# ONSHORE PETROLEUM PROJECTS ENVIRONMENTAL MANAGEMENT PLAN

# EP144 & 154

# MINERALS AUSTRALIA PTY LTD & JACARANDA MINERALS PTY LTD

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# **EXECUTIVE SUMMARY**

Minerals Australia Pty Ltd (Minerals Australia) and Jacaranda Minerals Pty Ltd. (Jacaranda Minerals), wholly owned subsidiaries of Hancock Prospecting Pty Ltd., are equal shareholders of exploration permits (EP) 144 and 154. Figure I and Figure 1-2 depicts the location and regional context of the EP's, which are the subject of Exploration and Coexistence Deeds between Minerals Australia Pty Ltd, Jacaranda Minerals Pty Ltd (an equal shareholder) and the Northern Land Council (NLC). Minerals Australia is the registered manager of the exploration permits.

Minerals Australia proposes the below works programme for the two EP's:

- EP144 drilling of two exploratory stratigraphic core drill holes to a maximum of approximately 1000 m in depth to obtain stratigraphic information.
- EP154 31.77 km of two dimensional (2D) seismic survey and the drilling of one stratigraphic core drill hole to 1000 m depth to obtain stratigraphic information.

The EP144 exploration area is located over the Mittiebah perpetual pastoral lease (01033), approximately 100 km north-east of the Barkly Roadhouse on the Barkly Highway. EP144 lies over five pastoral leases, Alroy Downs, Alexandria, Mittiebah, Brunette Downs and Mount Drummond. The nearest town is Tennant Creek, which is located approximately 210 km southwest of the project area. Contained within, but excluded from EP144 are the Connells Lagoon Conservation Reserve, an area associated with the Mittiebah Aboriginal Land Trust and a small portion of land used as a stock route. The project area for EP144 refers to the discrete disturbance area for the regulated activity.

EP154 is located over Aboriginal Freehold land owned by the Mangarrayi, Alawa and Alawa 1 Aboriginal Land Trusts, and is located 20 – 200 km south-east of Mataranka. EP154 comprises 15 discrete land parcels in the Roper Gulf Region, on the Marngarrayi, Kewulyi, Alawa and Alawa 1 Aboriginal Land Trusts. The activities covered by this EMP are proposed on a single EP parcel which straddles the Kewulyi and Alawa 1 land trusts, between the communities of Roper Valley and Minyerri. The project area is located south of the Roper Highway; most of the activity is proposed to the west of the Hodgson River Road, which will form part of the access route to the project area. The project area for EP154 refers to the discrete disturbance area for the regulated activity.

This Environment Management Plan (EMP) forms the basis of Minerals Australia's application to the Northern Territory (NT) Minister for Environment, Climate Change and Water Security for the proposed seismic and drilling exploration activities and associated activities. The EMP has been prepared with reference to clauses in the Schedule of Onshore Petroleum Exploration and Production Requirements 2019, the Code of Practice: Onshore Petroleum Activities in the NT (2019), Section 67 of the NT Petroleum Act (1984) and the Petroleum Environment Regulations (2016).

The key objective of this EMP is to outline the strategies that can be implemented to reduce the environmental risks and impacts resulting from the project activities within EP144 and 154.

Specifically, the EMP provides:

- A description of the regulated activity.
- A description of the existing environment (physical, biological, social, cultural) including any particular values or sensitivities.
- An assessment of environmental impacts and environmental risks.
- Environmental outcomes and environmental performance standards.
- An implementation strategy

The following table provides a summary of the regulated activities.

Component/Activity	Details			
	EP144	EP154		
Seismic survey				
2D vibroseis seismic survey	Not Applicable	<b>31.77 km</b> of survey, comprised of six separate survey lines		
Equipment and machinery		4WD, Bulldozer, Vibrator truck, Hand & Power Tools		
		Station		
Civil activities		<ul> <li>12.7 ha of vegetation clearing prior to survey</li> <li>Vegetation stockpiled for use in rehabilitation</li> </ul>		
Workforce		27		
Drilling				
Drilling of stratigraphic drill hole	<ul> <li>Drill holes at:</li> <li>Hole 1: longitude 136.924924, latitude -18.789388</li> <li>Hole 2: longitude 137.110851, latitude -18.897579</li> <li>Drill depth to 500 m for hole 1 and 1000 m for hole 2 to obtain stratigraphic information</li> <li>Drill holes are approximately 100 mm in diameter</li> <li>Create a drill pad at each location 150 m x 150 m</li> <li>Excavation of two sumps (25 m x 25 m x 2 m) per hole, one to contain drilling fluids and one for fresh water only</li> <li>Upon completion drill hole securely capped to Code requirements</li> </ul>	<ul> <li>Drill hole at longitude 133.951334, latitude -15.083513</li> <li>Drill depth to 1,000 m to obtain stratigraphic information</li> <li>Create a drill pad 150 m x 150 m</li> <li>Excavation of two sumps (25 m x 25 m x 2 m) per hole, one to contain drilling fluids and one for fresh water only</li> <li>Upon completion drill hole securely capped to Code requirements</li> </ul>		
Equipment and machinery	Grader, Bulldozer, Drill rig, Water Cart, Mobile Camp, Scraper, Hand & Power Tools	Grader, Bulldozer, Drill rig, Water Cart, Scraper, Hand & Power Tools		
Civil activities	4.5 ha of vegetation clearing	2.25 ha of vegetation clearing		
Workforce	20-30 drill contractor employees and geological specialists, as well as around 10 vehicles	20-30 drill contractor employees and geological specialists, as well as around 10 vehicles		
Supporting infrastruc	cture			
Campsite	<ul> <li>Campsite at longitude 137° 6'38.20"E, latitude 18°53'47.98"S</li> <li>Area: 1 ha</li> <li>Accommodate up to 6 personnel and drilling specialists.</li> <li>Fire breaks to be established around each camp site as per Fire Management Plan - Appendix J.</li> </ul>	Accommodation will be sourced at Flying Fox Station		
Access Route options	<ul> <li>Drill hole 1 is located in the central north of EP144 and is accessed via Ranken Road and the station access track.</li> <li>Drill hole 2 is located in the north and</li> </ul>	<ul> <li>Drill pad accessed 24 km down Hodgson Downs Rd, 5.7 km along existing station track, then 1.8 km along proposed seismic line – this is not expected, however relevant</li> </ul>		

Component/Activity	Details				
	EP144	EP154			
	accessed via Ranken Road and station access track.	<ul> <li>legislation will be met if clearing is required outside of the EP area.</li> <li>Seismic lines accessed via same route as drill pad, then at 12.5 km and 18.1 km down Hodgson Downs Rd</li> <li>All seismic lines planned are new lines which will require clearing.</li> </ul>			
Volumes diesel required for power supply, equipment, vehicles	Approximately 90,000 L	Approximately 90,000 L			
Water source/s, demand (estimate with breakdown for dust suppression, construction and amenities), volumes of onsite water storages, discharges.	<ul> <li>Approximately 0.75 ML</li> <li>Source – station bores</li> </ul>	<ul> <li>Approximately 0.6 ML</li> <li>Source – nearby pastoral bore</li> </ul>			
Rehabilitation					
Proposed methods	<ul> <li>The proposed rehabilitation approach is assisted natural regeneration in areas that have been cleared.</li> <li>Access tracks that have been established as part of this project will be rehabilitated by ripping and seeding where required.</li> <li>Heavily impacted areas will be treated using assisted regeneration methods, with light surface scarification and ripping.</li> <li>Drill pads will be proactively treated, e.g. ripped, to assist natural regeneration.</li> <li>Drill holes to be plugged and sealed permanently.</li> <li>All surface infrastructure will be removed.</li> </ul>	<ul> <li>The proposed rehabilitation approach is assisted natural regeneration in areas that have been cleared.</li> <li>Access tracks that have been established as part of this project will be rehabilitated by ripping and seeding where required.</li> <li>Heavily impacted areas will be treated using assisted regeneration methods, with light surface scarification and ripping.</li> <li>Drill pads will be proactively treated, e.g. ripped, to assist natural regeneration.</li> <li>Drill holes to be plugged and sealed permanently.</li> <li>All surface infrastructure will be removed.</li> </ul>			

The geographical coordinates and length of each of the lines for the seismic survey on EP154 are provided in the following table.

Line Name	Length (km)	Start latitude	Start Iongitude	Centre point latitude	Centre point longitude	End latitude	End longitude
Line 2	11.86	-15.09551	133.94112	-15.047	133.969	-15.09551	133.94112
Line 3	6.77	-15.03308	133.95897	-	-	-15.03308	133.95897
Line 4	7.85	-15.03464	134.01516	-	-	-15.03464	134.01516
Line 5	5.3	-15.09293	133.96665	-	-	-15.09293	133.96665

The geographical coordinates the depth for the drill hole on EP154 are provided in the following table.

