dense 30-70%)	ense Sparse Very sparse 0%) (10-30%) (<10%)				e		
Trees > 30 m Tall closed			-forest	Tall o	open-for	est	Tall v	voodl	and	nd Tall open-woodland		
Trees 10-30 m Closed-f		orest	Ор	en -fores	st	Wo	odlar	nd	i Open-woodland			
Trees 5-10 m Low closed-1		l-forest	Low	open-for	rest	Low	wood	land	l wood	Low open- woodland/grassland		
Shrubs 2-8 m Closed -so			scrub	Ор	en-scrub Tall shrubland Tall open-s			pen-shrui	en-shrubland			
Shrubs 0-2 m Closed -heath O			Ор	en-heat	h	Low s	shrub	land	Low o	pen-shru	bland	
Three most	domi	nant spe	cies:									
Overstorey			Midst	torey				Lo	wer s	storey		
1. Hakea arbores	cens (H	AAR)	1. Ipon	nea cost	ata (IPCC	J)) 1. Aristida holothera (ARHO)					
2. Hakea lorea ss	p. Lorea	(HALO)	2. Acad	ia adox	a (ACAD)			2. /	Eragrastis eriopoda (ERER)			
3. Corymbia opac	a (COO)	P)	3. Acad	tia aneu	ra (ACAN	ŋ		3. /	Rulingia	ı loxophyi	la (RULO)	
Strata	Dom (reco	inant spec ord in order	ies of domir	nance)		Ave (m)	erage ht of strat	ta ta	Cove (% co	ver (%) of strata cover classes)		
Emergent tree layer:	Hake Hake Coryn	a arborescens a lorea ssp. Lo nbia opaca (C	(HAAR) rea (HAL OOP)	0)			5		<10	10-30	30-70	>70
Upper shrub layer:	Acaci Acaci	a aneura (AC a adoxa (ACA	AN) D)				3 <10			10-30	30-70	>70
Lower shrub layer:	Ipom	ea costata (IP	CO)				1 <10 10-30 30-70				>70	

Ground layer: Eragrastis eriopoda (ERER) Aristida holothera (ARHO) Rulingia laxophylla (RULO) Acacia melleodora (ACMEL)

Notes:

- Elevation 612m
- Bottom of Palaeochannel? Drainline, Nyrippi road/bottom of Mt Doreen Station, Low Woodlands

0.4

<10 10-30 30-70 >70

- Dense Acaia Shrub and Blue Mallee + Scattered trees

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Bird	Observations
------	--------------

Observer	LE\$					s	ite 772, 7 Incide	75, 77 ntals	79, 781, 783,	
	Surname		Given N	iame	· · · · · · · · · · · · · · · · · · ·					
ID #	Date 21 Day	Month	Year	2 2	Survey E	clipse Meta	als	_		
AMG/MGA	Zone Easting		Northing		Pre	cision Me	res]		
Location	Mt Doreen Station									
Start 21	21/02/22 Finish 21/02/22									
Species	Species Name								Commante	
Code		AM	PM	AM	PM	AM	PM	TAL	comments	
								1		
B 772	Zebra Finch									
В	Diamond Dove									
В	Little Button Quail									
В	Superb Fairy Wren									
в										
B 775	Little Button Quail									
в	Diamond Dove									
В	Superb Fairy Wren									
В										
B 779	Diamond Dove									
в										
B 781	Masked Wood									
	Swallow									
в	Crested Bellbird									
В										
B 783	Emu									
В	Fledgling (species unknown)									
в										
B Inci.	Brown Falcon									
В	Black Falcon									
в	Buzzard (at Waterhole)									
в	Spotted Harrier									
В	Emu									
в	Kestrel									
В										

Appendix 6: Pictures from each Drillhole site recorded in order of North, East, South, and West respectively

6.1 Drillhole site 5



6.2 Drillhole site 4



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Ngalia Basin Drilling Program Exploration Mining Management Plan

6.3 Drillhole site 3



6.4 Drillhole site 2



6.5 Drillhole site 1





Department of INFRASTRUCTURE PLANNING AND LOGISTICS Level 3 Highway House Palmerston Circuit Palmerston NT 0831

> Postal address GPO Box 61 Palmerston NT 0831

E DevRoads.NTG@nt.gov.au

T 08 8999 4556

Andy Wilde Wilde Geoscience 2 Endell Ridge Mount Claremont WA 6010

File reference DDOT2015/0198-0010~0019 TCSD Project No: 2020-0074

Dear Andy

Re: ALICE SPRINGS – VAUGHAN SPRINGS PROPACC - ADJACENT TO NT PORTION 1947, LAKE MACKAY – PROPOSED DRILL LINE 2 – WILDE GEOSCIENCE – ECLIPSE METALS LTD

ROAD AGENCY APPROVAL – 2020-0074-D2

I refer to your email correspondence of 10 May 2023 and advise that the Transport and Civil Services Division, Department of Infrastructure, Planning and Logistics has no objections to the proposed drill line 2 within the Vaughan Springs Propacc road reserve, subject to the following comments and conditions:

- 1. Drilling shall not occur on the road pavement/ formation. All drilling holes are to be located a minimum of 5 metres from the edge of the carriageway within the Vaughan Springs Propacc road reserve. No drilling holes are to be located in the roadside drain formation.
- 2. The contractor / proponent is required to obtain all necessary clearances (Environmental, Sacred Sites, Heritage, Services, etc.) for the drilling activities beyond the existing Vaughan Springs Propacc road pavement and provide copies for verification on request.
- 3. The existing level of traffic efficiency along the Vaughan Springs Propacc shall remain unaffected by the proposed drilling operations. The contractor / proponent shall ensure a high level of road safety awareness and provide a safe route along the road for all contractor vehicles and the general public throughout the period of works.
- 4. The contractor / proponent is required to adopt traffic safety principles in accordance with Australian Standards AS1742.3 to manage risks of activities within the road reserve.

If contractor personnel walk along the road verge as part of the drilling activities, appropriate personal protective equipment shall be worn. Appropriate signage of temporary nature shall be installed at all road crossings. This shall be included in the "Work Zone Traffic Management Plan" submitted with the application for a "Permit to Work within NT Government Road Reserves".

5. The contractor / proponent is required to obtain a "Permit to Work within NT Government Road Reserves" prior to the commencement of any drilling activity within the Vaughan Springs Propacc road reserve.

The application procedure for a Permit to Work within NT Government Road Reserves is available at <u>https://nt.gov.au/driving/management/apply-for-permit-to-work-on-a-road.</u>

On application for a "Permit to Work within NT Government Road Reserves" the contractor / proponent will have to provide:

(i) A copy of Transport and Civil Services Division, Department of Infrastructure, Planning and Logistics approval (this letter).

(ii) An appropriate "Work ZoneTraffic Management Plan" prepared by a competent and accredited agent, and endorsed as in accordance with "AS1742.3".

If applicable, the "Work Zone Traffic Management Plan" must specify the location and management of access / egress, vehicle types proposed to use the access / egress, proposed route of travel, measures to prevent materials being tracked onto sealed road pavements and management of tracked materials.

- 6. The contractor / proponent may be required to provide a security deposit for the reinstatement of the road reserve. The amount of security will be determined at the time of the application for a "Permit to Work within NT Government Road Reserves". The security will be reimbursed upon satisfactory reinstatement of the road reserve.
- 7. The use of the road reserve for the proposed activity shall not be detrimental to any existing features infrastructure within the road reserve, including table drains and native vegetation.
- 8. The responsibility for ensuring the location of, reinstatement of, and / or minimising disruption of service infrastructure, along with associated costs resulting from disruption to or for the reinstatement of damaged services and road reserves shall be borne by the contractor and / or proponent.
- 9. The operator / proponent must ensure that all machinery / equipment and / or vehicles entering / exiting the works area are free from all declared plant material. It is the responsibility of the operator / proponent to check the NTG Weeds Distribution database in order to confirm the presence / absence of declared weeds in the works area.
- 10. On completion of the drilling program, all tracks and any areas disturbed by the activity shall be rehabilitated to the standards and specifications of the Department of Infrastructure, Planning and Logistics.
- 11. You are also advised to contact the Department of Environment and Natural Resources and the Parks and Wildlife Commission of the Northern Territory as these agencies may have restrictions / requirements regarding your proposed activities.

Should you wish to discuss the above mentioned further, please contact Corridor Management and Design at the Transport and Civil Services Division, Department of Infrastructure, Planning and Logistics on telephone 8999 4556.

Please quote the TCSD Project No 2020-0074 in all correspondence.

Yours sincerely

Chandan Kalase Executive Director, Transport Planning

9 1057 2023

cc: Manager Operations & Traffic – Sean Stieber A/Regional Director, Alice Springs – Gunalan Sivachelvan Maintenance Manager Roads, Alice Springs – Robert Olzomer



RISK MANAGEMENT PLAN NGALIA BASIN PROJECT

Prepared by: Andy Wilde

Date of Issue: 01/05/2023

Version Number: 1



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DOCUMENT DETAILS

Document Name	Risk Management Plan
Document Number	
Version Number	1
Date of Issue	01/05/2023
Date of Original	01/05/2023

Prepared by:

This Risk Management Plan has been prepared by Andy Wilde consultant to Eclipse Metals. Andy has considerable experience in the management of field exploration programs spanning over 35 years, including drilling in a wide range of environments and countries including Australia, West Africa and Canada.

Review of the Risk Management Plan:

This Risk Management Plan will be reviewed and, if necessary, revised in the following circumstances:

- New hazards or risks to health and safety are identified
- There is a change in control measures for managing health and safety risks

The revised Risk Management Plan must be certified by a competent person, in compliance with Regulation 614, Work Health and Safety (National Uniform Legislation) Regulations 2011.

The certified Risk Management Plan must be submitted, along with a cover letter certifying the Plan, to the Regulator (NT WorkSafe) as soon as practicable after the requirement to revise the plan arose.

PURPOSE

The purpose of this Risk Management Plan (Plan) is to ensure the health and safety of workers and other persons who may be affected by the work undertaken by Eclipse Metals Limited (*Eclipse Metals*) as per Section 19, Work Health and Safety (National Uniform Legislation) Act 2011. This is achieved through the establishment and maintenance of effective hazard identification and risk management practices within Eclipse Metals' operations, in accordance with Section 3.1, Work Health and Safety (National Uniform Legislation) Regulations 2011.

This Plan details the structured approach to identifying reasonably foreseeable hazards, assessing the risks that may arise from these hazards, and implementing and monitoring control measures to ensure effective management of risks.

This Plan applies to all Eclipse Metals officers and workers, and to all persons at risk from work carried out at Eclipse Metals workplaces. Failure to comply with this Plan may result in disciplinary action.

DEFINITIONS

Table 1: Terminology and Definitions

Table 1. Terminology and De	
Terminology	Definition
Person Conducting a Business or Undertaking (PCBU)	 A PCBU has the primary duty of care (Section 19, WHS Act) to ensure, so far as is reasonably practicable, the health and safety of: a. Workers engaged, or caused to be engaged, by the PCBU; and b. Workers whose activities in carrying out work are influenced or directed by the PCBU; while workers are at work in the business or undertaking. Eclipse Metals is a PCBU
Officer	A person is an Officer under the WHS Act if they 'make, or participate in making, decisions that affect the whole, or a substantial part, of the business of the corporation; or who has the capacity to significantly affect the corporation's financial standing'. An officer of the PCBU must exercise due diligence to ensure that the PCBU complies with its duties and obligations under the Act. The Board of Directors of Eclipse Metals are the Officers under the WHS Act



Worker	A person who carries out work in any capacity for a PCBU, including employees, contractors
	or sub-contractors and their employees, labour hire employees, outworkers, apprentices or
	trainees, work experience students and volunteers.
Other persons	Includes any visitors

RESPONSIBILITIES

General Statutory Requirements

Eclipse Metals must ensure, so far as is reasonably practicable, that the health and safety of persons is not put at risk from work carried out as part of Eclipse Metals' operations, through:

- the provision and maintenance of a work environment without risks to health and safety; and
- the provision and maintenance of safe plant and structures; and
- the provision and maintenance of safe systems of work; and
- the safe use, handling and storage of plant, structures, and substances; and
- the provision of adequate facilities for the welfare at work of workers in carrying out work for the business or undertaking, including ensuring access to those facilities; and
- the provision of any information, training, instruction, or supervision that is necessary to protect all persons from risks to their health and safety arising from work carried out as part of the conduct of the business or undertaking; and
- that the health of workers and the conditions at the workplace are monitored for the purpose of preventing illness or injury of workers arising from the conduct of the business or undertaking.
- identifying all reasonably foreseeable hazards that could give rise to risks to health and safety; and
- eliminating risks to health and safety so far as is reasonably practicable; and
- if it is not reasonably practicable to eliminate risks to health and safety, minimise those risks so far as is reasonably practicable by doing one or more of the following
 - o substituting (wholly or partly) the hazards with something that gives rise to a lesser risk
 - \circ \quad isolating the hazard from any person exposed to it
 - implementing engineering controls

Officers must exercise due diligence to ensure that the person conducting the business or undertaking complies with that duty or obligation. Due diligence includes taking reasonable steps:

- to acquire and keep up-to-date knowledge of work health and safety matters; and
- to gain an understanding of the nature of the operations of Eclipse Metals and generally of the hazards and risks associated with those operations; and
- to ensure that Eclipse Metals has available for use, and uses, appropriate resources and processes to eliminate or minimise risks to health and safety from work carried out as part of the operations; and
- to ensure that Eclipse Metals has appropriate processes for receiving and considering information regarding incidents, hazards and risks and responding in a timely way to that information; and
- to ensure that Eclipse Metals has, and implements, processes for complying with any duty or obligation of the PCBU under the Work Health and Safety (National Uniform Legislation) Act 2011; and
- to verify the provision and use of the resources and processes referred to in above.