Drill Hole Name	Depth (m)	Latitude	Longitude
Hole 1	~1000	-15.083513	133.951334

The geographical coordinates and the depth for the drill holes on EP144 are provided in the following table.

Drill Hole Name	Depth (m)	Latitude	Longitude
Hole 1	~500	-18.789388	136.924924
Hole 2	~1000	-18.8957579	137.110851

A campsite 100 m x 100 m (1 ha) will be set up as part of the activities on EP144. No campsite will be required for EP154.

Existing roads and station access tracks on EP144 and EP154 will be used for access to drill pads, camp site and seismic lines. It is proposed that the access track has a clearance area of 4 m width along its length.

Existing access tracks will be utilised during site activities, except for 1.8 km of access track to be constructed along the seismic line on EP154. Maintenance of tracks may be required before, during and following project activities. This may include grading, patching and watering.

A wide range of activities will all require water and energy sources. It is expected that all energy requirements will be supplied via diesel generators. Water will be required for campsite use, drilling and dust suppression. For works on EP144, it is expected that approximately 0.75 ML of water will be required, this will be sourced from station bores. Works on EP154 are expected to require 0.6 ML of water and it will be sourced from a nearby pastoral station bore with permission from the land manager.

#### Workforce composition

Seismic crews consist of surveyors, grader/bulldozer drivers, ground layout crews and seismic vehicle operators. The contractors have experienced field crews the majority of whom will be from interstate unless resident in the NT. Civil earthworks will be undertaken by a local contractor employing local operators

Drilling crews consist of 2-4 experienced drillers and experienced rig operators all of the majority of whom will be from interstate unless resident in the NT. General labourers may be sourced locally if available or may be from interstate if long-term workers for the drilling contractor.

Specialist well engineers and logging geologists will be from interstate unless resident in the NT.

Down-hole geophysical logging services will be provided by specialist contractors who will usually be from interstate unless suitably qualified contractors are available in the NT.

The seismic survey and drilling operations in the work programs are specialist activities which employ experienced operators. There may be opportunities for employment of local Aboriginal people as general labourers in particular for the drilling operations. However, those opportunities would be relatively short-term.

Appropriate local traditional owners will be required as cultural monitors during all seismic and drilling operations.



Patr: 2:01 Ec0z\_Documents/04 Ec0z\_Vanlage GISIE2[9191 - Hancock - EMP EP144/01 Project Files/Report maps/Figure 1 1 Map of the location of EP144, the proposed exploratory works and surrounding land use nod

Figure I. Map of the location of EP144, the proposed exploratory works and surrounding land use



Path: 2:101 EcOz\_Documents/04 EcOz Vanlage GISEZ19183 - Hanoock - EMP EP15401 Project Files/Report Maps/Figure 1.2. Map of the location of EP154, the proposed exploratory works and sumaunding land use mail

Figure II. Map of the location of EP154, the proposed exploratory works and surrounding land use

#### **Existing environment**

EP144 occurs within two bioregions – Mitchell Grass Downs (southern side of EP144), and the Gulf Fall and Uplands (northern side of EP144). The Davenport Murchison Range bioregion is immediately to the southwest.

The Gulf Fall and Uplands bioregion is characterised by undulating terrain with scattered low, steep hills. Soils are mostly skeletal or shallow sands. Woodland (*Eucalyptus* spp. or *Corymbia* spp.) over spinifex grasslands (*Triodia* spp.) communities dominate this bioregion. The Mitchell Grass Downs bioregion is mostly under pastoral tenure and consists largely of treeless plains with some occasional ridges, rivers and gorges. The dominant vegetation type is Mitchell Tussock Grasslands (*Astrebla* spp.) on cracking clay soils, with some intermittent lakes.

EP154 occurs within two bioregions – the Sturt Plateau (western side of EP154), and the Gulf Uplands and Falls (eastern side of EP154). Sturt Plateau comprises flat to gently undulating plains of predominant Eucalypt woodlands or tall shrublands and woodlands of Bullwaddy and Lancewood. In more open areas, perennial grasses predominate. Soils are mainly lateritic, but deep sands occur in the south and cracking clays in the south-east. Gulf Falls and Uplands is characterised by undulating terrain with scattered low, steep hills. Soils are mostly skeletal or shallow sands. The most extensive vegetation is dominated by Darwin Stringybark and variable Barked Bloodwood over a spinifex understory and woodland dominated by Northern Box over tussock grasslands.

## Rehabilitation

General maintenance of tracks may be required during and following project activities, undertaken in agreement with Station owners. This may include grading, patching and watering.

All significantly disturbed land is to be rehabilitated. Cleared areas will be progressively rehabilitated by spreading vegetation on cleared areas to promote regeneration. Rehabilitation analogue sites and photo points will be established prior to on-ground works to guide rehabilitation criteria and establish a baseline for monitoring comparison. All infrastructure and waste associated with the activities will be removed. As it is a short-term activity it is expected the area will rehabilitate naturally.

## **Community and Culture**

The area immediately surrounding EP144 is sparsely populated as the areas are pastoral properties. There are five areas within the EP that are not covered under the EP grant area and are not part of a pastoral lease. These areas are:

- Connells Lagoon Conservation Reserve, which is a Special Purpose Lease owned by the Conservation Land Corporation and managed by the Parks and Wildlife Commission of the NT.
- Mittiebah Aboriginal Land (contains the remote community of Connells Lagoon) and Gulgunnor Aboriginal Land (contains the remote community of Illuwurru) which are both areas of Aboriginal Land that is managed under the *Aboriginal Land Rights Act* (ALRA).
- A small parcel of land for Government purposes.
- A parcel of land that is reserved along the Ranken road.

Adjacent to the EP there are numerous remote Aboriginal communities / living areas, including Corella Creek, Gulunguru, Murun Murula, Ngunarra and Wangalinji. These remote areas are very small with each area containing a small number of houses and facilities.

The majority of the area immediately surrounding EP154 is sparsely populated as the areas are pastoral properties or Aboriginal freehold land. The town of Mataranka is 15 km north of the western edge of the EP and approximately 100 km west of the work location. There are a number of Aboriginal communities within and adjacent to the work location including, Minyerri, Kewulyi, Mole Hill and Jilkminggan. Kewulyi and Mole

Hill are very small communities containing few houses and facilities, with Minyerri and Jilkminggan being significantly larger.

AAPA certificates show that both EP144 and 154 each contain two restricted work areas.

Earthsea were engaged to provide a Heritage Impact Assessment on EP144 and 154. An archaeological field assessment, coupled with a desktop study, was used to analyse potential risks to archaeological resources and areas of cultural significance within the proposed seismic line, drill and campsite areas.

On EP144, the survey recorded four lithic scatters, two background scatters and 58 isolated artefacts. EP154 survey recorded three lithic scatters and 15 isolated artefacts. All recommendations to avoid impacts have been implemented.

#### Stakeholders

Minerals Australia and Jacaranda Minerals have identified the following as the key relevant stakeholder groups for the project and have liaised accordingly:

- Traditional Owners.
- Pastoral Leaseholders within the Location of the Regulated Activity.
- Other authorised land users within the Location of the Regulated Activity.

#### **Risk Assessment**

A risk assessment has been undertaken for both EP144 and 154. This involved assessing the likelihood and consequence of identified risks, the mitigation required, monitoring requirements and the residual risk rating.

A total of 34 risks were identified for both EP144 and EP154 within Appendix E. Of those risks there are a total of five moderate and 29 low residual risk ratings. The five moderate residual risks are related to clearing of habitat, spills, direct impact or mortality of fauna, and fire. A summary of the outcome of the risk assessment process is documented in this document, with the full risk assessment outlined in Appendix E.

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# ACRONYMS

2D	Two dimensional
ΑΑΡΑ	Aboriginal Areas Protection Authority
ALARP	As low as reasonably practicable
ALRA	Aboriginal Land Rights Act
ANZECC	Australian and New Zealand Environment and Conservation Council
AS	Australian Standard
ВМР	Bushfire Management Plan
BOM	Bureau of Meteorology
СОР	Code Of Practice
CPESC	Certified Professional in Erosion and Sediment Control
DBH	Diameter at Breast Height
DEPWS	Department of Environment, Parks and Water Security (Northern Territory) – formerly DENR or DLRM
DoH	Department of Health
EMP	Environmental Management Plan
EP	Exploration Permit
EPA	Environmental Protection Authority (NT)
EPBC	Environment Protection and Biodiversity Conservation Act (1999) (Commonwealth)
ERP	Emergency Response Plan
ESCP	Erosion and Sediment Control Plan
ESD	Ecologically sustainable development
FullCam	Fully integrated Carbon Accounting Model
GDE	Groundwater Dependent Ecosystem
GHG	Greenhouse gas
HSE	Health, Safety and Environment
HSEMS	Health, Safety and Environment Management System
IECA	International Erosion Control Association
LAA	Land Access Agreements
LACA	Land Access and Compensation Agreements
MNES	Matters of National Environmental Significance
NAFI	Northern Australian Fire Information
NLC	Northern Land Council
NT	Northern Territory
NT EPA	Northern Territory Environmental Protection Authority
NTG	Northern Territory Government
NTPF	Northern Territory Police Force
NVIS	National Vegetation Information System
OHS	Occupational Health and Safety
PMST	Protected Matters Search Tool
PPE	Personal Protective Equipment
SDS	Safety Data Sheet
SOBS	Sites of Botanical Significance
SOCS	Sites of Conservation Significance

SPM	Spill Management Plan
то	Traditional Owner
TPWC Act	Territory Parks and Wildlife Conservation Act (Northern Territory)
WHS	Workplace Health and Safety
WMP	Weed Management Plan
WoNS	Weed of National Significance
WWMP	Waste and Wastewater Management Plan

# TERMINOLOGY

Term	Definition			
Acceptable level	The level of impact or risk to the environment that may be considered broadly acceptable regardless of whether or not ALARP has been demonstrated			
ALARP	As Low As Reasonably Practicable: All reasonably practicable measures are in place to control a risk or impact considering the level of consequence and cost, time and resources involved to mitigate it.			
Aquifer	A body of rock that is sufficiently permeable to conduct groundwater and currently supplying, or potentially being able to supply, water for environmental or consumptive (stock or domestic) uses.			
Aquitard	A geologic unit or confining bed that retards but does not prevent the flow of water to an adjacent aquifer. It does not readily yield water to wells or springs.			
Cumulative impact	The cumulative effects of those impacts and risks when considered with each other and in conjunction with any other activities or events that occurred or may occur in or near the project area for the regulated activity.			
Environmental factors and objectives	Those parts of the environment that may be impacted by an aspect of a proposal or activity. They provide a systematic approach to organising environmental information for the purpose of assessment. The NT EPA will make judgements against objectives determined for each factor on whether the potential environmental impact on that factor may be significant			
Environmental impact	Any adverse change, or potential adverse change, to the environment resulting wholly or partly from a regulated activity.			
Environmental outcome	An outcome that will be achieved if the environmental impacts and environmental risks of a regulated activity are reduced to a level that is ALARP and acceptable.			
Environmental risk	A product of the likelihood of an event and the consequence of an event that will have an environmental impact: Risk = likelihood x consequence			
Ecologically sustainable development principles	<ul> <li>Decision-making processes should integrate both long-term and short-term economic, environmental, social and equitable considerations</li> <li>If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measure to prevent environmental degradation</li> <li>Principle of inter-generational equity – that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations</li> <li>Conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making</li> <li>Improved valuation, pricing and incentive mechanisms should be promoted</li> </ul>			
Hydraulic fracturing	The petroleum extraction process that involves the injection of fluids at high pressure into a geological formation to induce fractures that conduct hydrocarbons for extraction.			
Interest holder	A person who holds a petroleum interest for a regulated activity. For the purpose of this guideline, 'interest holder' has the same meaning as 'proponent' under the Environmental Assessment Administrative Procedures (clause 3).			
Intrinsic risk	The measure of a risk in the absence of mitigation controls and treatments.			
Petroleum interest	An exploration permit, retention licence, production licence or access authority under the <i>Petroleum Act 1984</i> .			
Project area or footprint	The discrete area(s) of disturbance upon which the development will occur. This			

	includes the location of all major and minor infrastructure associated with the proposed activity, for example, borrow pits, temporary retention ponds.
Regulated activity (the project)	As defined in Regulation 5, a regulated activity is an activity or a stage of an activity:
	(a) carried out, or proposed to be carried out, in connection with a technical works programme for a petroleum interest; and
	(b) that has, or will have, an environmental impact or environmental risk.
	For the purposes of this guideline, 'regulated activity' also has the same meaning as 'proposed action' under the Environmental Assessment Act 1982 (EA Act), section 4(a), (b), (c), (d), or (e).
Residual risk	The measure of a risk after mitigation measure and controls have been applied, and it has been demonstrated that the risk is ALARP and acceptable.
Stakeholder	A person or body whose rights or activities may be directly affected by the environmental impacts or environmental risks of the regulated activities
Survey area	An area which has undergone or will undergo environmental survey and assessment – for example, flora, fauna, cultural heritage, archaeological, soil, aquatic, hydrological, air quality, seismic. This typically encompasses the site of the regulated activity and contiguous environmental features (e.g., surface water bodies).

# **1 INTRODUCTION**

# 1.1 Background and purpose

Minerals Australia Pty Ltd (Minerals Australia) and Jacaranda Minerals Pty Ltd (Jacaranda Minerals), wholly owned subsidiaries of Hancock Prospecting Pty Ltd., are equal shareholders of exploration permits (EP) 144 and 154. Figure 1-1 and Figure 1-2 depicts the location and regional context of the EP's, which are the subject of Exploration and Coexistence Deeds between Minerals Australia Pty Ltd, Jacaranda Minerals Pty Ltd (an equal shareholder) and the Northern Land Council (NLC). Minerals Australia is the registered manager of the exploration permits. Minerals Australia endorses the range of commitments made within this EMP and will comply with the commitments set out within this document, and associated appendices.

Minerals Australia proposes the below works programme for the two EP's:

- EP144 drilling of two exploratory stratigraphic core drill holes to a maximum of approximately 1000 m in depth to obtain stratigraphic information.
- EP154 31.77 km of two dimensional (2D) seismic survey and the drilling of one stratigraphic core drill hole to 1000 m depth to obtain stratigraphic information.

Under the *Petroleum (Environment) Regulations 2016* (the Regulations), any petroleum title interest holder proposing to carry out a 'regulated activity' (i.e., one that has, or will have, an environmental impact or environmental risk) must submit an environmental management plan (EMP) to the Department of Environment, Parks and Water Security (DEPWS) for approval by the Northern Territory (NT) Minister for Environment, Climate Change and Water Security. This EMP has been prepared with reference to the *Code of Practice: Onshore Petroleum Activities in the NT* (2019), Section 67 of the *NT Petroleum Act* (1984) and the *Petroleum Environment Regulations* (2016).

# 1.2 Scope of this EMP

EcOz Environmental Consultants (EcOz) was engaged to prepare an EMP providing the information requirements set out in Schedule 1 of the Regulations. This EMP will cover the activities conducted under EP's 144 and 154. To address these requirements, this report presents:

- A description of the regulated activity.
- A description of the existing environment including any particular values or sensitivities.
- An assessment of environmental impacts and environmental risks.
- Environmental outcomes and environmental performance standards.
- An implementation strategy.

Further details regarding these requirements are set out in the following sections of this report.

# 1.3 Titleholder's Details

Business name:	Minerals Australia Pty Ltd and Jacaranda Minerals Pty Ltd
Contact person:	Peter Collings, Chief Geologist
Postal address:	Locked Bag 2, West Perth, WA 6972
Contact details:	(08) 9429 8272 peter_collings@hancockexplorationhq.com.au

If there are any changes to the above details, Minerals Australia will provide the updated details to DEPWS.



Patr: 2101 EcOz\_Documents/04 EcOz Vantage GISIE219191 - Handook - EMP EP144/01 Project Files/Report maps/Figure 1 1 Map of the location of EP144, the proposed exploratory works and surrounding land use-mod

Figure 1-1. Map of the location of EP144 and regional context



Path: 2101 EcOz\_Documents104 EcOz Vantage GISIEZ19193 - Hancock - EMP EP15401 Project Files/Report Maps/Figure 1 2. Map of the location of EP154, the proposed exploratory works and surrounding land use mid

Figure 1-2. Map of the location of EP154 and regional context.

# 1.4 Project location and footprint

The following sections describe the project location and footprint for the project within both EP144 and EP154.

## 1.4.1 EP144

The EP144 exploration area is located over the Mittiebah perpetual pastoral lease (01033), approximately 100 km north-east of the Barkly Roadhouse on the Barkly Highway.

The EP location in a regional context is shown in Figure 1-1. The EP is not subject to town zoning, however the primary use of the area is for pastoral activities. EP144 lies over five pastoral leases, Alroy Downs, Alexandria, Mittiebah, Brunette Downs and Mount Drummond. The nearest town is Tennant Creek, which is located approximately 210 km southwest of the project area. Contained within EP144 is the Connells Lagoon Conservation Reserve, an area associated with the Mittiebah Aboriginal Land Trust and a small portion of land used as a stock route.

The regulated activities, the associated drill camp facilities, and the access route will occur within a smaller section of the EP144 boundary. The EP144 project area includes the activity areas shown in Figure 1-1.

## 1.4.2 EP154

EP154 is located over Aboriginal Freehold land owned by the Mangarrayi, Alawa and Alawa 1 Aboriginal Land Trusts, and is located 20 – 200 km southeast of Mataranka.

The nearest major town to the work activities is Mataranka, which is located approximately 100 km west of the project area Figure 1-2. The EP154 project area includes the activity areas shown in Figure 1-2.