Workers are responsible for:

- protecting their own health and safety and to ensuring their actions or omissions do not adversely affect the health and safety of any other person; and
- complying with any reasonable safety instruction given that allows Eclipse Metals to comply with relevant health and safety legislation; and
- cooperate with any reasonable policy or procedure of Eclipse Metals relating to health or safety at the workplace that has been notified to workers.



Onsite Responsibilities

The Exploration Manager is responsible for ensuring the on-site implementation of any health and safety directives of Eclipse Metals, including but not limited to:

- Management of the health and safety of workers at the work site
- Ensuring that day-to-day safety and health practices are being maintained
 - Daily pre-start checks
 - o Take 5s
 - o JSAs
- Regular communication of health and safety performance and issues to workers and Eclipse Metals Board of Directors
- Facilitating consultation with all workers on issues regarding health and safety, through regular site safety meetings
- Regular monitoring and assessment of the work environment, work procedures, equipment, and installations
- Appropriate inspection of each work site
- Adequate planning, organisation, leadership, supervision, and control of the work site
- Maintenance of site health and safety records

While onsite, all workers must take reasonable care for their own health and safety while they are at work, and take reasonable care that their acts of omissions do not adversely affect the health and safety of any other person Workers must comply, so far as they are reasonably able, with any reasonable instruction given by their supervisors, as well as cooperating with any reasonable policy or procedure of Eclipse Metals relating to health or safety at the workplace that has been notified to workers.

INTRODUCTION

Eclipse Metals is an Australian exploration company focused on exploring for multi-commodity mineralisation, with projects in Australia and Greenland. Within Australia, Eclipse Metals hold 19 tenements or applications over an area of more than 8,000km², prospective for manganese, uranium, gold, vanadium, and precious metals.

The Ngalia Project is located approximately 300km WNW of Alice Springs (see Figure 1), covering an area of 5,748km² of terrain considered prospective for sandstone paleochannel style uranium mineralisation within and marginal to the Ngalia Basin.

Proposed work includes reconnaissance style aircore drilling using a 4WD-drive mounted rig.

Tenement ID	Application/Original Grant Date	Expiry Date	Area (Blocks)	Status
EL24808	10/08/2006	09/08/2023	27	Renew Retained
EL32080	23/08/2019	22/08/2025	63	Grant
EL31499	06/02/2017	-	249	Application
EL31500	06/02/2017	-	250	Application
EL31501	06/02/2017	-	250	Application
EL31502	06/02/2017	-	226	Application
EL32077	01/02/2019	-	195	Application
EL32078	01/02/2019	-	248	Application
EL32079	01/02/2019	-	248	Application

Table 2: Tenement Details



Figure 1: Project Location Map



Doc. No.:

Organisational Structure The Directors and Management of Eclipse Metals are:

Carl Popal – Executive Chairman

Carl Popal (B. Bus) has more than 20 years entrepreneurial experience covering diverse range of commodities trading, corporate management, minerals exploration, asset management and construction to name some. Previously Carl was Chief Executive Director of ASX listed company Paynes Find Gold Ltd. He is the Managing Director of Ghan Resources Pty Ltd and Popal Enterprise Pty Ltd. Since 2001, Mr Popal has managed several entities conducting international trading. He has more than 12 years' experience in property development and has managed various commercial dealings within a network of companies around the world including in India, China and Malaysia.

Ibrar Idrees – Non Executive Director

Ibrar Idrees has a Bachelor of Commerce (majoring in Accounting and Finance) from Deakin University and has over 10 years professional and corporate experience gained in a diverse range of industries in Australian and South Asia. Mr Idrees, a practicing accountant has worked in a variety of business development and financial positions in small and large companies.

Rodney Dale – Non Executive Director

Rodney Dale holds a Fellowship Diploma in Geology from the Royal Melbourne Institute of Technology (FRMIT) and is a Fellow of the Australasian Institute of Mining and Metallurgy (FAusIMM). His experience covers more than 60 years, working in many parts of Australia, Indonesia and Africa on gold, tin, wolfram, base metals and industrial mineral exploration and mining, including trial mining and export of high-grade quartz. He has worked in and managed small gold mines in Western Australia. Since 1970, Mr Dale has been an independent geological consultant with three periods as a director of ASX listed companies. More recently, Mr Dale has been involved with assessment of iron ore projects in Australia, South America, India, China and Africa.

Oliver Kreuzer – Non Executive Director

Dr Kreuzer is a Registered Professional Geoscientist (MAIG RPGeo) and company director with a broad skill set in structural, generative and corporate geology honed during a 20+ year career in applied research and mineral exploration across a wide range of gold, base, energy and battery metals projects worldwide. His generative work laid the foundations to several new company floats, project acquisitions and new discoveries. Dr Kreuzer is currently a non-executive director of ASX-listed exploration companies 92 Energy Ltd and NickelX Ltd.

Matthew Foy – Company Secretary

Matthew Foy is a professional company secretary and active member of the Governance Institute Australia (GIA). He has 14 years experience facilitating the listing and compliance of ASX companies and possesses core competencies in publicly listed company secretarial, operational and governance disciplines.

Andrew Wilde – Consultant Exploration Manager

Dr Andy Wilde is a mineral explorer with over 35 years experience including substantial experience of managing field operations in many countries including Australia, Canada and West Africa. His experience has included senior roles at BHP and Gold Fields focussing on gold and base-metal exploration. His interest in uranium began in 1982 with Uranerz Australia, exploring for unconformity-type deposits in the Alligator Rivers region. This lead to a PhD researching the major Nabarlek, Jabiluka and Koongarra deposits. After spells as chief geologist for Paladin and Deep Yellow, and consulting for numerous exploration companies, as well as the United Nations IAEA. Andy has recently managed exploration for newly listed 92 Energy (leading to the discovery of the GMZ deposit) and Elevate Uranium (leading to the discovery of the Capri deposit).

Additional technical resources will be engaged on an as needed basis.

Figure 2 shows the management structure of Eclipse Metals. Each management position/role for the site will be allocated health and safety responsibilities as per the RESPONSIBILITIES section of this document.



Figure 2: Management Structure

HAZARD IDENTIFICATION, RISK ASSESSMENT AND CONTROL

Risk Management Process (Overview)

As per Section 3.1, Work Health and Safety (National Uniform Legislation) Regulations 2011, Eclipse Metals must eliminate or, if elimination is not possible, minimise health and safety risks arising from its operations. The following risk management process is applied to all Eclipse Metals activities, and used by all people working at the site:

- 1. Identify hazards
- 2. Assess risks, if necessary
- 3. Control risks
- 4. Review hazards and control measures to ensure they are working as planned.



Figure 3: The risk management process (Northern Territory Government, NT WorkSafe, Code of Practice – How to manage health and safety risks, Northern Territory Government Gazette (No. G9), 04 March 2020, Web. 2 Feb 2022)

1. Identify Hazards

Eclipse Metals identifies hazards through use of the following tools:

- Take 5s
- Job Safety Analysis
- Daily pre-start checks
- Review of hazards with contractors during inductions
- Regular Workplace inspections
- Consultation with workers (toolbox meetings, site safety meetings
- Reporting hazards, near misses and incidents as soon as they are found/occur
- Incident investigations
- Review of available information (from regulators, industry associations, manufacturers, and suppliers)

2. Risk Assessment

Hazards identified through the above tools are assessed based on the probability of exposure to the hazard (Likelihood - Table 3), and the most probable consequences of that exposure (Consequence - Table 4).



Table 3: Likelihood Rating

	Likelihood				
Α	Almost Certain	Expected to occur in most circumstances, more than once a year			
В	Likely	Will probably occur in most circumstances, at least once in 5 years			
С	Moderate	Should occur at some time, at least once in 10 years			
D	Unlikely	Could occur at some time, at least once in 30 years			
E	Rare	May occur in exceptional circumstances, less than once in 30 years			

Table 4: Consequence Rating

	Consequence				
1	Insignificant	First aid treatment, minor injury, no time off work			
2	Minor	Single occurrence of medical treatment, minor injury, no time off work			
3	Moderate	Multiple medical treatments, non-permanent injury, admitted to hospital, less than 10 days off work			
4	Major	Extensive injuries requiring medical treatment (e.g., surgery), serious or permanent injury/illness, greater than 10 days off work			
5	Catastrophic	Severe injury/illness requiring life support, actual or potential fatalit(ies), greater than 250 days off work			

This information is used to determine the level of risk associated with the hazard (Risk Rating). Risk assessments are conducted using the below two variable risk matrix (Table 5).

		Consequence Rating				
		1	2	3	4	5
	А	Medium	Medium	High	High	High
Likelihood	В	Medium	Medium	Medium	High	High
	С	Low	Medium	Medium	High	High
	D	Low	Low	Medium	Medium	High
	Е	Low	Low	Medium	Medium	Medium

Table 5: Risk Matrix

Note: Risk assessments must be conducted with the current controls in place

Consideration has been given to high consequence/low probability events within the Ngalia Project, and no such events have been identified.

A risk assessment is not required when legislation requires a hazard or risk to be controlled in a specific way. These requirements must be complied with.

A detailed risk assessment may not be required in the following situations;

- a. A code of practice or other guideline sets out a way of controlling a hazard or risk that is applicable in the situation
- b. There are well-known and effective controls that are in use in the particular industry that are suited to the circumstances in the workplace.

In these situations, control measures may simply be implemented.



3. Risk Control

In accordance with Regulations 35-36, *Work Health and Safety (National Uniform Legislation) Regulations 2011* where a risk to health and safety has been identified Eclipse Metals follows the hierarchy of control measures to eliminate or minimise the risk so far as is reasonably practicable:

- 1. Elimination
- 2. Substitution
- 3. Isolation
- 4. Engineering
- 5. Administrative Controls
- 6. Personal Protective Equipment



Figure 4: The hierarchy of control measures (Northern Territory Government, NT WorkSafe, Code of Practice – How to manage health and safety risks, Northern Territory Government Gazette (No. G9), 04 March 2020, Web. 2 Feb 2022

4. Review of Control Measures

Control measures must be reviewed and, if necessary, revised in the following circumstances:

- When a control measure is not effective in controlling the risk
- Before a change at the workplace that is likely to give rise to a new or different risk the health or safety that the measure may not effectively control
- A new relevant hazard or risk is identified
- The results of consultation indicate that a review is necessary, or
- A health and safety representative requests a review.

The Exploration Manager is responsible for facilitating the review of hazards and control measures prior to the commencement of each field work campaign with the team, including all contractors and workers. This review is to be recorded, and the risk register updated if required. Where additional hazards are identified, or implemented control measures are found to be inadequate, the program must not commence until effective control measures are in place.

Risk Register See Attachment 1.



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CODE OF CONDUCT – SEXUAL HARASSMENT, DISCRIMINATION AND VOILENCE

Eclipse Metals recognises the importance of a safe work environment which actively promotes the highest standards of ethics, integrity and behaviour. Eclipse recognise that the remote and isolated nature of the mining industry presents unique challenges in managing the risks of psychosocial hazards in the workplace.

All personnel working at an Eclipse Metals' site are expected to:

- Treat all persons in a non-discriminatory manner with proper regard for their rights and dignity;
- Refrain from any form of conduct which may cause any reasonable person unwarranted offence or embarrassment or give rise to the reasonable suspicion or appearance of improper conduct or biased performance;
- Report any violations of law or ethical principles;
- Refrain from use of inappropriate or offensive language in the workplace (including camps);
- Refrain from fighting, arguing or use threatening or abusive language in the workplace (including camps).

Discrimination, victimisation or harassment based on a person's race, colour, religion, national origin, age, sex, sexual orientation, marital status, family responsibilities, pregnancy or potential pregnancy, union membership or non-membership, mental or physical disability, or any other classification protected by law will not be tolerated.

Misconduct, abuse or assault (mental, physical, sexual or emotional) will not be tolerated.

Eclipse Metals manages the risk of psychosocial hazards in the workplace by:

- Recognising that workplace culture is established at a Senior Management level, and ensuring that a positive culture is supported from the top-down;
- Reenforcing that lack of intent does not minimise the impact of racism, sexism, or any form of discrimination;
- Ensuring all personnel are aware of the expected conduct at the site, and providing information and training to personnel on the importance of bystander action in preventing and reporting misconduct;
- Providing opportunities for confidential reporting of misconduct;
- Reviewing staff turnover rates, exit interviews, and confidential reporting and feedback to identify any concerns or misconduct;
- Facilitating the fair and equitable treatment of those reporting misconduct, and ensuring those reporting misconduct do not face unfair treatment during or following the investigation;
- Ensuring all personnel receive adequate training and instruction regarding the requirements of their position; and
- Ensuring all contractors and consultants are aware of the standards of conduct held by Eclipse Metals.

FITNESS TO WORK

Eclipse Metals is committed to ensuring the safety for its workers is not put at risk in the workplace as a result of fatigue or consumption of drugs or alcohol.

Each worker must periodically conduct a self-assessment of their condition (including, for example, for effects of heat strain or fatigue) to decide if they are in a fit condition to perform their duties without creating an unacceptable level of risk.

A visitor must not enter an operating area unless their fitness level is adequate to visit the area. A visitor must complete the visitor's induction and questionnaire to help decide whether or not they are fit to enter site.