At 5,477 km<sup>2</sup>, EP154 comprises 15 discrete land parcels in the Roper Gulf Region, on the Marngarrayi, Kewulyi, Alawa and Alawa 1 Aboriginal Land Trusts. The activities covered by this EMP are proposed on a single EP parcel which straddles the Kewulyi and Alawa 1 land trusts, between the communities of Roper Valley and Minyerri. Figure 1-2 shows the location of the proposed activities within the EP.

The project area is located south of the Roper Highway; most of the activity is proposed to the west of the Hodgson River Road, which will form part of the access route to the area. The nearest town is Mataranka, approximately 100 km to the west; the communities of Roper Valley and Minyerri are approximately 7 km northeast and 18 km southeast respectively. The project area is surrounded by Aboriginal land to the east and west, and pastoral properties to the north (Flying Fox and Numul-Numul Stations), and south (Hodgson Downs Station).

# 1.5 Land tenure and access

The following sections describe land tenure and access for the proposed activities on EP144 and EP154.

## 1.5.1 EP144

Land tenure and access arrangements within EP144 are influenced by Pastoral Land Access and Compensation Agreements (LACA), agreements under the *Native Title Act 1993*, and conditions legislated under the *NT Aboriginal Scared Sites Act 1989*. These are described in the following sections.

## Pastoral properties

The work activities are located within the Mittiebah (NT Portion 962) pastoral leases. Minerals Australia has undertaken consultation with the North Australian Pastoral Company, owners of Mittiebah and Alexandria pastoral stations, over the development of the EMP, to arrange access for work activities. This includes the baseline studies used to guide the development of this EMP.

Access will utilise existing roads as well as pastoral tracks and a Pastoral Land Access and Compensation Agreement (LACA) has been executed with the relevant leaseholders. Tracks are not required to be widened as part of the project. The required consents and approvals will be obtained prior to work activities commencing. Measures to minimise the impacts on pastoral operations include:

- Implement measures of the EMP to minimise impact on pastoral operations.
- Engage and consult with leaseholders on the proposed activities.
- Maintain and repair existing access tracks at completion of project activities.
- Rehabilitate drill pads and camp sites at completion of works and conduct rehabilitation monitoring to ensure drill pads and camp sites are returned to original condition.
- Report any incidents to leaseholders and address.

#### Traditional owners and Northern Land Council

Petroleum exploration is subject to an agreement between the proponent and the Northern Land Council (NLC), which has provisions under the Commonwealth *Native Title Act 1993* for:

- Opportunity to comment on the EMP.
- Indigenous employment opportunities.
- Sacred Site clearance.

The Native Title determination over the exploration area in EP144 is "in progress" in the NNTT. Regardless, Minerals Australia and Jacaranda Minerals have a Co-existence and Exploration Deed for EP144 that was signed on 25th March 2013 between the Native Title Parties, NLC and Conarco Minerals, Minerals Australia, who subsequently assigned the Deed to the current holders.

The Deed details how the project is to be undertaken in a way that:

- Shows understanding and respect for the Native Title Parties and their members and continues to keep them informed as necessary.
- Minimises the impact on the Native Title Parties and their members.
- Minimises the impact upon the environment.

#### Aboriginal Areas Protection Authority

AAPA certificates are required for all exploration activities and must be obtained prior to approval of an EMP. The *Northern Territory Aboriginal Sacred Sites Act* outlines the procedure for protecting and registering Sacred Sites, through the following:

- Procedures to avoid Sacred Sites.
- Establishing an Authority for the purposes of the Act.
- Procedures for the review of decisions of the Authority by the Minister.

This process is implemented to prevent damage to and interference with Sacred Sites, by setting conditions for entering and working on land.

Minerals Australia have received an AAPA certificate (201908471) for all exploration activities proposed on EP144 by this EMP. Minerals Australia will comply with conditions of the AAPA certificate.

## 1.5.2 EP154

Land tenure and access arrangements within EP154 are determined by agreements for Aboriginal Freehold land, agreements under the *Aboriginal Land Rights Act 1976*, and conditions legislated under the *NT Aboriginal Scared Sites Act 1989*. These are described in the following sections.

### Aboriginal Freehold land

The work activities on EP154 are located within NT Portion 671 and 4777 Aboriginal freehold land. Minerals Australia and Jacaranda Minerals have undertaken consultation with the NLC and relevant Traditional Owners over the development of the EMP, to arrange access for work activities. This includes the baseline studies used to guide the development of this EMP.

Access will utilise existing roads as well as station tracks, except for 1.8 km of access to the drill hole that will be developed along a seismic line. Tracks are not required to be widened as part of the project.

#### Traditional Owners and Northern Land Council

Petroleum exploration on EP154 is subject to an agreement between the proponent and the NLC, which has provisions under the Commonwealth *Aboriginal Land Rights Act* for:

- Opportunity to comment on the EMP.
- Indigenous employment opportunities.
- Sacred Site clearance.

A Co-existence and Exploration Deed was executed on 26 June 2013 between Minerals Australia, Jacaranda Minerals and the Northern Land Council representing the Tradition Owners of the Aboriginal Land Trust areas.

The Deed details how the project is to be undertaken that:

- Shows understanding and respect for the Traditional Owners and continues to keep them informed as necessary.
- Minimises the impact on the Traditional Owners.
- Minimises the impact upon the environment.

#### Aboriginal Areas Protection Authority

AAPA certificates are required for all exploration activities and must be obtained prior to approval of an EMP. The Northern Territory Aboriginal Sacred Sites Act outlines the procedure for protecting and registering Sacred Sites, through the following.

- Procedures to avoid Sacred Sites.
- Establishing an Authority for the purposes of the act
- Procedures for the review of decisions of the Authority by the Minister.

This process is implemented to prevent damage to and interference with Sacred Sites, by setting conditions for entering and working on land.

Minerals Australia have received an AAPA certificate (201908530) for all exploration activities proposed on EP154 by this EMP. Minerals Australia will comply with conditions of the AAPA certificate.

# 1.6 Environmental objectives

The key objective of this EMP is to outline the strategies that can be implemented to reduce the environmental risks and impacts resulting from the project activities within EP144 and 154.

An EMP is a requirement under the *Petroleum (Environment) Regulations 2016* and must be approved by the NT Minister for Environment, Climate Change and Water Security to form a statutory document that is enforceable through NT Legislation.

The objectives of the *Petroleum (Environment)* Regulations 2016 are to ensure that petroleum activities, including exploration, are conducted in a way that is consistent with the principles of ecologically sustainable development. It also ensures that impacts and risks associated with the activities are reduced to As Low As

Reasonably Practical (ALARP), meaning all reasonably practicable measures are in place to control a risk or impact considering the level of consequence and cost, time and resources involved to mitigate it.

The objectives of this EMP are:

- To describe the exploration activities (regulated activity).
- Describe the site-specific existing environment, including physical, biological, social and cultural characteristics.
- Outline management strategies to reduce the risks of the proposed activities on the environment.
- Align with the principles of ecologically sustainable development.
- Ensure regulatory requirements are met.

This EMP will guide the implementation and management of the regulated activity.

# **2 ENVIRONMENTAL LEGISLATION**

This section provides an overview of the key legislation (Commonwealth and NT) applicable to the project, and key approvals, licences or permits received and/or required to proceed.

It is important to note that when an activity is authorised under the *Petroleum Act 1984*, the *Waste Management and Pollution Control Act 1998 (NT)* Act applies if a contaminant or waste is not confined within the authorised lease boundary. As waste will be transported from the EP area(s) to a licensed waste facility the *Waste Management and Pollution Control Act 1998 (NT)* must be considered.

Legislation relevant to the regulated activities and how the legislative requirements have/will be met is outlined in Table 2-1.

Legislation	Requirements	Applicability	How the legislation is met	
Land tenure and access				
Petroleum Act 1984	s. 22 Term of exploration permit – Subject to s. 28(3), 30(3), 73 and 74, an exploration permit remains in force for 5 years commencing on the day on which it was granted or renewed. s. 18 Revision required at end of each 5-year period.	A petroleum exploration permit is required to explore for oil and gas in the Northern Territory.	For the relevant Petroleum Exploration Permits Minerals Australia and Jacaranda Minerals are the registered holders each with 50% interest.	
	s. 67 (1) Drilling and seismic surveys – notice.	Access authority shall not commence operations for a seismic survey unless notice in accordance with this section is given to the Minister and Minister approves.	Minerals Australia will issue a notice to the NT Department of Infrastructure, Tourism and Trade (DITT) Minister at least 28 days before commencing of drilling a well or seismic operations in accordance with requirements of the section 1.5.	
	Pastoral Land Access: s. 65 Access. s. 81 Compensation to owners. s. 82 Compensation for right of access. Stakeholder Engagement Guidelines Land Access 2016.	Pastoral Land Access and Compensation Agreements (LACA) with the relevant pastoral stations are required before access to exploration sites for activities approved by DITT such as seismic surveys and drilling.	This will only impact on EP144 and Minerals Australia have a LACA with NAPCO. The work program in EP154 is not on a pastoral lease and does not require a LACA. Minerals Australia have considered the possible consequences on the pastoral operations of carrying out the planned exploration and have indicated a range of measures that will be implemented to minimise impacts. Refer to Section 6.	
		Activities for this project which do not disturb the land or vegetation require written notice to the pastoral leaseholder/manager with at least 14 days before any works can start.	Minerals Australia has conducted baseline surveys in July 2021, 14 days' notice was provided to the pastoral leaseholder/manager prior to commencement of activities (see Section 5).	

## Table 2-1. Relevant legislation and how it is addressed.

Legislation	Requirements	Applicability	How the legislation is met
Schedule of Onshore Petroleum Exploration and Production Requirements	<ul> <li>Approval to carry out well activities <ul> <li>(1) A regulated well activity shall not be commenced without an accepted Well Operations Management Plan (WOMP or plan) in force. Regulated activities are those as defined in the Petroleum (Environment) Regulations (PER). A regulated well activity includes but is not limited to; the drilling and well construction of exploration, appraisal or development well(s), re-entering an existing well for the operation, modification, decommissioning of that well or any other purpose.</li> <li>(2) All regulated well activities must be undertaken in accordance with an accepted WOMP.</li> <li>(3) Subject to Sub-Clause (2), a titleholder may request in writing, the consent of the Regulator to the titleholder undertaking a well activity in a specified manner. The request must include sufficient information for the Regulator to assess whether or not undertaking the well activity in the requested manner would result in the integrity of the well becoming subject to a significant new risk or a significantly increased level of risk.</li> </ul> </li> <li>(4) Subject to Sub-Clause (1), a titleholder for acceptance by the Regulator of a WOMP not less than 45 days before the proposed start of the first well activity to which the plan would apply.</li> </ul>	Clause 301 requires an accepted Well Operations Management Plan to be in force before regulated well activities can commence.	Minerals Australia commits to having an accepted Well Operations Management Plan before regulated well activities can commence.
Native Title Act 1993	s. 25 Ensuring that the Right to Negotiate with native claimants and any Expedited procedure for consultation (s. 37 and s. 237) are complied	Not applicable - the Native Title determination over the exploration area in	Minerals Australia and Jacaranda Minerals have a Co-existence and Exploration Deed for EP144 that was signed on 25th March

Legislation	Requirements	Applicability	How the legislation is met
	with. s.57F Notification to native title holders etc.	EP144 is "in progress" in the NNTT. There are no Native Title claims relevant to EP154.	2013 between the Native Title Parties, NLC and Conarco Minerals, Minerals Australia, who subsequently assigned the Deed to the current holders.
Petroleum (Environment) Regulations 2016	Reg 9 s. 1(a), s. 1(b) and s. 1(c) Approval criteria for plan.	Minerals Australia has a current plan for the regulated activity which includes all information required in Schedule 1.	This EMP fulfils this requirement.
	Reg 4a The code of practice is the <i>Code of</i> <i>Practice: Onshore Petroleum Activities in the</i> <i>Northern Territory.</i> Schedule 1 s. 10(2) legislative requirements include the requirement to comply with the code of practice.	This EMP identifies the regulated activities.	The EMP has been developed in accordance with the Code of Practice and the Regulations.
	Reg 5A decisions subject to the principles of ecologically sustainable development.	EMP has been developed with the principles of ecological sustainable development in mind.	The EMP considers the principles of ecological sustainable development.
	Schedule 1 s. 3(2b) must be of the cumulative effects of those impacts and risks when considered with each other and in conjunction with any other activities or events that occurred or may occur in or near the permit area for the regulated activity.	Cumulative impacts of the activities associated with this EMP are considered.	Section 6.3 of the EMP addresses cumulative impacts.
Environmental Protection Act 2019 (EP Act) and Environmental Protection Regulations 2020	s. 28 Declaration of environmental objectives. s. 29 Purpose and effect of referral triggers.	The activities outlined in this EMP will not have a significant impact as outlined by the EP Act. Therefore, the project has not been referred to the NT Environment Protection Authority for assessment under the EP Act.	Minerals Australia has assessed the activities outlined in this EMP and the potential impacts on the environment and has concluded that there will not be a significant impact (see Section 6).
Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)	The protection of matters of national environmental significance (MNES). Includes the potential need for approval for any activity that is likely to have significant impact on any matters of identified World Heritage (s.12), National Heritage (s.15B), wetlands of international importance (s.16), threatened	The activities outlined in this EMP will not have a significant impact on MNES as defined by the EPBC Act. Therefore, the project has not been referred to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) for assessment under the EPBC Act.	Minerals Australia has assessed the activities outlined in this project and the potential impacts to MNES and has concluded that there will not be a significant impact (see Section 6).

Legislation	Requirements	Applicability	How the legislation is met
	species (s.18) and listed migratory species (s.20).		
Site selection and p	blanning		
Code of Practice: Onshore Petroleum Activities in the Northern Territory	COP A.2 Scope and application – Part A applies to all activities that cause disturbances to the surface of the land, including activities such as the preparation of well pads, seismic surveys, access tracks and other infrastructure.	Minerals Australia plan on conducting seismic surveys, stratigraphic drilling and associated activities, such as camp establishment and access track creation.	Investigations have informed decisions relating to planning, design and locations of the works.
Erosion and sedime	ent control		
Code of Practice: Onshore Petroleum Activities in the Northern Territory	A.3.4 An Erosion and Sediment Control Plan (ESCP) must be developed by a suitably qualified person	Project activities have the potential to lead to erosion and land degradation.	An ESCP has been developed for the project. The ESCP has been signed off by an Associate Certified Professional in Erosion and Sediment Control (Emma Lewis - CPESC IT #9647) (Appendix F and Appendix G).
	A.3.4 Land Clearing Guidelines as published by DEPWS must be complied with in relation to protection of natural waterways as a result of land disturbance.	There will be some land clearing required as part of the project activities.	Site selection has adopted recommended buffers from the Land Clearing Guidelines where possible, with this guiding campsite and well pad locations, and seismic lines will be micro-sited as required to minimise impacts on riparian areas (Section 6).
	<ul> <li>A.3.4 Ensure the following:</li> <li>appropriate buffers are implemented around natural waterways</li> <li>disturbance in the wet season is minimised</li> <li>the number of crossing points is minimised</li> <li>crossings are constructed as close as practicable to right angles to the waterway</li> <li>material changes in the shape of the waterway are avoided</li> <li>material changes in the volume, speed</li> </ul>	There will be clearing required and project activities have the potential to lead to erosion and land degradation.	Site selection has adopted recommended buffers from the Land Clearing Guidelines where possible, with this guiding campsite and well pad locations, and seismic lines will be micro-sited as required to minimise impacts on riparian areas. The ESCP's in Appendix F and Appendix G will be implemented.

Legislation	Requirements	Applicability	How the legislation is met
	<ul> <li>or direction of flow or likely flow of water in the waterway are avoided</li> <li>alteration to the stability of the bed or banks of the waterway (including by removal of vegetation) is avoided</li> <li>erosion risk, sedimentation and pollution of waterways is minimised through the appropriate design and implementation of best practice erosion and sediment control measures.</li> </ul>		
Water Act 1992 (NT), Water Act 1992, Water Legislation Amendment Act 2018	<ul> <li>s. 40 interfering with waterway without authorisation.</li> <li>s. 41 grant of permit to interfere with waterway.</li> </ul>	Line preparation activities which interfere with a waterway may require permit to interfere under the <i>Water Act 1992</i> .	Minerals Australia has surveyed creek crossings (Appendix C of Appendix A and Appendix B). Waterways will be crossed when dry, crossings will not require any construction and crossings will be located in an area where the waterway profile will not be impacted (Section 6).
Land Clearing Guidelines 2020	<ul> <li>A.3.4 e Land Clearing Guidelines as published by DENR must be considered in relation to protection of natural waterways as a result of land disturbance</li> <li>The Land Clearing Guidelines identifies recommended buffers as follows: <ul> <li>Section 4.3.3 recommended minimum 200 m buffer of native vegetation along property boundaries &gt;100 ha.</li> <li>Section 4.3.5.1 Road buffers – where land proposed for clearing is adjacent to a public road reserveretain minimum 50 m wide native vegetation buffer.</li> <li>Section 4.4.6 Sensitive or significant vegetation types retain 50 m buffer.</li> <li>Section 4.4.7 Riparian areas related to the stream order classification of the waterway;</li> </ul> </li> </ul>	Minerals Australia require some vegetation clearing for line preparation. Clearing on a slope gradient of 2 to 3% presents a high erosion risk and a slope gradient >3% presents a very high erosion risk.	Seismic lines will not have a significant or long-term impact within these buffers, because the nature of the activity will limit clearing, has a small footprint and the disturbed areas will be rehabilitated. Where land clearing is required, campsites and drill pads, these will not be located within the areas mentioned under the Land Clearing Guidelines (see Figure 6-3 and Figure 6-4).