Fatigue Management

Fatigue is a state of mental and/or physical exhaustion that may result in a lack of alertness, slower reactions, and decreased ability to make good decisions. In the workplace, fatigue may increase the risk of incidents, particularly related to:

- The operation of fixed or mobile plant
- Critical tasks that require a high level of concentration
- Night or shift work



Eclipse Metals manages the risks associated with fatigue through the following work practices:

- Identification of factors that may cause or contribute to fatigue in the workplace, and implementation of the most effective controls that are reasonably practicable to remove or minimise these risks
- Consultation and communication with workers regarding the risks of fatigue
- Ensuring workers are aware of their obligations to ensure their actions or omissions do not cause risk to the health and safety of themselves or others, specifically in relation to working in a fatigued state

Drug and Alcohol Management

Eclipse Metals is committed to providing a safe, healthy, and productive workplace for all workers, contractors, and visitors, free from the risks associated with the consumption of drugs and/or alcohol. Eclipse Metals has implemented this Policy to achieve compliance with all relevant legislation, including but not limited to, «Act», «Regulations», relevant Codes of Practice, and relevant Australian/New Zealand Standards.

This Policy applies to all persons working at, or attend in any capacity, a Eclipse Metals workplace, as well as Eclipse Metals workers when required to work off-site.

For the purpose of this Policy:

Alcohol refers to any beverage containing an alcoholic content that temporarily impairs a person's physical or mental capacity.

Drugs refers to a chemical substance, whether it is legal or illegal, which may have the ability to impair a person's physical or mental capacity. These can include prescription medication issued by a medical practitioner (such as antibiotics), or non-prescription drugs, such as codeine, cough syrups and similar, and illicit drugs such as heroin, amphetamines, LSD, crack, cocaine, ecstasy, or marijuana

Consumption of drugs and/or alcohol may result in impaired coordination, memory, or other cognitive functions, as well as delayed reaction time, and decreased ability to concentrate and communicate. The possession, use or consumption of drugs or alcohol at Eclipse Metals workplaces is strictly prohibited, except:

- For legitimate medical purposes workers taking prescription or non-prescription medication that may affect their ability to perform their job safely must disclose this to their manager prior to the commencement of work. The Manager, in consultation with the worker (and the worker's medical practitioner, if appropriate) will determine whether the worker can perform normal or modified duties. All information disclosed will be strictly confidential.
- At workplace-based functions, or functions on behalf of Eclipse Metals, that include the service of alcohol in this instance Eclipse Metals workers are expected to behave in a professional and responsible manner, ensuring that duty of care is provided to both themselves and others.

It is the responsibility of all persons working at, or representing, Eclipse Metals to ensure that they are not, by the consumption of drugs or alcohol, in such a condition as to endanger their own safety or the safety of others at the workplace. This includes circumstances where, following the consumption of drugs or alcohol in the worker's social time, the worker's ability to work safely is still impaired at the time of their next rostered shift. In this event, it is expected that the worker will not attend the workplace and will contact their manager immediately.

If the Manager/Supervisor at the workplace has reasonable grounds for believing that a worker in incapable of safely performing their duties or may be a risk to others due to the effects of drugs or alcohol, arrangements will be made to remove the worker from the workplace.

Eclipse Metals is committed to, in consultation with workers, HSRs and health and safety committee, identifying all workplace factors that may contribute to a worker's decision to turn to drugs or alcohol, and through the hazard management process eliminate or control the risks from these hazards.

Eclipse Metals has the right to take action if a worker is:

• Affected by drugs or alcohol, endangering their own safety and the safety of others at the workplace



Eclipse Metals Ltd Risk Management Plan Ngalia Project

- Found in the possession of illicit drugs and/or associated paraphernalia, or alcohol at Eclipse Metals workplace without prior consent from management
- Affected by drug or alcohol, so that their work performance is impaired.

The possession, distribution, manufacture, sale or consumption of drugs or alcohol at the workplace, or presence at the workplace while under the influence of drugs or alcohol, will be subject to disciplinary action, which, dependent on the nature of the incident, may include:

- Counselling
- Suspension
- Written or verbal warning
- Dismissal for serious misconduct.

Eclipse Metals will provide information and training about the effects of alcohol and drug use on personal and work health and safety, and on this Policy.

Any workers who have concerns regarding the consumption of drugs or alcohol, either for themselves, their family members, or others, are encouraged to seek professional help:

National Alcohol and Other Drug Hotline – 1800 250 015

HEALTH MONITORING PROGRAM

For personnel employed directly by Eclipse Metals, the Company implements a health monitoring program in the event that a worker may be exposed to a hazard during the course of their normal work, in compliance with Regulation 616, *Work Health and Safety (National Uniform Legislation) Regulations 2011*. The health monitoring program includes the following:

- The worker's demographic, medical and occupational history
- Physical examination
- Audiometric testing if the worker is frequently required to use PPE to protect the worker from the risk of hearing loss associated with noise that exceeds the exposure standard for noise
- Any other monitoring that forms part of the control measures to be implemented during the risk assessment and control process (i.e., exposure to crystalline silica or asbestos, exposure to hazardous chemicals)

Initial health monitoring will be provided within 90 days of the commencement of the workers employment where health monitoring is required as per the above, and at least every two years thereafter. Health monitoring may also be required prior to the two-year reassessment if:

- The worker's duties change, and
- If assessment of the worker's fitness for work is required.

Health monitoring will be provided by a competent person at Eclipse Metals' expense. The outcomes of health monitoring may be used to evaluate, review, and modify control measures implemented. Health monitoring reports will be kept by Eclipse Metals until the worker ceases to be a worker at the site.

Where the results of health monitoring show temporary or permanent changes that may be attributed to exposure to hazards in the workplace, Eclipse Metals will seek advice from the competent person who completed the assessment regarding workplace changes and accommodations required to better control the hazard.

Health monitoring will be offered to former workers before or when the person ceases to be a worker at the site, if:

- The person is a worker for whom Eclipse Metals is required to provide health monitoring; and
- More than 12 months has elapsed since the person was last provided with health monitoring.

The offer must be accepted by the former worker no later than 7 days after the conclusion of employment.

As a condition of engagement, Eclipse Metals requires Contractors and/or Consultants to provide health monitoring as per Regulation 616 to applicable personnel entering the Eclipse Metals site.



TRAINING

Eclipse Metals is committed to ensuring that workers are provided the information, training, instruction, and supervision necessary to allow them to work safely. The Eclipse Metals training program includes the following:

- All employees, contractors and visitors are required to complete a site induction prior to commencing work
- Employees are trained internally in Eclipse Metals' hazard identification and risk assessment procedures, safe operating methods, and incident reporting system
- Employees will undertake training through an external provider if it is a requirement of their position.

Eclipse Metals maintains a current training/competency register for each employee, detailing the date of attainment, expiry date, and re-certification requirements of both internal and externally obtained qualifications. Training records are stored at Eclipse Metals office.

RECORD KEEPING

All records pertaining to the development, revision and implementation of this Risk Management Plan will be retained for the duration of the licence, unless specified otherwise in legislation. In this case, records will be retained for the period specified in compliance with legislative requirements. Records retained by Eclipse Metals include, but are not limited to;

- Employee health monitoring records and reports
- Hazard identification and risk assessments
- Safety meeting minutes
- Accident/incident notification and investigation reports
- Workplace inspection records, hazard reports and audit reports
- Maintenance records
- Test and calibration records
- Employee training/development records
- Contractor compliance statements
- Emergency response exercise reports.

REFERENCES

Document	Location
Work Health and Safety (National Uniform Legislation) Act 2011	legislation.nt.gov.au
Work Health and Safety (National Uniform Legislation) Regulations 2011	legislation.nt.gov.au
Bulletin – Risk Management Plan (RMP) – mining operations	worksafe.nt.gov.au
Code of Practice – How to Manage Work Health and Safety Risks	worksafe.nt.gov.au

ATTACHMENTS

- 1. Eclipse Metals Exploration Risk Register
- 2. Eclipse Metals Emergency Plan



RADIATION PROTECTION PLAN

for

Eclipse Metals Ltd – Devil's Elbow & Ngalia Basin Projects

March 2023

RSWA Reference: EPM2303 Version: V0.2



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ACRONYMS

- ALARA As Low as Reasonably Achievable (social & economic)
- ANRDR Australian National Radiation Dose Register
- ARPANSA Australian Radiation Protection and Nuclear Safety Agency
- HOC Head of Chain
- LLA Long Lived Alpha
- NORM Naturally Occurring Radioactive Material
- OSL Optically Stimulated Luminescence dosimeter (a type of PRMD)
- PED Personal Electronic Dosimeter (a type of PRMD)
- PRMD Personal Radiation Monitoring Device
- RnDP Radon Decay Progeny
- RPA Radiation Protection Act 2004
- RPNT Radiation Protection, Northern Territory
- RPR Radiation Protection Regulations 2007
- RPS Radiation Protection Series document eg ARPANSA Safety Guide
- RSO Radiation Safety Officer generally a statutory appointed position
- TnDP Thoron Decay Progeny
- TLD Thermo Luminescent Dosimeter (a type of PRMD)



DEFINITIONS

Term	Definition
Controlled Area	A defined area in which specific protection measures and safety provisions are or could be required for controlling exposures or preventing the spread of contamination in normal working conditions, and preventing or limiting the extent of potential exposures. (ARPANSA, 2020)
Critical Group	A group of members of the public comprising individuals who are relatively homogeneous with regard to age, diet and those behavioural characteristics that affect the doses received and who receive the highest radiation doses from a particular practice.
NORM	Naturally Occurring Radioactive Material – material above regulatory exemption levels. The NORM Guideline 1 also defines as: "material containing no significant amounts of radionuclides other than naturally occurring radionuclides, disturbed or altered from natural settings, or present in technologically enhanced concentrations above background radiation levels due to human activities that may result in a relative increase in radiation exposures and risks to the public and the environment."
Radiation Source	Anything that emits ionising radiation – this may include radioactive material, x-ray apparatus or laser / transilluminator devices
Radiation Worker	A radiation worker is a person who is required to be monitored under the operator's authorisation or under the ARPANSA Safety Guide for Monitoring, Assessing and Recording Occupational Radiation Doses in Mining and Mineral Processing.
Radioactive Material	Material designated by the relevant regulatory authority as being subject to regulatory control because of its radioactivity (regulatory definition) Note: different exemption levels apply for 'use/storage', disposal and transport of NORM
Responsible Person	The person responsible for the management of the premises in / on which a radiation source is used or exists
Supervised Area	A defined area not designated as a controlled area but for which occupational exposure conditions are kept under review, even though specific protection measures or safety provisions are not normally needed. (ARPANSA, 2020)



1 Introduction

1.1 Devil's Elbow

The Devil's Elbow Project consists of five exploration licences, totalling 1,229 km², situated in Arnhemland, Northern Territory, near the world class uranium deposits of Ranger, Nabarlek, and Jabiluka (Alligator Rivers Uranium Field). These licences are considered to be prospective for unconformity-type uranium, gold, platinum and palladium.

Previous exploration within the Devil's Elbow area discovered outcropping radioactive material, assaying at up to $0.3\% U_3O_8$. Outcrop samples also returned elevated Au and Pd. Drilling was conducted in the nineties by Uranerz Australia who intersected promising uranium, but abandoned the project due to a precipitous drop in uranium price and Uranerz' decision to exit exploration. Cameco Australia subsequently explored the area between 2001 and 2007. Numerous radiometric anomalies remain to be tested.

1.2 Ngalia Basin

The Ngalia Basin project licences cover an area of 5,748 km² and are considered prospective for sandstone-hosted (e.g. Bigryli: 12,230 t U_3O_8 and 13,980 t of V_2O_5) and palaeochannel-hosted (e.g. Napperby) uranium deposits. The licences are located approximately 300 km west-northwest of Alice Springs.

A gravity survey over EL24808, Cusack's Bore, has indicated the presence of a paleochannel similar to those reported by other companies exploring in the Ngalia Basin. This newly discovered palaeochannel will be the initial focus of Eclipse' exploration and will involve drilling a series of "fences" across the palaeochannel.







1.3 Purpose

The purpose of this Radiation Protection Plan (RPP) is to establish radiological management procedures for the protection of workers, the public and the environment. This RPP has been prepared to meet the requirements of Radiation Protection, Northern Territory Health (RPNT), the NT radiation regulator.

This RPP outlines how *naturally occurring radioactive material* (NORM) will be managed to ensure that the radiation doses received by personnel are kept below prescribed limits and are in accordance with the ALARA principle, which aims to keep exposures <u>As Low As</u> <u>Reasonably Achievable</u>, with economic and social factors considered.

1.4 Scope

This RPP applies to the radiological management of NORM at Devil's Elbow & Ngalia Basin Projects within the leases and tenements described in Table 1.



Table 1. Leases and Tenements

	EL27584, EL31065, EL31770, EL31771,
Exploration Tenement	EL31772, EL24808, EL31499, EL31502,
	EL32077, EL32080

This Radiation Protection Plan is for the control and monitoring of radiation exposure and the management of any radioactive waste generated in greenfield exploration activities on the project areas. This work is planned to be carried out with specialist contractors and drilling contractors using aircore and diamond drilling equipment to explore for and define the economic resources within this project.

The exploration activities at the Devil's Elbow & Ngalia Basin project areas include:

- Drilling
 - Diamond Drilling
 - Aircore and Reverse Circulation Drilling
- Soil Sampling
- Rock Chip Sampling
- Clearing
- Ground geophysical surveys
- Geological Mapping
- Heritage Survey

Any changes to the above activities will prompt a revision of this Radiation Protection Plan.

This RPP does not apply to any ionising radiation sources other than NORM, or to non-ionising radiation sources such as lasers, radio transmitters, microwave emitters or electromagnetic fields (EMF).