Legislation	Requirements	Applicability	How the legislation is met	
	<ul> <li>Drainage depressions 25 m buffer from outer edge</li> <li>Intermittent streams (first order) 25 m buffer from outer edge of riparian vegetation or levee (whichever is greater)</li> <li>Intermittent streams (second order) 50 m buffer from outer edge of riparian vegetation or levee (whichever is greater)</li> <li>Creeks (third and fourth order) 100 m buffer from outer edge of riparian vegetation or levee (whichever is greater)</li> <li>Creeks (third and fourth order) 100 m buffer from outer edge of riparian vegetation or levee (whichever is greater)</li> <li>Rivers (fifth or higher order) 250 m buffer from outer edge of riparian vegetation or levee (whichever is greater)</li> <li>Rivers (fifth or higher order) 250 m buffer from outer edge of riparian vegetation or levee (whichever is greater)</li> <li>The NT Planning Scheme (2020) Overlays S 3.2.5 states that the clearing of native vegetation is to:         <ul> <li>(a) avoid impacts on environmentally significant or sensitive vegetation;</li> <li>(b) be based on land capability and suitability for the intended use;</li> <li>(c) avoid impacts on drainage areas, wetlands and waterways;</li> <li>(d) avoid habitat fragmentation and impacts on native wildlife corridors; and</li> </ul> </li> </ul>			
Biodiversity protec	Biodiversity protection			
Code of Practice: Onshore Petroleum Activities in the Northern Territory	COP A.3.5 Surface activities must be undertaken in a manner that avoids and minimises environmental risks and environmental impacts to flora and fauna, critical habitat and important habitat to ALARP and acceptable in accordance the Land Clearing Guidelines.	The nature of works has the potential to impact on the biodiversity values.	Biodiversity values have been assessed in section 4.2 and the nature of the activities will have a minimal impact on these values, as the project is not intersecting with any areas of biodiversity significance, there is minimal land clearing, and any disturbed areas will be rehabilitated.	
Petroleum	reg 9 11 demonstratesactivity will be		Appendix A and Appendix D provides	

Legislation	Requirements	Applicability	How the legislation is met
(Environment) Regulations 2016	conductedwhich the environmental impacts and environmental risks are reducedALARP and acceptable.		assessments of threatened species within the project area and the species critical habitat. None of these values are significantly
Environmental Protection Act 2019	s. 17 Principals of ecological sustainable development. s. 19 Precautionary principle.		impacted by the project activities.
Territory Parks and Wildlife Conservation Act	s. 3.3 Biodiversity s. 10.3 (2) an application for the clearing of native vegetation is to demonstrate consideration of threatened wildlife, presence of sensitive vegetation communities, essential habitats etc.		
Weed Management		•	
Weed Management Act 2001	COP A.3.6 A project specific weed management plan must be developed as part of the EMP which meets the requirements of the NT Weed Management Planning Guide: Onshore Petroleum Projects.	Ensure that the risk of weed introduction and spread resulting from activities associated with this project are mitigated to protect the economic, community, industry and environmental interests of the Territory.	A baseline weed survey was completed (Appendix A and Appendix B). This informed the development of a weed management plan (Appendix H and Appendix I).
Weed Management Planning Guide: Onshore Petroleum Projects 2019	s. 3 Dedicated weed officer.	To ensure necessary weed management outcomes, the weed officer must have relevant skills and experience and availability to successfully manage weed related issues for the project	EcOz Environmental Consultants will provide the dedicated weed officer (Appendix H and Appendix I).
	s. 8 Notification procedure.	48-hour notification timeframe upon discovery of a new weed species in the project area is incorporated into company policy, planning and procedure.	Required notification timeframes will be adhered too.
Fire management			
Bushfires Management Act 2016	s. 81 and s. 84 Property fire management plans.	Project activities have the potential to cause bushfires.	The Bushfire Management Plan (Appendix J and Appendix K) aims at eliminating the risk of bushfires caused by project activities.
Code of Practice: Onshore Petroleum	A.3.7 A fire management plan at a project level must be developed as part of the EMP. Site		

Legislation	Requirements	Applicability	How the legislation is met
Activities in the Northern Territory	specific analysis of bushfire risks.		
Bushfire Management Planning Guide: Onshore Petroleum Projects			
Contamination			
Petroleum Act 1984	s. 117AAC(1) A person must not, during the conduct of an operation authorised under this Act, intentionally do an act, or fail to do an act, that causes the release of a contaminant or waste material.	During the project, contaminants will be generated. Minerals Australia will take all reasonable and practicable measures to prevent or minimise pollution or environmental harm.	Waste and Wastewater Management Plan (Appendix L). Spill Prevention and Response Plan (Appendix M). Risk Assessment (Section 6).
Code of Practice: Onshore Petroleum Activities in the Northern Territory	<ul> <li>A.3.8 Containment of contaminants:</li> <li>(a) Activities that involve wastewater or chemical storage must be carried out according to the wastewater management plan and spill management plan which are part of the EMP (which are further detailed in section C.7 of this Code).</li> </ul>		
Rehabilitation			
Petroleum Act 1984	57A 12(b)the rehabilitation of the environment in the area to which the access authority applied and any other area that has been damaged byoperations authorised by the access authority.	Land disturbance activities will occur.	Minerals Australia has developed a Rehabilitation Plan that outlines progressive rehabilitation and ongoing monitoring (Appendix O).
Code of Practice: Onshore Petroleum Activities in the Northern Territory	A. 3.9 (a) A Rehabilitation Plan must be included as part of an EMP.		
	A. 3.9 (b) Appropriate to scale and nature of activity.		
	A.3.9 (c) Progressive rehabilitation of significantly disturbed land which is not required for the ongoing conduct of the petroleum activities or future activities, must		

Legislation	Requirements	Applicability	How the legislation is met
	commence as soon as practicable, but not longer than 12 months following the cessation of activities on the land.		
	A. 3.9 (d) All significantly disturbed land must be reinstated to its pre-disturbed condition. For areas that previously contained native vegetation, native vegetation must be re- established such that the corridors become ecologically integrated into the surrounding landscape		
	A. 3.9 (e) Regular maintenance and at least yearly monitoring of rehabilitated areas must take place to measure compliance with the Rehabilitation Plan.		
	A. 3.9 (f) If contamination is detected, remediation must commence immediately in accordance with the spill management plan and/or emergency contingency plan.		
Water and wastewa	iter		
Waste Management and Pollution Control Act 1998 (NT)	<ul> <li>s. 12 take all measures that are reasonable and practicable to prevent or minimise pollution or environmental harm and reduce the amount of waste.</li> <li>s. 14 Duty to notify of incidents causing or threatening to cause pollution.</li> </ul>	The WMPC Act only applies when the transport of waste to and from the site is required.	Minerals Australia have considered the requirements of the WMPC Act as relates to conducting the Regulated activities and included the following ways to manage impacts. Transport of any listed waste will be by a person licensed under the WMPC Act to a licensed facility. Relevant plans include: Waste and Wastewater Management Plan (Appendix L). Spill Prevention and Response Plan (Appendix M).
Water Act 1992 (NT), Water Legislation		The use of up to 5 ML does not requires water licensing under the following conditions:	A general exemption made in Gazette S109 allows up to 5 ML per year to be taken. Land Access Agreement will include

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Onshore petroleum projects environmental management plan - EP144 &154
Legislation	Requirements	Applicability	How the legislation is met
Amendment Act 2018		<ul> <li>Water can only be taken from bores in accordance with the bore owner's consent.</li> <li>Permission from the owners of any bores within 1 km of a bore being used for water extraction must also be sought.</li> <li>Permission must be obtained from the Controller of Water Resources prior to extraction of water from a NTG bore.</li> </ul>	permission from the land holder to use any required water bores within the EP. Water extraction will be monitored and measured to quantify amount of water taken from bore. The source of the water used for the well operations will be recorded as per Clause B.4.10.2(f) of the Code. There are no bores within 1 km of the proposed well pad locations.
	s. 60 Grant of licence to take groundwater	<ul> <li>The taking of water from a bore for employee use requires a water extraction licence for the beneficial use of petroleum.</li> <li>The Controller must not grant a licence unless: <ul> <li>Owner of bore consents</li> <li>Hydrogeological investigations and modelling indicate no adverse effect on supply of water</li> <li>1 km from designated bores.</li> </ul> </li> </ul>	A water extraction licence is not required for petroleum activity unless the amount of water required is equal to or exceeds 5ML per annum. Minerals Australia intends to extract under a general exemption made in Gazette S109 of 20 December 2018 which allows up to 5 ML per year to be taken. The land access agreement includes owner of bores permission for use of production bores within the permit area. The intended groundwater bores to be used are detailed in Section 3.3.5.
	s. 16 Prohibition of pollution. s. 7(2) Section 16 does not apply to waste that comes into contact with water, or water that is polluted, if thepollution occurs in the course of carrying outor petroleum activity; andis confined within thepetroleum site on which the activity is being carried out.	Minerals Australia is required to report pollution events within 24 hours where contaminant or waste leaves the regulated site.	Refer to the Risk Assessment (Section 6).
Code of Practice: Onshore Petroleum Activities in the Northern Territory	C.2.1 Water and wastewater (b) "waste material" and material containing "contaminants" as defined in s 117AAB of the Act; (c) wastewater meeting the definition of waste under the Waste Management and	During project activities, Minerals Australia must take all reasonable and practicable measures to prevent or minimise pollution or environmental harm.	<ul> <li>Minerals Australia have prepared the following plans:</li> <li>Spill Prevention and Response Plan (Appendix M)</li> </ul>