2 Legislative Framework and Legal Requirements

This section of the RPP details high level information only – a full list of applicable legislation, Codes of Practice and Safety Guides is detailed in Section 10.

2.1 Territory Legislation

- Radiation Protection Act 2004 (RPA),
- Radiation Protection Regulations 2007 (RPR)
- Work Health and Safety (National Uniform Legislation) Act 2011

2.2 Regulators

Radiation and radioactive material is regulated by the Radiation Protection, Northern Territory Health (RPNT)

The Radiation Protection work unit (Table 2) sits within the Public Health Directorate and aims to protect the health and safety of people in the Northern Territory and their environment from the harmful effects of radiation.

This protection is achieved through legislation that authorises the sale, acquisition, possession, use, storage, transport and disposal of radioactive materials and radiation apparatus.

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T	abl	e	2:	Regi	ilator	Conta	act D	Details	

	Phone:	(08) 8922 7152
	Email:	radiationprotection@nt.gov.au
Radiation Protection,	Mail:	Radiation Protection
Northern Territory Health	Location:	PO Box 40596
(RPNT)		Casuarina NT 0811
		Level 5, Manunda Place
		38 Cavenagh Street,
		Darwin NT 0800

2.3 Compliance and Registration

All radiation places, apparatus and sealed radiation sources must be registered. Before registration is possible it may be necessary to acquire a licence to possess (Section 2.4). This will be dependent upon initial measurement results from the area.

The registrations shall be maintained by Eclipse Metal's Responsible Person (also known as the Owner or Person Conducting a Business or Undertaking [PCBU]).

RPNT requires that radiation sources are:

- Overseen by a Responsible Person



- Dealt with in accordance with an endorsed Radiation Protection Plan (RPP)
- Dealt with under the direction of a competent and endorsed Licensee (otherwise known as a Radiation Safety Officer (RSO))

2.4 Licences and Accreditation

The Responsible Person shall nominate a suitably qualified person to be the site's statutory Licensee (Radiation Safety Officer (RSO)). The Licensee will have oversight of the licence to possess.

A licence to possess is also known as a radiation protection plan. It is a document that describes the current and planned radiation-related procedures. An organisation needs a licence to possess a radiation source (which includes radiation apparatus) in order to register any radiation place, source or apparatus.

Any company or individual who want to install, repair, service or test radiation sources in the Northern Territory must be accredited. Accreditation will allow the company/individual to:

- Issue certificates of compliance for radiation sources and radiation places
- Decommission a radiation source
- Install a radiation source
- Repair or service a radiation source
- Test a radiation source.

In the absence of the Licensee, on-site responsibility for their functions may be exercised (under delegation) by a suitably trained worker nominated/appointed by the Responsible Person ['Site Nominee'] (see Section 3.2)

2.5 Dose Limits

The system of radiation protection as recommended by international guidelines is based on the principles of justification, optimization, and limitation of doses to persons.

Exposure of persons to radiation is classified into three classes: occupational, medical, and public. Occupational exposure is defined as being incurred at work and principally as a result of working directly with radiation. Dose limits for radiation and non-radiation workers are given in Table 3.

Table 3: Radiation Dose Limits

Radiation Worker	Less than 20 mSv per year, averaged over a five-year period
Non-Radiation Worker	Less than 1 mSv per year, averaged over a five-year period



3 Responsibilities and Duties

3.1 Leadership and Accountability

Table 4 lists the major project responsibilities.

Table 4: Responsibilities

Company	Eclipse Metals Ltd			
Site	Devil's Elbow & Ngalia Basin Projects			
Registration #	ТВА			
Radiation Use	Exploration - NORM			
Responsible Person	Andy Wilde Exploration Manager (currently consultant) 0409-006585 wildegeoscience@gmail.com			
Site Nominee	Andy Wilde Exploration Manager (currently consultant) 0409-006585 wildegeoscience@gmail.com			
Radiation Service Provider	Radiation Services WA 08 6117 4095 admin@rswa.com.au www.rswa.com.au			

3.2 Responsibility for Radiation Safety

Eclipse Metals' Responsible Person (also known as the Person Conducting a Business or Undertaking (PBCU)) holds ultimate responsibility to ensure that correct procedures are followed in the care, use and disposal of radioactive sources.

Information relating to changes concerning the site's radiation sources or associated plant must be communicated to RPNT so that information contained on the registration and licensing files remains current. The RPA requires that RPNT be notified of any changes before they are made effective.

RPNT require written submission of any changes made to individuals who hold a possess, use, sell, acquire, transport, dispose or otherwise deal with a radiation source.



Eclipse Metals must ensure that a competent person provides radiation protection advice to the Responsible Person and the site. This role is typically referred to as the Radiation Safety Officer (RSO).

The practicalities and duration of site operations will typically mean that the statutory licensee is not on-site at all times. Eclipse Metals will appoint a worker (or workers) ['Site Nominee/s'] on the site to monitor, report and take action in relation to the duties of the Responsible Person (section 3.3) in this RPP. Worker(s) so nominated need to have received training equivalent to the NORM Technician training course, the appropriate RSWA package.

3.3 Duties of the Company/ Responsible Person

The responsibilities of the Responsible Person are defined in the RPA and the RPR¹. Some of the major responsibilities required include, but are not limited to:

- A current registration is held for the site and the radiation sources.
- The radiation practice is covered by a licence to possess a radiation source and has a Radiation Protection Plan (RPP).
- Planned practices comply with licence and registration conditions.
- A suitably qualified licensee is nominated.
- A calibrated radiation survey meter, suitable for the type of radiation emitted by site devices (Cs-137 and x-radiation), must be readily available or accessible
- Procedures described in this plan are followed and check lists are completed when maintenance is carried out.
- Disposal of radiation sources is performed in accordance with registration requirements prior written approval must be obtained and RPNT are notified of any disposals.
- Radiation sources are only transferred to another licensed person and RPNT are notified of any movement of sources in and out of the territory.
- A suitable store for radioactive sources can be made available on site if required which meets all radiation store requirements.

3.4 Duties of the Licensee (Radiation Safety Officer (RSO))

Although ultimate responsibility of radiation management is incumbent on the Responsible Person, the RSO generally has a higher degree of competence in radiation management and is more involved in the daily duties of radiation management. The RSO must maintain the level of expertise required to perform these duties efficiently.

Eclipse Metals has engaged the services of Radiation Services WA (RSWA) to provide subject matter expertise and advise on radiation protection matters.

The RSO is responsible for the onsite implementation of the RPP and safe work practices as well as carrying out radiation monitoring. The main responsibilities of the RSO include:

- Assist the Responsible Person to comply with the site's legislative requirements
- Ensure facilities are maintained to a suitably safe standard
- Assist in the preparation and enforcement of safety rules
- Ensure training, instruction and supervision to perform duties safely is provided
- Ensure all monitoring equipment is maintained and regularly calibrated
- Personal radiation monitoring is performed where appropriate

¹ See page 6 for the list of Acronyms



- Investigate and report any radiation exposure or contamination incidents
- Report to registrant radiation hazards or non-compliance with procedures
- Maintain records of registration, use, monitoring, calibrations, and serial numbers
- Maintain site inventory and movement log
- Oversee the safe transport of radioactive material / contaminated equipment
- Reports on any incidents or accidents
- Maintain the security of radioactive material
- Survey meters and monitoring equipment are maintained in accordance with this RPP
- Assess and monitor radiation dose rates on site
- Assess internal exposure pathways for workers
- Assess contamination levels on site (working surfaces, equipment, personnel)
- Assess and estimate doses to site workers, public and the environment
- Perform radiation inductions and re-inductions for site personnel

Only people suitably trained in the use of monitoring equipment will conduct the monitoring in accordance with the company monitoring procedures. Sample analysis is performed at endorsed analytical laboratories.

Where appropriate, and the worker is suitably trained, some of these duties will be actioned on a day-to-day basis by the Site Nominee on the authorisation of the RSO.

3.5 Worker

The term 'worker' applies to all persons working onsite – employees, contractors, etc.

Ideally, temporary workers should avoid working near NORM. If they are required to work near NORM, they shall be:

- Advised of the hazards via site inductions
- Supervised
- Provided with appropriate PPE and training to minimise radiation exposure

Workers in the designated radiation work group must work in accordance with the RPP and with any instructions from the RSO. This includes wearing all PPE required and complying with all monitoring requirements.

Non-radiation workers must work in accordance with their specific job requirements. Non-radiation workers are not permitted into restricted areas without approval of the RSO.



4 Risk Assessment and Work Planning Protocols

Personnel working near NORM shall ensure work is undertaken in accordance with the protocols contained in this RPP.

Site activities identified as presenting radiological risk include:

- Drilling
- Sample collection and storage
- Sample transport
- Management of drill spoils
- Digging exploration trenches

4.1 Workforce Details

Planned site activities include a drilling campaign to commence in Q3/4 of 2023 with follow up programs the following year. The Ngalia work program consists of a 1 month campaign with a drilling operation of 2 weeks while the work program at Devil's Elbow consists of a 2 month campaign with a drilling operation of 1 month. The nature of future work programs will be dependent on the findings from the initial campaign, although for the purposes of calculating potential radiation doses, the total drilling campaign will be of 6 weeks (42 days) duration over the course of a year.

Site workers include Drillers, Geologists and Field Assistants as shown in Table 5. All workers are at the drill rig for the duration of their swing over the campaign. Where there is uncertainty in the rostering, the potential radiation risk to personnel is based on the assumption that would have personnel at the drill rig for longer hours over the campaign, thus providing the worst-case scenario.

Work category	Number of workers	Number of drilling operations /year	Roster	Shift (hours)	Drilling operation hours at Ngalia Basin Project	Drilling operation hours at Devil's Elbow Project
Geologist	1	2	4 weeks	12	168	336
Field Assistant	1	2	4 weeks	12	168	336
Driller	2	2	2:2	12	168	168

Table 5: Workforce rostered during drilling operations

4.2 Critical Groups

The closest critical group to the Ngalia Basin Project area is the Vaughan Springs Homestead, which is located approximately 3.5km away. Additionally, there is the Bigryli camp (uranium project) which is situated 7km from the northern boundary and Yuendumu is 60km east of the tenements and 21km north of the applications. There are no critical groups within 12 km of the Devil's Elbow Project area or applications. There are no settlements within either exploration project areas.



Since there are no permanent settlements and exposure to any members of the public is limited to a very brief moments while driving through the tenement on the public road, the risk to any members of the public is assessed as negligible.

4.3 Foundation Information

The DMIRS NORM Guidelines (May 2021) document NORM-V Dose Assessment requires that all exposure pathways must be considered when assessing potential radiation doses arising from exposure to NORM, including:

- External radiation exposure
- Inhalation of dust containing radionuclides
- Inhalation of radon (both Rn-222 and Rn-220) and their decay products
- Ingestion of drinking water
- Ingestion of food, dust and soil

NORM that may be encountered are predominantly uranium and thorium bearing ores. Both uranium and thorium have complex decay chains emitting alpha, beta and gamma radiation through natural decay; however, the highest risk to human health will be from alpha radiation through inhalation and ingestion.

Depending on the rock type and the drill rig, percussion drilling in ore intersections above the water table can result in the generation of substantial dust. Handling of the samples may also generate dust. It is therefore necessary to determine whether respiratory protection, such as disposable P1 or P2 type dust masks, will be required.

4.4 Radiation Risk Assessment

The exposure pathways for radiation doses are:

- Direct irradiation by gamma radiation
- Inhalation of radon progeny in the air
- Inhalation of airborne ore dust containing long-lived alpha-emitting radionuclides
- Ingestion of radioactive contamination

These pathways can be examined in more detail with respect to the project tasks. A summary of NORM / radiation exposure pathways identified for the project are detailed in Table 6.

Table 6: Exposure Pathways and their Relevance to the Project

Exposure Pathways	Comment	Assessed
External radiation exposure (γ-radiation)	Direct irradiation from mineralised sample cuttings, core and sludges from the drilling process at the drill site, and samples of these materials stored elsewhere. The sample storage area is expected to be the source of the highest gamma levels on the project site.	Yes



Exposure Pathways	Comment	Assessed
Inhalation of dust (α- radiation)	Inhalation of airborne mineralised dust at the drill site and where radioactive samples are stored. This exposure pathway is possible when conducting drilling or when digging pits and trenches. Dust exposure levels may also be exacerbated when sludges from wet (core or mud rotary) drilling dry, leaving concentrated mineralised dust deposits. Dust is controlled using correct work practices and respiratory protection if necessary.	Yes
Ingestion of drinking water (α- and β- radiation)	No bore water will be used for drinking. Drinking water will be supplied from reliable safe source	No
Incidental ingestion of dust and soil (α- and β- radiation)	Ingestion of mineralised dusts transferred from hands to mouth when eating or smoking. This risk is eliminated by adoption of good hygiene and housekeeping practices including no smoking near the drill rigs will be allowed. Therefore, exposure from this pathway will be insignificant	No
Surface contamination (α - and β - radiation)	Due to the potential of radiation levels in excess of natural background levels, equipment and area assessments will be carried out to mitigate this risk. Therefore exposure from this pathway is expected to be very low.	No
Inhalation of radon and decay products (α- radiation)	Due to the open nature of the exploration process radon gas exposure will be insignificant.	No
Ingestion of home grown/local produce (vegetables, meat & fish)	Not considered applicable, as no produce is grown on the site.	No

4.5 Project Dose Assessment

As detailed in Table 6, the only dose pathways of any significance are external radiation exposure and inhalation of dust. The other radiation dose pathways have therefore not been included in the Project Dose Assessment.