Legislation	Requirements	Applicability	How the legislation is met
	<ul> <li>Pollution Control Act 1998 (NT).</li> <li>C.3.1 The waste hierarchy outlined in the National Waste Policy, 2018, must be implemented by interest holders when developing their WWMP.</li> <li>C.5.1 (a) Monitoring programs must be described in the WWMP and SMP and must address the requirements in this section C.5.</li> </ul>	Part C of the Code of Practice mainly applies to well site water management. However, some clauses apply to surface activities as relates to the wastewater management during the seismic survey, stratigraphic drilling and ancillary activities such as camp operations.	<ul> <li>Waste and Wastewater Management Plan (Appendix L)</li> <li>Risk Assessment (Section 6).</li> </ul>
	C.6.1 Water and wastewater tracking and reporting requirements (b) Wastewater tracking must be documented in an auditable chain of custody system. Wastewater tracking must be in accordance with other legislative requirements such as those imposed under the Waste Management and Pollution Control Act 1998 (NT). (d) Wastewater tracking documentation must be reported to the Minister at least annually in accordance with the framework provided in the EMP.	Water and wastewater tracking is required to be reported to the Minister at completion of the exploration activity or annually.	<ul> <li>Minerals Australia will develop a register for all on site water use and wastewater disposal.</li> <li>Minerals Australia have prepared the following plans: <ul> <li>Spill Prevention and Response Plan (Appendix M).</li> <li>Waste and Wastewater Management Plan (Appendix L).</li> <li>Risk Assessment (Section 6).</li> </ul> </li> </ul>
Public and Environmental Health Act 2011 and Public and Environmental Health Regulations 2014	Reg 73 Installation of wastewater management system Reg 74 Operation, maintenance and servicing of a wastewater management system Reg 96 Notification of installation of wastewater management system	Wastewater systems (WMS) to be installed outside building control areas. You must notify the Department of Health (DoH) if you want to install a WMS that treats more than 2,000 L per day or multiple systems that treat more than 2,000 L per day. You must get the design and installation of your WMS certified. You should engage a hydraulic consultant to certify the design and a licensed plumber and drainer to certify the installation. A hydraulic consultant can either be a certifying engineer (hydraulic) or certifying plumber and drainer (design).	The proposed temporary field camp is outside a building control area. The estimated daily hydraulic flow of the on- site wastewater treatment system for the camp is 6,000 L. Minerals Australia will ensure that they comply with design and installation requirements and notify DoH.

Legislation	Requirements	Applicability	How the legislation is met			
Spill management plan						
Code of Practice: Onshore Petroleum Activities in the Northern Territory	COP C.7.2 (a) An EMP for a petroleum activity must include a Spill Management Plan (SMP). Monitor, manage and report in accordance with the WWMP and SMP.	Spill Management Plan is required.	Minerals Australia have prepared a Spill Prevention and Response Plan (Appendix M), and a Waste and Wastewater Management Plan (Appendix L).			
Noise						
Code of Practice: Onshore Petroleum Activities in the Northern Territory	A.3.3. Noise assessment, planning and management associated with petroleum activities shall comply with the Northern Territory Noise Management Framework Guidelines.	Minerals Australia work activities have the potential to create noise pollution.	Due to the nature of the activities and the isolated location there will be no noise impact. Refer to risks register Section 6.			
Stakeholder engage	ement					
Petroleum (Environment) Regulations 2016	Reg 7(1) stakeholder engagement.	Stakeholder engagement must be conducted in accordance with this regulation during the EMP preparation and will be included within the submitted EMP.	Minerals Australia has conducted consultation with pastoral leaseholders and stakeholders who may be directly affected by the environmental impacts or environmental risks associated with the proposed activities (Appendix P).			
	Reg 7 s. 2(2a) information provided. Reg 7 s. 2(2b) reasonable period.	Minerals Australia have to inform the stakeholders about the intended work program over the course of the EMP development.	Stakeholder engagement section of the EMP has been updated to reflect the ongoing engagement activities for the development of the EMP (Section 5).			
	Reg 7 s. 3(a) Definition of a stakeholder means a person or body whose rights or activities may be directly affected by the environmental impacts or risks of the regulated activity, or their agent/representative. s.36 Records to be kept.	Minerals Australia to identify the stakeholders who will potentially be directly affected by the impacts or risks of the regulated activity.	Section 5 outlines the stakeholders that will be affected by the proposed work program. Records have been maintained over the development of the EMP and will be ongoing over the course of the project activities. Records will be maintained, as shown in Appendix P.			
Sacred site and her	itage management		•			
Northern Territory Aboriginal Sacred Sites Act 1989	Part III Site protection procedures, Div. 1A Application for Authority Certificate. s. 19B-19L, s. 22 Authority Certificate. The Legislation establishes a procedure for the	Authority Certificate required under the regulations.	Minerals Australia have AAPA Certificates for both EP144 and EP154. Minerals Australia will comply with conditions			

Legislation	Requirements	Applicability	How the legislation is met
	<ul> <li>protection and registration of sacred sites, through:</li> <li>s. 33 providing entry onto sacred sites and the conditions to which such entry is subject.</li> <li>s. 37 procedures for avoidance of sacred sites when developing and using land.</li> <li>s. 22 establishing an Authority for the purposes of the Act.</li> <li>s. 30 procedures for the review of decisions of the Authority by the Minister, and for related purposes.</li> </ul>		of the AAPA certificate.
Aboriginal Land Rights (Northern Territory) Act 1976	s. 41(6) Application for consent to exploration licences.	Consent is required for ALRA land.	Minerals Australia & Jacaranda Minerals have a Co-existence and Exploration Deed with the NLC on behalf of the Traditional Owners.
Petroleum (Environment) Regulations 2016	Reg 9 s. 1(d) Approval criteria for plan. Reg 7 stakeholder engagement.	Authority Certificate required under the regulations.	Minerals Australia have AAPA Certificates for both EP144 and EP154. Minerals Australia will comply with conditions of the AAPA certificate.
Heritage Act 2011 and Heritage Regulation 2012	Reg 3(c) exempt – the work does not detrimentally affect the heritage significance of the place or object. Part 3.3 s. 76(2) Work approval for removal or damage of archaeological place or object.	Activities have the potential to impact on Heritage.	Minerals Australia has considered the recommendations outlined in the Archaeological Impact Assessments (Appendix C and Appendix D) for EP144 and EP154. Minerals Australia will implement the recommendations as per Table 4-15 and Table 4-16.
Social and commu	nity	-	-
Work Health and Safety (National Uniform Legislation) Act 2011 and Regulations 2011	Activities will comply with NT WorkSafe legislation.	Activities are required comply with NT WorkSafe legislation.	Minerals Australia will ensure that the work contractors comply with the requirements of the Work Health and Safety (National Uniform Legislation) Act 2011 and Regulations 2011, in the provision of the project.
Schedule of	Clause 220 - Reporting a potentially hazardous	As per Clause 220 reporting of potentially	Minerals Australia has outlined reporting

Legislation	Requirements	Applicability	How the legislation is met
Onshore Petroleum Exploration and Production Requirements 2019	event.	hazardous events is required.	requirements in the EMP (refer Section 7.5).
Dangerous Goods Act 1998 AS 1940:2004 (and amendments) Storage and handling of flammable and combustible liquids, 2004	The legislation sets out the requirements and allowances for licensing, packaging, storage, transportation and use of dangerous goods. s.9 Persons involved in handling dangerous goods.	Minerals Australia will be transporting and storing fuel.	Fuel storage facilities will be constructed in accordance with AS1940 and considers requirement of the WHS(NUL) Act and WMPC Act.
Public and Environmental Health Act 2011 and Regulations	<ul> <li>The construction and operation of the camp must not create a public health nuisance.</li> <li>Including: <ul> <li>Food Act 2004</li> <li>Australian Drinking Water Guidelines (2011)</li> <li>National Construction Code</li> <li>Code of Practice for On-site Wastewater Management (2014).</li> </ul> </li> </ul>	Activities of Minerals Australia should be managed in a way that will not cause a public health nuisance as defined under the Act.	Minerals Australia will ensure contractors comply with the requirements of the <i>Public</i> <i>and Environmental Health Act 2011</i> and Regulations, in the provision of the project.
Emergency Manage	ement	1	1
Emergency Management Action 2013	The Act adopts an 'all hazards' approach to all emergencies and disasters, natural or otherwise, and provides authority for four phases of emergency management (prevention, preparedness, response and recovery). This Act provides for the adoption of measures necessary for the protection of life and property from the effects of disasters and emergencies and forms the legislative authority basis for emergency management activities across all levels of government	In the event of an emergency Minerals Australia is responsible for ensuring the emergency is managed appropriately to protect life and property from the effects of disasters.	Minerals Australia's actions will be managed under an Emergency Response Plan (Appendix N). If an emergency impacts and off-site area, Minerals Australia will follow all directions from the Police, Fire and Emergency Services.