Direct gamma irradiation may occur when people are exposed to mineralised sample cuttings, core and sludges.

Department of Mines and Petroleum, (2010) NORM-2.1 guideline Table 2.2 details a range of calculated dose and dose rates from various uranium projects with varying ore grades. This information is useful for planning purposes, where an estimate of the ore grade can be made. **Please note** that this is a guide of potential doses only and must be supplemented by the collection of 'actual' site data.



Internal radiation dose exposure is dependent on a number of factors, but two main factors in this risk assessment are the variation in uranium grade (ppm or Bq/g) and the dust particle size.

External Exposure – Ngalia Basin project

The uranium concentration for Ngalia Basin is up to 500 ppm U_3O_8 . Using the dose estimates from the NORM 2.1 Guideline, it is possible to estimate the doses from external exposure at various distances from mineralised material within the deposits, as shown in Table 7 and Figure 2. Calculations are based on the information in Table 5, on the assumption that the workers spend half the time at Ngalia Basin and the other half at Devil's Elbow.

Table 7: Dose	Assessment from	External	Radiation	Exposure	for Nga	lia Basin	Project
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Workforce SEG's	Exposure (hours)	Distance (m)	Dose rate (uSv/h)	Dose (uSv)
		0.5	0.125	21
Coologist	460	1	0.03	5
Geologist	108	1.5	0.015	2.5
		2	0.01	1.7
		0.5	0.125	21
Field Assistant	160	1	0.03	5
	100	1.5	0.015	2.5
		2	0.01	1.7
		0.5	0.125	21
Drillor	169	1	0.03	5
Dimer	100	1.5	0.015	2.5
		2	0.01	1.7





Figure 2: Dose Assessment from External Radiation Exposure for Ngalia Basin Project

The project dose assessment estimate shows that it is extremely unlikely that workers on the project will be exposed to significant doses through direct gamma emission from mineralised samples.

External Exposure - Devil's Elbow project

The uranium concentration for Devil's Elbow is up to 5,000 ppm U_3O_8 . Using the dose estimates from the NORM 2.1 Guideline, it is possible to estimate the doses from external exposure at various distances from mineralised material within the deposits, as shown in Table 8 and Figure 3. Calculations are based on the information in Table 5, on the assumption that the workers spend half the time at Ngalia Basin and the other half at Devil's Elbow.

Workforce SEG's	Exposure (hours)	Distance (m)	Dose rate (uSv/h)	Dose (uSv)
		0.5	1.27	427
Coologist	226	1	0.315	106
Geologist	550	1.5	0.14	47
		2	0.08	27
		0.5	1.27	427
Field Assistant	336	1	0.315	106
		1.5	0.14	47

Table 8: Dose Assessment from External Radiation Exposure for Devil's Elbow Project



		2	0.08	27
		0.5	1.27	213
Duillen	100	1	0.315	53
Driller	108	1.5	0.14	24
		2	0.08	13



Figure 3: Dose Assessment from External Radiation Exposure for Devil's Elbow Project

The project dose assessment estimate shows that workers on the project may be exposed to doses through direct gamma emission from mineralised samples that may be approaching the non-radiation worker dose limit at close distances.

Internal Exposure by Inhalation of Dust – Ngalia Basin project



Table 9 and Figure 4 show estimated doses to personnel for various dust concentrations for 5 um dust at 300 ppm U_30_8 (NORM 2.1 Guideline). Although it is anticipated that respirable dust levels will typically be less than 3 mg/m³, calculations in later sections of this RMP assume a factor increase scenario of 5 mg/m³ for dose assessment purposes.



Table 9: Dose Assessment from Internal Radiation Exposure (LLA - radiation) from 5 um dust at Ngalia Basin Project

Workforce SEG's	Exposure (hours)	Dust concentration (mg/m ³)	Dose rate (uSv/h)	Dose (mSv)
		1	0.05	8
		5	0.25	42
Geologist	168	10	0.55	92
		15	0.8	134
		20	1.05	176
	_	1	0.05	8
Field Assistant 1		5	0.25	42
	168	10	0.55	92
		15	0.8	134
		20	1.05	176
		1	0.05	8
		5	0.25	42
Driller	168	10	0.55	92
		15	0.8	134
		20	1.05	176



Figure 4: Dose Assessment from Internal Radiation Exposure for Ngalia Basin Project



The project dose assessment estimate shows that workers on the project may be exposed to doses through inhalation of dust from mineralised samples that may be approaching the non-radiation worker dose limit for higher dust concentrations.

Internal Exposure by Inhalation of Dust - Devil's Elbow Project



Table 9 and Figure 5 show estimated doses to personnel for various dust concentrations for 5 um dust at 300 ppm U_30_8 (NORM 2.1 Guideline). Although it is anticipated that respirable dust levels will typically be less than 3 mg/m³, calculations in later sections of this RMP assume a factor increase scenario of 5 mg/m³ for dose assessment purposes.

Workforce SEG's	Exposure (hours)	Dust concentration (mg/m³)	Dose rate (uSv/h)	Dose (mSv)
		1	0.55	185
		5	2.65	890
Geologist	336	10	5.25	1764
		15	7.9	2654
		20	10.5	3528
		1	0.55	185
Field Assistant	336	5	2.65	890
		10	5.25	1764
		15	7.9	2654
		20	10.5	3528
		1	0.55	92
		5	2.65	445
Driller	168	10	5.25	882
		15	7.9	1327
		20	10.5	1764

Table 10: Dose Assessment from Internal Radiation Exposure (LLA - radiation) from 5 um dust at Devil's Elbow Project





Figure 5: Dose Assessment from Internal Radiation Exposure Devil's Elbow Project

The project dose assessment estimate shows that workers on the project may be exposed to doses through inhalation of dust from mineralised samples that will be in excess of the non-radiation worker dose limit for most dust concentrations.

Estimated Resultant Dose

The results for the total dose to personnel are a sum of internal and external doses using the estimates outlined above - refer to Table 11. Expected doses are calculated based at 1 m distance with 5 mg/m³ dust concentration.

Workforce	Ngalia Bas	in Project	Devil's Elbo	ow Project	Expected
SEG's	Estimated External Gamma (mSv)	Estimated Internal Dust (mSv)	Estimated External Gamma (mSv)	Estimated Internal Dust (mSv)	Total Dose (mSv)
Geologist	0.005	0.042	0.11	0.89	1.05
Field Assistant	0.005	0.042	0.11	0.89	1.05
Driller	0.005	0.042	0.05	0.44	0.54

Table 11: Dose Assessment (tota	l dose) based on ty	ypical working distances	and dust concentrations.
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Using the results obtained from the assessment above it can be seen that, without any controls in place, the potential dose estimates for some workers could exceed the non-radiation worker dose limit of 1 mSv. Note: The Expected Total Dose for Driller SEG is notably lower than the Expected Total Dose for the other workforce SEG's due to the assumed roster pattern. This result was based on assumptions about the working environment and procedures, which include a conservative estimate of the dust concentration. It is probable, that with reasonable weather conditions and appropriate controls, the actual dose will be much less then modelled.



Given these expected doses to personnel, monitoring and training will be required for all workers as described in sections 6 and 7 respectively. It will also be necessary to incorporate controls as stipulated in the following sections to ensure potential doses to personnel are kept below the legislative dose limits. Furthermore, workers shall apply the ALARA principle to the management of potential exposure - that is to say it seeks to ensure that radiation exposure is "as low as reasonably achievable".

4.6 Risk Assessment

Additional risk assessments shall be performed for all tasks related to working near NORM that are not covered by this RPP. Copies of the risk assessments are to be kept as part of the Site Radiation Records.

The risk assessment should include the following:

- Information on the planned activity, personnel involved, and the main hazards and risks identified
- An estimate of potential doses arising from planned work. The regulatory Dose Limits are set out in this RPP
- Control measures to be implemented
- If applicable, consideration of female employees who have declared they are pregnant
- Planning for accidents and foreseeable incidents, e.g., possible failures of control measures

Work undertaken by contractors (e.g. drilling) is carried out in accordance with their procedures, however, the radiation management protocols shall be overseen by Eclipse Metals' workers.



5 Work Practices and Dose Minimisation

All workers are reminded that they shall comply with the legislation and publications listed in this RPP. This system also considers the three principles of radiation protection, being:

- Justification (that any activity involving radiation should do more good than harm)
- Optimisation (that actual exposure, likelihood of exposures and number of exposed persons should be as low as reasonably achievable (ALARA), taking into account economic and societal factors)
- Dose limits (levels of radiation dose that must not, under normal circumstances, be exceeded)

Given the presence of the drill spoils on the surface, and the potential for doses to exceed the dose limits without adequate controls, it is important that work practices are implemented to ensure dose minimisation. This section of the RPP details those dose minimisation practices and how the principles of radiation protection are put into practice.

5.1 Fundamental Controls

Eclipse Metals shall ensure that the plan for control of exposure to radiation in the workplace is based on a hierarchy of controls, including:

- Avoidance of exposure, where practicable
- Isolation of sources of radiation, where practicable, through shielding, containment, and remote handling techniques
- Engineering controls to reduce radiation levels and intakes of radioactive materials in the workplace
- Adoption of safe work practices, including work methods that make use of distance, time and shielding to minimise exposure
- Where other means of controlling exposure are not practicable or not sufficient, the use of approved personal protective equipment

It is worth offering a more in-depth explanation of the Distance, Time and Shielding principles² as they relate to radiation protection:

- Increase distance doubling the distance from the source, will reduce the dose rate to a quarter of the previous value
- Decrease time The dose accumulated from being near a radiation source or working in an area with a specific dose rate is directly proportional to the amount of time they spend in that area
- Increase shielding The use of suitable shielding material will reduce the dose rates from the source. Shielding is incorporated into gauge design and the use of processes such as source isolation will ensure that dose rates remain within the acceptable range during normal operation.

5.2 Storage and Waste Management

It is important to minimise the impact on the environment by limiting dispersion of radioactive materials. Eclipse Metals will seek to contain all drill cuttings to the extent reasonably practical

² These are also referred to in the Appendix



by capturing all cuttings via cyclone and then storing them in a fenced open storage area (to minimise radon accumulation) within standard core trays remote from field camp. The core trays will be covered to minimise dispersion of dust.

Materials in excess to sampling needs, spillages or wastes from sample preparation activities, will be disposed of by burial in specially designated pits. These pits will be covered with approximately 1 metre of local spoil, located by GPS, photographed, and recorded.

5.3 NORM Identification Marking and Warning Signage

NORM-impacted equipment and NORM material must bear an identification marking to show radiation levels and the date the measurements were taken. The identification marking must be visible and legible.

Additionally, a warning sign bearing the international radiation warning 'trefoil' and the words 'RADIOACTIVE MATERIAL' must be posted on or adjacent to the segregated area where the NORM-impacted equipment and waste is stored.

Examples of identification and warning signs for are shown below in Figure 6 and Figure 7.

N.0	D.R.N	۱.
Cont	amina	ted
Project		
Name		
Date		
Details		

Figure 6: ID and warning label for NORM impacted waste



Figure 7: Radiation Store warning signage

5.4 Control of Radioactive Contamination

Radioactive contamination refers to radioactive material that may enter the body. People who handle radioactive material may take some of the radioactive material into their bodies via ingestion, inhalation, injection, or absorption through intact or damaged skin. Radioactive contamination is generally not visible, so anything that has come into contact with a radioactive material must be assumed to be contaminated until a contamination clearance has been conducted, either by direct monitoring or analysing a wipe test. If radioactive contamination enters the body, the contamination then causes internal radiation exposure.



To minimise internal radiation exposure, the following control measures apply to personnel handling a sample containing radioactive material:

- Special consideration should be given to protecting damaged skin. Personnel with open wounds or rashes must not conduct work with samples unless suitably covered with waterproof dressing. As part of the risk management process consider postponing operations until skin has healed
- Disposable gloves are to be worn at all times when handling radioactive material
- The handling of radioactive material is to be carried out in a designated controlled area
- The designated controlled area must be clearly labelled with signs stating "CAUTION: RADIATION AREA" with the radiation trefoil symbol
- When moving a core sample containing radioactive material around the facility it should be packaged in enclosed containers/trays
- No smoking, eating or drinking is permitted in areas where radioactive material is being handled
- Do not place pens or other tools such as rulers in mouth while handling radioactive material
- Do not lick core samples
- So as to reduce the risk of personal contamination remove gloves on completion of handling radioactive material by peeling off inside out from the wrist, and wash hands prior to commencing new tasks
- Anything that comes into contact with a sample should be checked before leaving the controlled area with a contamination monitor capable of detecting alpha, beta and gamma radiation
- When handling samples attempt to minimise dust, or wear a P2 dust mask to avoid breathing dust from the material
- Instructions as to the immediate actions that will be taken in the event of emergencies must at all times be carried by employees when moving radioactive material, and be displayed in the designated controlled area
- Wash hands regularly, especially before meals or smoking
- Wash clothes regularly to prevent dust build-up
- Maintain vehicles so they are clean and free of dust and dirt (particularly inside vehicles)

5.5 Exposure Minimisation Techniques

Sampling of drill chips may involve working in close proximity to low grade ore mineralisation, and therefore exposure to minor levels of gamma radiation at the drill site and sample storage facility. No worker should unnecessarily stand in close proximity (<1 m) to either the filled sample bags or the drill spoil. Samples should only be handled via sampling buckets and/or spears, or other indirect methods wherever possible. If it is necessary to handle the sample directly then impervious gloves should be worn.

Each sample interval recovered from the drill hole will be measured with a radiation survey meter. Workers will be alerted to the presence of samples with elevated radiation (and hence radioactivity) levels.

Ingestion and inhalation of radioactive material shall be minimised by maintaining high levels of workplace and personal cleanliness. Support vehicles will have basic hand and face wash facilities (bowl and/or portable shower, clean water, soap, paper towels). Cleanliness measures to be implemented include:



- Wash hands and face prior to meal and drink breaks, or before smoking or going to the toilet
- No smoking is allowed in the vicinity of the operating drill rig
- Workers shall shower and change at the end of every shift
- Open wounds/cuts should be irrigated liberally before dressing (to remove dust) then a dressing maintained at all times while working (to prevent further dust ingress)

Radioactive samples from the drill site (and field inspections) will be stored in a secure wellventilated area away from the temporary campsite/driller's accommodation and access roads. Any samples with a surface dose-rate greater than 5 uSv/h will be labelled as "Radioactive", and the area shall be designated as a "Supervised Area" and access will be controlled and time spent in the area will be limited.

5.6 Decontamination Procedures

Contamination occurs when radioactive material is deposited on materials, skin, clothing, or any place where it is not desired. When working in an area where NORM is present, a quick determination of whether contamination is present can be made by using a survey meter near the material, skin, clothing or other surface and observing whether the reading is greater than twice the background level for the area. As the drill site is inherently dusty, further cleaning must be undertaken when personnel or equipment are to be moved offsite to limit the spread of radioactive contamination from the drill site.

Personal Decontamination

Radioactive contamination should be removed from the skin as soon as possible to reduce radiation exposure. Contamination deposited directly on the skin can cause irradiation of the skin as well as substantially increasing the risk of intake into the body.

- Use water, mild hand soap or other appropriate solution for use on the skin. It is highly likely that the contamination will be in the form of dirt or soil and therefore water or mild hand soap should be used first when attempting to remove contamination. Some decontamination solutions and cleansers contain harsh chemicals and are not intended for use on the skin
- Water used for skin decontamination should be lukewarm in temperature. Water that is too hot or too cold will increase the blood flow to the area and increase the absorption of the contamination
- Gently wash the affected skin areas for two to three minutes. Pay special attention to the fingernails if the hands are contaminated
- Rinse with clean water and gently pat dry. Re-monitor the area with a contamination monitor
- Repeat this procedure as necessary: RUB, DO NOT SCRUB

Note: Gloves should be worn to prevent the spread of radioactive contamination to the hands during decontamination operations

- Work from the centre of your body outwards (if your forearm is contaminated wash from the elbow towards the hand, hold your arm such that the water runs off your arm into the sink, not onto the floor or your body)
- Monitor affected skin areas after every decontamination attempt to determine effectiveness



- Stop cleaning immediately if contamination cannot be removed, or if the skin becomes irritated
- Rinse your eyes in an eyewash station for at least 15 minutes to flush foreign material out
- Rinse your mouth with water, but DO NOT swallow
- Blow your nose and keep the tissue, it will be analysed for radioactive contamination. The nose filters approximately 50% of particulate matter
- Have someone absorb surface liquids, and liquids in the outer ear, lean to the side which has the liquid in it. Do not stick anything in your ear

Control of Contaminated Clothing

- Put on a clean pair of gloves to carefully remove all contaminated clothing in such a way as to prevent further contamination, especially to the skin. Remove clothing inside out to contain the contamination
- Seal the contaminated clothing in a plastic bag. Write the following information on the bag: Name of the owner, date bagged, telephone number of the owner of the clothing, and the radioisotopes involved
- After removal of contaminated clothing, carefully monitor all exposed skin areas. Monitor your hands. Follow the personal decontamination procedure above if skin contamination is detected
- The clothing must be stored safely until it can be cleaned. If the clothing cannot be cleaned it must be analysed for contamination levels to determine the correct disposal path

Decontamination of Equipment and Surfaces

Tools, equipment, and work areas must be free of radioactive contamination whenever possible. All users are responsible for conducting surveys and promptly decontaminating all items and surfaces, if required.

- Always wear protective clothing during decontamination operations. Minimum requirements include wearing a lab coat and two pairs of gloves
- Ensure that all radioactive waste generated during decontamination is properly collected and disposed of into designated and clearly labelled radioactive solid and liquid waste containers
- Conduct wipe tests to assess if there is any removable contamination
- Methods used in decontamination include washing, scrubbing, abrasion, and corrosive methods. Always start with washing before progressing to more difficult decontamination methods

Decontamination Methods

Tape strip method:

- Attempt to remove the contamination using a manageable strip of cloth-backed adhesive tape by placing over the contaminated area and carefully removing again
- Encapsulate the tape strip within a glove
- Monitor the tape (within the glove) away from the immediate area to determine effectiveness and dispose of appropriately
- Check and replace gloves as necessary



- Re-survey the decontaminated area to determine if any contamination remains: if there has been a reduction, continue to decontaminate using the tape method (as above)

Cloth and decontamination agent method:

- Moisten area with decontamination agent or detergent
- Using a cloth, decontaminate the area by wiping from the outer perimeter of contaminated area inwards
- Encapsulate the cloth within a glove
- Monitor the cloth (within the glove) away from the immediate area to determine effectiveness and dispose of appropriately
- Check and replace gloves as necessary
- Re-survey the decontaminated area to determine if any contamination remains: if any contamination remains, continue to decontaminate

Scourers and decontamination agent method:

- Moisten area with decontamination agent or detergent
- Using a scourer, decontaminate the area by rubbing in a circular motion from the outer perimeter of contaminated area inwards
- Encapsulate the scourer within a glove
- Monitor the scourer (within the glove) away from the immediate area to determine effectiveness and dispose of appropriately
- Check and replace gloves as necessary
- Re-survey the decontaminated area to determine if any contamination remains: if any contamination remains, continue to decontaminate

Additional guidelines:

- DO NOT use methods such as grinding, sanding, scraping, or chipping contaminated surfaces without further consulting the RSO
- Complex items should be dis-assembled as much as possible to allow sufficient cleaning of inner surfaces which may be contaminated. Do not dis-assemble if such action will jeopardise the operational integrity of the item or equipment
- Use disposable materials, such as paper towels
- Minimise the spread of contamination during decontamination operations. Avoid wiping a highly contaminated cleaning towel over a less contaminated surface. Generally, the best technique is to start at the edge of a contaminated area and work toward the area of highest contamination. The exception to this, however, would be to clean highly contaminated areas first if those areas were creating unacceptably high radiation exposure levels (dose rates)
- Frequently monitor surfaces during decontamination with either portable survey instruments or wipe tests to determine the effectiveness of the procedures being used. Continue decontamination as necessary
- Items and surfaces which cannot be successfully decontaminated must be identified and controlled as radioactive material. Such areas may also require shielding
- Once decontamination procedures are complete, remove gloves and wash hands thoroughly. Monitor hands, body, clothing, etc., for radioactive contamination



Contamination Control Protocols and Record Keeping

Radioactive mineralised bagged samples will be stored in clearly labelled, sealed 200 litre steel drums. Drums shall be sealed with steel banding and monitored for contamination as they may be subsequently transported for assaying.

All tools, equipment or scrap that may be contaminated with radioactive material are to be screened to ensure that they are within the release limits. Surface radiation contamination on drill rigs, plant and all field-based equipment must be no more than 0.4 Bq/cm² for beta and gamma emitters and low toxicity alpha emitters, or 0.04 Bq/cm² for all other alpha emitters, otherwise, equipment should not be released from the site.

Records must be maintained documenting the results of this testing and demonstrating results complied with the nominated clean-up criteria.

5.7 Dust Control

Dust Control is typically the main potential source of exposure in exploration, so it is important that dust be controlled during drilling operations. Percussion drilling above the water table can generate substantial volumes of dust whereas percussion drilling below the water table, and the diamond and rotary mud drilling techniques are effectively dust free.

Potential dust sources on a drilling rig when drilling dry or above the water-table include the: T-piece, Splitter, Cyclone (top vent), drill rods, drilling equipment, clothing and collar cutting. Water will be applied accordingly to prevent any form of contamination which may result from the dust being produced and the use of a pipe that allows discharge of dusty air at a safe distance from the rig. Drilling contractors and company representatives at the drill site will be required to wear disposable P1 or P2 type dust masks whenever drilling and related activities (e.g., riffle splitting of samples) is creating visible dust.

Employees wearing dust masks will be required to be clean shaven and they will be trained in the appropriate use and fitting of the masks. Disposable respirators should be replaced regularly to prevent build-up of dust. Additional work practice controls include the requirement is that staff stand downwind of the cyclone when it is operational, Drilling contractors have hygiene and dust suppression in their risk register and have standard operating procedures for this. This includes prestart checks and job observations. Dust monitoring will be conducted to confirm the suitability of controls implemented.

5.8 Radon and Thoron Decay Progeny

Radon and thoron and their decay products (RnDP / TnDP) are non-filterable, heavier than air and are generally only an issue where there is no natural (or mechanical) ventilation – e.g. dead air spaces in sealed processes or storage vessels.

Exposure to radon and thoron has been determined to be of negligible risk (Table 6). The existence of RnDP and TnDP is not considered an issue on this site, as site works are conducted in a fresh-air environment.

If, in the future, drums or containers used for NORM storage are to be opened, natural ventilation will be allowed to occur for ten (10) minutes after opening. The drums and containers are to be stored in an open area.



If work practices change so that personnel are likely to be in the area for three months or more, then radon and thoron monitoring will be conducted.



6 Radiation Monitoring

Radiation monitoring will be carried out to determine the potential impact of the day-to-day operations to workers, the public (not anticipated) and the environment.

For exploration of greenfield sites (before any definite indication of continuous radioactive mineralization), it is not necessary to have a full suite of radiation detection instrumentation. However, it will be necessary to have enough instrumentation to conduct the operational monitoring focusing on measuring all the potential pathways described in Section 4.5. This will consist of routine monitoring of gamma radiation, dust, and contamination levels, which can be achieved with a handheld survey meter.

If longer duration intensive drilling campaigns are required in the future it may be necessary to conduct more monitoring consisting of a GM survey meter, air sampling pump, filter alphacounting equipment, and alpha surface contamination probe, as well as ensuring personnel are wearing their own personal dosimeters.

6.1 Personal Radiation Monitoring Devices

Based on the dose calculations in section 4.5, it is anticipated that personal will be considered as radiation workers, and therefore require radiation monitoring.

A personal radiation monitoring device (PRMD) may be a passive device (e.g., Thermoluminescence Dosimeter (TLD) or Optically Stimulated Luminescence (OSL); or a Personal Electronic Dosimeter (PED) which gives an instantaneous result. TLD and OSL devices do not provide any immediate feedback to the wearer. The TLD and OSL devices must be analysed in a laboratory to obtain the dosimetry results. The co-ordination of PRMD is delegated by the Responsible Person to the RSO. The RSO will assess the PRMD requirements in consideration of the legislative requirements.

Optically Stimulated Luminescent (OSL) dosimeters are issued to site workers (including contractors) for the duration of drilling programs for twelve week or less counting cycles. These dosimeters are designed to be worn over work clothing and will provide an accumulated dose measurement for each individual. Measurement is typically made after the dosimeters are received by the originating organisation and do not provide an instantaneous measure of dose.

Personal radiation dose records shall be retained by the Responsible Person and at the conclusion of the site-based program will provide exposure measurements for employees and contractors. All measurements must be kept for 30 years and provided to the Australian National Radiation Dose Register (ANRDR) at ARPANSA. All individual employees must be provided with a yearly report on their exposure by their employer

6.2 Radiation Survey Equipment

The radiation monitoring equipment to be used has the capability to measure both ambient gamma dose rates and surface contamination. In addition, equipment for the monitoring of dust, which can subsequently be analysed to quantify the presence of radiological material is to be used. This allows for the monitoring of radiological conditions and personal exposure while operating. Radiation monitoring equipment is calibrated every 12 months.



Appropriate NORM radionuclide correction factors are used to assess potentially contaminated surfaces.



CAUTION: Only trained and competent operators are to select and use radiation survey equipment due to the complexities involved.



NOTE: Survey meters are generally calibrated against the radiation emitted from Cs-137 (662 keV gamma radiation) as per industry standards. Measuring the radiation emitted from NORM is complicated, however survey meters can generally still be used valuably for the detection of this radiation.

6.3 Baseline Radiation Monitoring

A baseline survey of the project areas that will be affected by the drilling operations and subsequent handling and storage of radioactive material, will be performed. This baseline survey will take place prior to any drilling operations.

The purpose of this baseline survey is to establish the pre-operational radiological profile of the site. This will provide the reference levels for the rehabilitation of the area at the end of operational lifetime of the facility to ensure that the impact on the environment is minimal.

The baseline monitoring will focus on an environmental gamma survey obtained at key locations such as anticipated drill pad sites, drill rig access tracks etc.

6.4 External Gamma Radiation Monitoring

Routine gamma surveys will take place by direct radiation monitoring. They include surveys of the following areas at various times during the campaign:

- Drill site
 - The area around each new drill site will monitored to confirm consistency with expected dose rates
 - At the conclusion of drilling at each site the area will be monitored to ascertain whether there have been any changes
- NORM storage area or stockpile (Boundary constraint of 10 uGy/h)
 - If samples are stored on the surface
 - Monitoring of the dose rate profile following inventory changes (addition or removal of radioactive material)
- Receipt of packages (if applicable)
 - Monitoring of NORM material (e.g. drums, IBC) on receipt to determine dose rate profile on the 'packages' prior to placing into storage or treatment
 - Plant, laydown and storage areas

6.5 Internal Radiation Monitoring - Dust Monitoring

Dust monitoring will be conducted as inhalation is considered the most significant exposure pathway. A personal dust pump should be worn by a worker on the rig to allow the collection of dust for analysis. Sample will be collected at the end of each shift and sent for laboratory analysis.



Data from the analysis will be used to determine the long-lived alpha activity, which can be converted to internal dose, which can then be compared against the modelled data in section 4.5.

The monitoring program will include at least one sample taken for an entire shift from each work category – Geologist, Field Assistant, and Driller. These samples are to be taken near the beginning of the drilling program, and will be conducted at both locations, Ngalia Basin and Devil's Elbow.

Based on these initial results, additional or ongoing dust monitoring may be required.

6.6 Surface Contamination Monitoring

Monitoring for radioactive contamination will be conducted using surface contamination monitors with the ability to measure alpha and beta surface contamination. Specific NORM efficiency factors should be applied. Direct surface contamination monitoring should be complemented by using wipe (contamination) testing.

Any equipment permanently leaving site must be issued with a clearance certificate, including hire equipment being returned to owners and departing drill rigs. These clearances are essential to mitigate the spread of contamination. All this equipment must be washed and checked and only released after it is certified clean and uncontaminated. All clearances are to be recorded in the Site Radiation Logbook.

An understanding of the type of contamination is essential. The following limits should be applied for a definition of 'contaminated':

- 0.4 Bq/cm² where U-238 and/or Th-232 is considered as the Head of Chain (HOC)

Periodic checks will be performed in the following areas or operations:

- Infrastructure in sample storage area and associated handling areas
- Receipt of packages
- General work area in the project area
- Any break in plant containment where NORM may be present
- Clearance of any plant leaving facility that may be NORM impacted
- Crib, ablution, change facility and general office areas


7 Training

7.1 Radiation workers

All workers that may be exposed to radiation, or working nearby NORM shall undertake radiation protection training to a level commensurate with the complexity of the work they will be undertaking.

Site Nominees acting on behalf of the Responsible Person and RSO on site, and designated radiation workers in supervisory roles shall undertake a NORM Technician (3 day) training course (minimum). This course provides the participant with the skill and knowledge requirements to work safely with NORM under the guidance of a NORM RSO and existing radiation management plan.

Course Structure

- NORM underpinning knowledge
- NORM assessment radiation exposure and contamination of equipment
- Protection principles, hygiene and PPE requirements
- Regulatory framework and responsibilities
- Working in accordance with your Radiation Management Plan (RMP)
- Course Structure
- An Introduction to Radiation
- Radiation in Perspective
- Radiation Dose, Measurement and Protection Principles
- NORM Assessment & Measurement
- Handling, Storage & Transport of NORM
- Regulatory Considerations
- Radiation Management Procedures
- NORM Incident Response

Workers who are non-designated, but who are dealing with NORM on a regular basis (eg, sampling), shall undertake a NORM Awareness (1 day) training course or appropriate on-site radiation safety induction (minimum).

On completion of this one-day course a worker will have the skills required to apply radiation protection and work safety measures, which involve:

- Recognising the hazards and risks associated with working near sources of ionising radiation
- Interpreting and following site safety information
- Using specified radiation protection and safety measures
- Applying required operational safety measures
- Responding appropriately to actual or potential emergencies

Toolbox meetings shall be held regularly to ensure that all site workers are aware of radiological hazards present on-site.



7.2 Induction

All workers conducting duties that may involve exposure to radiation shall receive a Site Induction explaining radiological management processes by appropriately trained employee, including:

- The likelihood of encountering NORM and elevated levels of radiation
- Areas where radiological control measures are implemented particularly the drill site area, and sample storage area
- Personal hygiene and other radiation exposure minimisation techniques.
- PPE training

All other personnel attending site shall receive a Site Induction relevant to their role explaining:

- The likelihood of encountering NORM and elevated levels of radiation
- Areas where radiological control measures are implemented and which they must avoid

Records of inductions undertaken will be recorded in the Site Logbook.

Emphasis should be made to take note of radioactive warning signage. All persons responsible for radiation monitoring will be provided with training in the use of the monitoring equipment, and how to interpret and record the results.

A useful document commonly referred to in the NORM industry is the AUA Handbook, which can be downloaded at:

http://www.i2massociates.com/downloads/Radiation Workers Handbook Radiation Con.pdf



8 Records Management and Reporting

Radiological management records shall be maintained and made available to RPNT as required. Typically, a 'Site Radiation File' is used for this purpose and may be in either a hard copy or in electronic form.

Eclipse Metals will maintain the following information, to be readily accessible:

- Radiation Management Plan (RMP)
- Emergency Response Plan
- Copies of the site registration and licences
- Correspondence with RPNT
- NORM inventory
- NORM movement log (details of NORM itself, where it is from, etc.)
- Annual reports and site visit reports
- Radiation audits and survey results
- Environmental measurements
- Personal Dosimetry data
- Air Sampling data
- Surface Contamination checks/clearance (for release from site geochemical samples mainly, but also vehicles and equipment)
- Details of training conducted
- Equipment inspections (i.e. contamination)
- Survey meter calibration information
- Incident reporting (if applicable)

A clearance certificate shall be issued for NORM samples, vehicles and equipment leaving site certifying that they exhibit only background levels of radiation and must be signed off by the Site Manager and records kept in the radiation file.

The Site Radiation File and Site Logbook may be requested by RPNT. It may also be required at some time in the future as evidence in legal claims.

8.1 Impact on Local Environment

The main impact envisaged for the company's exploration is the result of clearing drill sites and disposing of any radioactive material at the drill site (down the hole), into the sump, or in a dedicated pit remote from the drill site.

Photographs of drill sites will be taken before and after drilling and rehabilitation – environmental gamma measurements will be taken before and after works, and the details of siteworks shall be recorded on an Environmental & Work Area Record form.

Similarly, any disposal pit created by the company will be photographed before and after and relevant details recorded in the logbook. The position of the pit will be recorded with a GPS device so that it can be relocated in the future after topsoil has been replaced and vegetation has regrown.



8.2 Waste Management

Site activities relating to waste identification and disposal will be noted in the Site Logbook and measurements of environmental gamma and radioactivity will be recorded in an Environmental & Work Area Record form.

8.3 Identification of Workers

Record of worker's site attendance shall be maintained by Eclipse Metals for the life of the project, and for 30 years post project completion. This record of worker attendance should include:

- Identification documents (eg drivers licence)
- Role onsite
- Dates onsite
- Personal dosimetry results

8.4 Reporting to RPNT

Eclipse Metals will provide a combined radiation occupational and environmental monitoring report on radiation monitoring of the drilling program. Items reported will include:

- Results of radiation monitoring program
- Dose to workers (based on third party measurements)
- Comparison to dose limits
- Pre- and post-site works measurements at all disturbed sites (i.e. tracks and drill sites)
- Decontamination records for vehicles and equipment leaving the site
- Recommendations for improvements in work practices



9 Incident Response Procedures

In the event of a radiological incident, the Responsible Person, and RSO shall be notified immediately and will determine further notifications and response actions.

Contact details for key personnel and entities are detailed in Table 12.

Table 12. Emergency and Security Contacts

Responsible Person	See Table 4	
Radiation Services WA	Simon Booth (Radiation Protection Expert)	
EMERGENCY PHONE	Phone: 0417 966 438	
Northern Territory	Radiation Protection / Public Health Unit	
REGULATOR -	Email: <u>radiationprotection@nt.gov.au</u>	
EMERGENCY	Phone: (08) 8922 7152	
Northern Territory	Emergency 000	
POLICE, FIRE &	Non-emergency Police assistance Phone – 131 444	
EMERGENCY SERVICE	Non-emergency Fire assistance Phone – (08) 8999 3473	

9.1 Incident Response Information

Incident Response Planning should address potential incident scenarios and specify appropriate action, since the risk of external and internal exposure may increase under abnormal conditions. When large NORM quantities are spilled or released, personnel should stop work immediately. Proper recovery operations should be planned with the advice of the RSO to maintain exposure controls.

9.2 Generic Actions Common to All Incidents

The person discovering the incident/accident shall:

- Notify the RSO immediately
- Arrange for the area to be cordoned off and prevent the entry of non-essential personnel.
- Render (where appropriate) assistance to any injured personnel and call the appropriate emergency services.

The RSO will:

- Notify the Northern Territory Chief Health Officer Immediately
- Ensure that the Responsible Person has been advised of the nature and location of the event
- Allay panic by communicating with the incident scene
- The RSO will attend the incident scene, if practicable



- Assess (with the aid of a radiation survey meter) the nature and scope of the radiation hazard
- Ensure adequate access control is established over the incident scene
- Move persons to a safe distance and prevent unauthorized and unnecessary access to the secured area.
- Prevent the further spread of contamination (if the possibility of this arises)
- Ensure further actions are implemented to remediate the incident scene
- Investigate the cause and circumstances of the incident, including an estimate of doses received by personnel
- Advise the Responsible Person on changes required to prevent the recurrence of a similar incident

An incident report must be completed and forwarded, in writing, to RPNT within 7 days. This report must outline the steps taken to rectify the problem; estimated doses received by all personnel and outline the proposed corrective actions to ensure the incident does not occur again.

PPE and Equipment Requirements

- Respiratory protection (minimum P2)
- Safety glasses
- Gloves (either nitrile, or general purpose are adequate)
- Long sleeves and pants, or coveralls
- Dosimeter (OSL/TLD/PED)
- Radiation survey meter (gamma and contamination capability)

First Aid

Should personnel be contaminated with NORM without PPE, or PPE breach:

- Urgent first aid treatment should take priority over radiation exposure, but if time is permitting, the first aid responder should consider their own protection from NORM exposure ideally all personnel should try to avoid contact with NORM
- Remove contaminated PPC/E and dispose of it safely
- Wash affected skin with water for two (2) minutes
- If eyes have been exposed to NORM, flush eyes immediately continue irrigation for five (5) minutes
- If a person has inhaled, ingested, or eyes have been exposed to NORM, seek medical and radiological advice (from Radiation Service Provider)

Emergency Response Priorities

In the event of a serious accident or emergency that may occur or arise, and Emergency Services are required, they need to know that existing HAZMAT procedures (part of the Emergency Response Plan) and PPE are adequate to control the hazard, and that the sample material:

- Should not be inhaled, eaten or allowed to get into an open wound
- Is not explosive
- Will not burn
- Is a naturally occurring radioactive material of low specific activity
- Can be approached without danger for injury from external radiation



Responding Emergency Services should take the following actions where safe and practicable to do so:

- Rescue injured personnel and provide any emergency first aid/medical attention required
- Evacuate non-essential personnel and members of the community (if applicable) in the immediate area if required
- Use respiratory protection to reduce the possibility of inhaling radioactive material
- Control fires and other common consequences of transport accidents
- Minimise the time spent nearby, and maximise the distance to, any spilt material
- Identify any other associated hazards (e.g. other dangerous goods such as fuel spills, electrical sources) and establish a controlled cordoned-off area
- Control and prevent any additional spread of radioactive contamination

9.3 Loss of Containment / Spill

Should NORM be spilled or released unintentionally, personnel should stop work immediately. Unless urgent action is required to prevent further loss of containment, the emphasis should be on slowing down operations and developing a robust recovery plan.

NORM in general can be cleaned up by suitably experienced site personnel, under the indirect supervision (advice) of the RSO. The RSO, or Site Nominee, will develop a plan to safely recover the material, and to maintain exposure controls, prevent or mitigate further consequences, and regain control of the situation.

In the event of loss of containment, the main exposure for personnel in attendance is likely to occur through internal pathways (inhalation and ingestion). The use of correct personal protective equipment (appropriate respiratory protective equipment and gloves) will reduce the risk of internal exposure.

The affected area should be suitably controlled and segregated, and access should be restricted. Qualified persons such as the facility radiation workers and/or the Site Project Manager would take control of the incident and supervise the response operation. The RSO should also be notified. Suitably qualified and experienced Eclipse Metals personnel will respond with appropriate equipment for undertaking immediate monitoring of the area and conducting any clean up actions.

Upon completion the area should be monitored by suitably experienced personnel. Corrective measures will be taken, as necessary, to prevent the spread of contamination and to prevent a recurrence.

9.4 Spill Kits

An incident response spill kit will be present in the designated storage area for radioactive material and in designated controlled areas. The kit has been designed to assist in safe and efficient containment in the initial stages of a spill. The kit will include, but not be limited to, the following items:

- Personnel Protective Equipment (PPE)
- Personal hygiene materials
- Workplace first aid kit
- Traffic management devices



- Recovery equipment
- Emergency Information

The spill kits are to be maintained by Eclipse Metals employees. Procedural control will ensure that the contents of the kits are checked on a regular basis to ensure they are maintained and ready for use at any time during transport or inspection of samples containing radioactive material.

9.5 Fire

NORM is not flammable. For a situation where fire has impacted on NORM material:

- Where appropriate and safe to do so, extinguish small fires immediately
- The risk associated with inhalation of NORM involved in fire is inconsequential compared to the risk of inhaling smoke and fire gases, and the direct impact of fire itself
- Firefighting measures should be followed as per standard protocols avoid smoke exposure by normal protocols (i.e., stand upwind) – it is possible that the smoke/plume may contain traces of radioactive material
- Environmental considerations should include NORM migration within the fire plume, and within firefighting water run-off
- Following control and extinguishment of fire, NORM containment shall be assessed ideally, the initial assessment should be from a distance and from upwind and uphill of NORM
- Should further assessment be required, or if it is determined that NORM containment has been breached, follow directions in Section 9.3.
- Clean-up of NORM should be performed in accordance with instructions provided by the RSO the engagement of the Radiation Service Provider should be considered

9.6 Transport Incident

This section has been written from the perspective that a transport incident has occurred on a public road, although there are correlations to an incident that may occur on a private site, or when the transport involves rail or ocean transport also.

Transport contractors should have their own emergency management protocols, however they are typically generic and are focused on immediate actions only – they will often seek further advice from the NORM owner, or the consignor, or consignee of the NORM.

In addition to the generic actions outlined in Section 9.2:

- The RSO shall liaise with Responsible Person for the transport of the NORM (via driver, project manager, etc)
- It needs to be emphasized in planning phases that when departing vehicle cab, the driver should take the manifest, consignor's declaration and emergency procedures with them
- Re-visit the emergency response instructions contained on the consignor's declaration
- Maintain incident exclusion zone if possible: keep people away and upwind; do not touch the consignment
- Consider the possibility that persons may be exposed to radioactive material (not to be confused with exposure to radiation from NORM
- All vehicles should remain at the incident site until cleared by: police, or other competent person (e.g. fire brigade personnel, emergency response personnel, etc)



- Should the incident involve a loss of containment, no-one should attempt to: clean up any broken package(s) or materials; handle broken package(s) or materials in any way; or remove the spilt material, packaging or wrapping, unless they have specific knowledge and training in how to do so safely. Protocols from Section 9.3 shall be implemented
- The risk associated with inhalation of NORM involved in fire is inconsequential compared to the risk of inhaling smoke and fire gases, and the direct impact of fire itself
- Firefighting measures should be followed as per standard protocols avoid smoke exposure by normal protocols (i.e. stand upwind) it is possible that the smoke/plume may contain traces of radioactive material
- Environmental considerations should include NORM migration within the fire plume, and within firefighting water run-off
- Following control and extinguishment of fire, NORM containment shall be assessed ideally, the initial assessment should be from a distance and from upwind and uphill of NORM
- Should further assessment be required, or if it is determined that NORM containment has been breached, follow directions in this RMP or the Emergency Response Plan
- Clean-up of NORM should be performed in accordance with instructions provided by the RSO the engagement of the Radiation Services WA should be considered

9.7 Cyclone or Flood Damage

NORM itself is non-affected by wind, water or flood, however the migration of material is possible, if the material has not been adequately contained / protected.

If time permits, attempt to remove NORM material from site prior to the arrival of flood water, or cyclone. As a minimum, ensure that NORM material is stored in sealed containers (i.e., 200L drums) and the drums (or containers) are secured to the ground, as per standard flood & cyclone protocols.

9.8 Loss or Theft

If NORM material is lost or stolen, the RSO, Responsible Person, RPNT shall be advised immediately with a written report completed within 7 days. Attempts to locate NORM shall be commenced as soon as practicable by contacting key personnel, and tracking consignments and movements of material.



10 References

- Radiation Protection Act 2004 (RPA)
- Radiation Protection Regulations 2007 (RPR)
- Work Health and Safety (National Uniform Legislation) Act 2011
- Radiation protection code of practice: acquiring a radiation source.
- Radiation protection code of practice: application for alteration to current radiation protection plan.
- Radiation Protection code of practice: approved form for certificate of compliance.
- Radiation protection code of practice: certificate compliance for radiation place.
- Radiation protection code of practice: disposal of radiation source.
- Radiation protection code of practice: service checks for sealed radioactive material
- NDRP National Directory for Radiation Protection (2nd Edition 2021)
- NDRP National Directory for Radiation Protection (2nd Edition 2021)
- RPS C-1 Code for Radiation Protection in Planned Exposure Situations (Rev. 1) 2020
- RPS C-2 Code for the Safe Transport of Radioactive Material (Rev. 1) 2019
- RPS F-1 Fundamentals for Protection Against Ionising Radiation 2014
- RPS G-3 Guide for Radiation Protection in Emergency Exposure Situations 2019
- RPS 2 Code of Practice for the Safe Transport of Radioactive Material 2008
- RPS 9.1 Safety Guide for Monitoring, Assessing and Recording Occupational Radiation Doses in Mining and Mineral Processing 2011
- NORM-1 Applying the system of radiation protection to mining operations, DMP 2010
- NORM-2.1 Preparation of a Radiation Management Plan exploration, DMP 2010
- NORM-V Dose assessment, DMP 2010



11 Appendix: Understanding Radiation — Basics

11.1 Introduction

Everybody is exposed to ionising radiation on a daily basis, from a variety of natural radiation sources. These include cosmic radiation from outer space, potassium-40 inside our bodies, the presence of uranium, thorium and potassium-40 in the earth's crust and subsequent incorporation into food, water and building materials, and radon gas released during the decay of uranium and thorium.

The radioactivity (or activity) of a substance is expressed as the number of nuclear disintegrations per unit of time. The international (SI) unit of radioactivity is the Becquerel (Bq), which is equivalent to one disintegration per second. The concentration of radioactivity in a substance is measured as activity per unit mass, usually Bq/g.

Radionuclides decay by emission of radiation which can cause damage to biological tissue. The three main modes of radioactive decay are:

- Emission of an alpha (α) particle, which is similar to a helium nucleus consisting of two protons and two neutrons. Alpha particles have only a short range in air and do not pose a significant external radiation hazard. However, they pose an internal radiation hazard via inhalation and/or ingestion.
- Emission of a beta (β) particle, also called beta ray or beta radiation, is a high-energy, high-speed electron or positron emitted by the radioactive decay of an atomic nucleus during the process of beta decay. There are two forms of beta decay, β- decay and β+ decay, which produce electrons and positrons respectively. The range and effects of beta radiation depend on its energy. Beta radiation can pose an external skin dose hazard and an internal hazard.
- Emission of gamma (γ) radiation, which consists of high energy photons emitted from the nucleus. Gamma radiation is highly penetrating and poses an external radiation hazard.
 Alpha and beta emissions are often accompanied by emission of gamma radiation.

The alpha, beta and gamma radiation emitted by radionuclides are examples of "ionising radiation". When such radiation interacts with human tissue it has the potential to damage the cell structure and induce health effects such as cancer. The extent of damage depends on the type of radiation and its energy and is described by the "effective radiation dose". The unit of effective radiation dose is the Sievert (Sv). Since the Sievert is a large unit, radiation doses are often expressed as millisieverts (mSv) and dose rates as microsieverts (μ Sv) per hour or mSv per year (mSv/yr).

11.2 Naturally Occurring Radioactive Material (NORM)

When conducting exploration at the Cummins Range drilling project, the most important naturally occurring radioactive materials are those that contain uranium, thorium and their radioactive progeny (sometimes referred to as "daughters"). There are three naturally occurring radioactive decay chains, each with a very long-lived parent:

- Uranium-238 (half-life 4.5 billion years), specific activity 12300 Bq/g uranium
- Thorium-232 (half-life 14 billion years), specific activity 4040 Bq/g thorium.
- Uranium-235 (half-life 704 million years), specific activity 564 Bq/g uranium



Table 13 shows the radionuclides of concern from the uranium-238, thorium-232 and uranium-235 decay chains. If left undisturbed for a very long time, as in most mineral deposits, the activity of each member of the chain will be identical and the radionuclides are described as being in 'secular equilibrium'. Mineral deposits that have been weathered may not be in secular equilibrium due to the selective leaching of some radionuclides. If the chain is 'broken" by processing, radionuclides will decay or in-grow to establish a new secular equilibrium at a rate determined by the half-lives of the various radionuclides. A useful 'rule of thumb' is that secular equilibrium will be restored within five half-lives of the longest-lived daughter.

Table 13: NORM Decay Series

U-238 Decay Chain	Th-232 Decay Chain	U-235 Decay Chain
Uranium 238	Thorium 232	Uranium 235
Thorium 234	Radium 228	Thorium 231
Protactinium 234	Actinium 228	Protactinium 231
Uranium 234	Thorium 228	Actinium 227
Thorium 230	Radium 224	Thorium 227
Radium 226	Radon 220 (Thoron) (gas)	Radium 223
Radon 222 (gas)	Polonium 216	Radon 219 (Actinon) (gas)
Polonium 218	Lead 212	Polonium 215
Lead 214	Bismuth 212	Lead 211
Bismuth 214	Polonium 212 (64%)	Bismuth 211
Polonium 214	Thallium 208 (36%)	Thallium 207
Lead 210		
Bismuth 210		
Polonium 210		

Naturally occurring radioactive materials (NORM) are common in the environment and contribute to the natural radiation exposure. The median concentrations of uranium and thorium in soils are 3 ppm (0.035 Bq/g) and 7 ppm (0.030 Bq/g), respectively. Radon gas produced by the decay of uranium (Rn-222) and thorium (Rn-220, referred to as thoron), continually emanate from soils. Exposure to radon and thoron gas (from uranium and thorium decay) is unavoidable and is responsible for about 50% of the average radiation dose to individuals worldwide. In some ores and minerals, much higher concentrations of uranium or thorium are encountered.

11.3 Radiation Exposure Pathways

Humans can be exposed to radiation through various pathways, resulting in either an external exposure or an internal exposure (Figure 8). The five main exposure pathways that human organs and tissue can be exposed to radiation are:

- Exposure from external radiation from a source outside the body such as an X-ray machine or standing next to a radioactive source or ore body (an external radiation hazard).
- Through the inhalation of airborne particulates into the lungs which may remain in the lungs or be absorbed into the bloodstream, depending upon its particular physical and chemical properties (an internal radiation hazard).
- Exposure from radon decay products (RnDP) following the inhalation of radon, which may remain in the lungs (an internal radiation hazard).



- Through ingesting material via the mouth, where it will either be absorbed into the bloodstream and distributed around the body, or if insoluble pass through the gut and be excreted (an internal radiation hazard).
- Through entry of radionuclides into the bloodstream via cuts and abrasions in the skin or in some cases by absorption through the skin (an internal radiation hazard).



Figure 8: Potential Radiation Exposure Pathways (Holbert, K.E., Arizona State University)

Exposure via these pathways is highly dependent upon the chemical and physical properties, and forms of the radionuclides. Regardless of whether the exposure is an internal or external dose, exposure from all pathways contributes to a person's dose, which is measured in mSv.

11.4 Natural Background Radiation

lonising radiation from a variety of natural sources is a constant presence in the environment. The global average total dose to an individual is approximately 2.4 mSv per year. However, this varies considerably depending upon factors such as local geology, altitude, the material that houses are built from and the food consumed. Typical doses in Australia are somewhat lower — around 1.5 mSv per year (ARPANSA, 2020).

Uranium, thorium and isotopes from their associated decay chains are present in low concentrations in rocks and soils. Typically, they average about 3 parts per million (ppm) uranium and 7 ppm thorium in ordinary soil, and up to 30 ppm or more in some granites. Uranium ores range from 0.03% (300 ppm) up to a few percent (> 10 000 ppm) in the richest international uranium ore deposits. A number of radionuclides in these natural decay chains emit gamma radiation, which can be an external radiation hazard to people. Radioactive potassium-40 also exists naturally alongside stable potassium isotopes and contributes to external radiation exposure. In addition, potassium-40 exists within our bodies and naturally is a source of internal exposure.



Some radionuclides from the uranium and thorium decay series may be incorporated into food and drinking water, which results in internal exposures to radiation.

Radon (Rn-222) gas and thoron (Rn-220) gas can be a significant source of exposure through inhalation and ingestion through drinking water and may contribute to more than half of the exposure to individuals from natural sources. The exposure from radon and thoron will vary significantly, depending upon the ventilation of the dwelling, the local geology and the weather.

Activities such as the mining of resources containing naturally occurring radiological materials (NORM) or indeed mining the minerals themselves, can lead to additional exposure. Enhanced levels of NORM may also be present at a site as a result of processing this material.

11.5 Minimising Radiation Exposure

All persons using radioactive materials are required to ensure that exposure to radiation follows the ALARA principle: exposure is kept <u>As Low As Reasonably Achievable</u>.

This philosophy should always be borne in mind when working with radiation and fundamentally involves the considerations of time, distance and shielding to control external radiation hazards; and contamination control for internal radiation hazards. The amount of control required will be dependent on measured dose rates from the sample where you will be working, and how easily transferable (friable) the radioactive core sample material is.

The external hazard is controlled by applying three basic principles: Time, Distance and Shielding.

Time

The less time you spend near a source of radiation, the less dose you will receive.

Before approaching a sample containing radioactive material prepare equipment and relevant paperwork. Plan your activities to reasonably minimise time spent near the sample. This will be dependent on dose rates from the sample where you will be working. While not actually physically inspecting a sample, keep at a distance where dose rate is not measurably above background.

Distance

The further you are from a source of radiation, the less dose you will receive.

Ionising radiation spreads through space like light or heat, and the gamma dose rate from radioactive material is inversely proportional to the square of the distance from the source, i.e., the Inverse Square Law applies twice the distance results in quarter the dose rate.

Work practices such as recording details of the samples should be done at a reasonable distance from the radioactive sample. Where possible, rather than recording information directly in front of a sample use space at least one metre away. When handling the sample use an extended arm, where possible, to keep the distance between your body and the radioactive material as large as possible.



Shielding

The more shielding material between you and a source of radiation, the less dose you will receive.

The dose rates around a sample containing radioactive material should be low enough that for the time required to inspect the sample, no significant radiation will be received when following procedures. In some cases, shielding may be used to reduce exposure. Dose rates measurable around a sample will dictate the necessity for shielding. If large volumes of samples are stored in high occupancy areas shielding may need to be considered to protect personnel from an increase in radiation exposure.

There is a variety of shielding materials that can be placed between people and a source of radiation to absorb most of the radiation that would otherwise reach them. The choice of shielding material depends on the type of radiation and what would be considered an acceptable dose rate.