# **3 DESCRIPTION OF THE REGULATED ACTIVITY**

This section describes the regulated activity proposed by Minerals Australia including:

- Locations of activities.
- Construction and facility layout details.
- An outline of, and proposed schedule for, the operational details.

It is designed to address Part 1 of Schedule 1 of *The Regulations.* Table 3-1 shows a summary of the program, with further detail in subsequent sections.

### Table 3-1. Summary of regulated activities

Component/Activity	Details	Details			
	EP144	EP154			
Seismic survey					
2D vibroseis seismic survey	Not Applicable	<b>31.77 km</b> of survey, comprised of six separate survey lines			
Equipment and machinery		4WD, Bulldozer, Vibrator truck, Hand & Power Tools No camp, accommodation at Flying Fox Station			
Civil activities		<ul> <li>12.7 ha of potential vegetation disturbance</li> <li>Vegetation stockpiled for use in rehabilitation</li> </ul>			
Workforce		25-30			
Workforce composition		Seismic crews consist of surveyors, grader/bulldozer drivers, ground layout crews and seismic vehicle operators. The contractors require and have experienced field crews the majority of whom will be from interstate unless resident in the NT. Civil earthworks required will be by a local contractor employing local operators			
		Appropriate local traditional owners will be required as cultural monitors during all seismic and drilling operations.			
		Opportunities will exist for local businesses for the provision of contracting services for civil works using local operators and workforce and for the provision of camp facilities, supplies and operations and general workforce, including local Aboriginal workers if available.			
		The contracted Project Management and Implementation company will liaise to the extent possible with the NT Indigenous Business Network (IBN) for the provision of contracting services.			
		Appropriate aboriginal cultural monitors nominated by the Northern Land Council will be employed during all field activities			
		Drilling and seismic activities are short duration, and			

Component/Activity	Details		
	EP144	EP154	
		specialist in nature and will be done by contracting companies.	
Drilling			
Drilling of stratigraphic drill hole	<ul> <li>Drill holes at:</li> <li>Hole 1: longitude 136.924924, latitude - 18.789388</li> <li>Hole 2: longitude 137.110851, latitude - 18.897579</li> <li>Drill depth to 1,000 m for hole 1 and 500 m for hole 2 to obtain stratigraphic information</li> <li>Drill holes are approximately 100mm in diameter</li> <li>Create a drill pad at each location 150 m x 150 m</li> <li>Excavation of two sumps (25 m x 25 m x 2 m) per hole, one to contain drilling fluids and one for fresh water only</li> <li>Upon completion drill hole securely capped to Code requirements</li> </ul>	<ul> <li>Drill hole at longitude 133.951334, latitude - 15.083513</li> <li>Drill depth to 1,000 m to obtain stratigraphic information</li> <li>Create a drill pad 150 m x 150 m</li> <li>Excavation of two sumps (25 m x 25 m x 2 m) per hole, one to contain drilling fluids and one for fresh water only</li> <li>Upon completion drill hole securely capped to Code requirements</li> </ul>	
Equipment and machinery	Grader, Bulldozer, Drill rig, Water Cart, Mobile Camps, Scraper, Hand & Power Tools	Grader, Bulldozer, Drill rig, Water Cart, Scraper, Hand & Power Tools	
Civil activities	4.5 ha of vegetation clearing	2.25 ha of vegetation clearing	
Workforce	20-30 drill contractor employees and geological specialists, as well as around 10 vehicles	20-30 drill contractor employees and geological specialists, as well as around 10 vehicles	
Workforce composition	Drilling crews consist of 2-4 experienced drillers and experienced rig operators all of the majority of whom will be from interstate unless resident in the NT. General labourers may be sourced locally if available or may be from interstate if long-term workers for the drilling contractor.         Specialist well engineers and logging geologists will be from interstate unless resident in the NT.         Down-hole geophysical logging services will be provided by specialist contractors who will usually be from interstate unless suitably qualified contractors are available in the NT.         There may be opportunities for employment of local Aboriginal people for the drilling operations. However, those opportunities would be relatively short-term.         Appropriate local traditional owners will be required as cultural monitors during all seismic and drilling operations.		

Component/Activity	Details	
	EP144	EP154
Supporting infrastructure		
Campsite	<ul> <li>Campsite at longitude 137° 6'38.20"E, latitude 18°53'47.98"S</li> <li>Area: 1 ha</li> <li>Accommodate up to 6 personnel and drilling specialists.</li> <li>Fire breaks to be established around each camp site as per Fire Management Plan - Appendix J.</li> </ul>	Accommodation will be sourced at Flying Fox Station
Access Route options	<ul> <li>Drill hole 1 is located in the central north of EP144 and is accessed via Ranken Road and the station access track.</li> <li>Drill hole 2 is located in the north and accessed via Ranken Road and station access track.</li> </ul>	<ul> <li>Drill pad accessed 24 km down Hodgson Downs Rd/Hodgson River Road, 5.7 km along existing station track, then 1.8 km along proposed seismic line – this is not expected, however relevant legislation will be met if clearing is required outside of the EP area.</li> <li>Seismic lines accessed via same route as drill pad, then at 12.5 km and 18.1 km down Hodgson Downs Rd</li> <li>All seismic lines planned are new lines which may require clearing.</li> </ul>
Volumes diesel required for power supply, equipment, vehicles	Approximately 90,000 L	Approximately 90,000 L
Water source/s, demand (estimate with breakdown for dust suppression, construction and amenities), volumes of onsite water storages, discharges.	<ul> <li>Approximately 0.75 ML</li> <li>Source – station bores</li> </ul>	<ul> <li>Approximately 0.6 ML</li> <li>Source – nearby pastoral bore</li> </ul>
Rehabilitation		
Proposed methods	<ul> <li>The proposed rehabilitation approach is assisted natural regeneration in areas that have been cleared.</li> <li>Access tracks that have been established as part of this project will be rehabilitated by ripping and seeding where required.</li> <li>Heavily impacted areas will be treated using assisted regeneration methods, with light</li> </ul>	<ul> <li>The proposed rehabilitation approach is assisted natural regeneration in areas that have been cleared.</li> <li>Access tracks that have been established as part of this project will be rehabilitated by ripping and seeding where required.</li> <li>Heavily impacted areas will be treated using assisted regeneration methods, with light</li> </ul>

Component/Activity	Details				
	EP144	EP154			
	<ul> <li>surface scarification and ripping.</li> <li>Drill pads will be proactively treated, e.g. ripped, to assist natural regeneration.</li> <li>Drill holes to be plugged and sealed permanently.</li> <li>All surface infrastructure will be removed</li> </ul>	<ul> <li>surface scarification and ripping.</li> <li>Drill pads will be proactively treated, e.g. ripped, to assist natural regeneration.</li> <li>Drill holes to be plugged and sealed permanently.</li> <li>All surface infrastructure will be removed</li> </ul>			



Path: Z101 EcOz\_Documents/04 EoOz Vantage GIS/EZ10191 - Hancook - EMP EP144/01 Project Files/Report maps/Figure 1.2.mxd

#### Figure 3-1. Map of project activities on EP144



Path: Z-101 EcOz\_Documents104 EcOz Vantage GIS/EZ19193 - Hancock - EMP EP154/01 Project Files/Report Maps/Map of key works and exploration activity sites within EP154.mxd

### 3.1 Seismic Program

The following sections provide an overview of the program and methodology for the seismic program, and specific details relevant EP154 outlined. There will be no seismic on EP144.

### 3.1.1 General

Broadly, the seismic program consists of two parts: preparation of the seismic lines and seismic line data collection. These are described below.

### Seismic line preparation

Seismic lines need to be approximately 4 metres wide to ensure sufficient access for the seismic survey vehicles. This may require clearing of lines to allow for unobstructed access. Clearing of lines will as far as is possible avoid the removal of any vegetation, topsoil, rootstock and seeds, but will unavoidably involve some disturbance. Such vegetation will regenerate quickly after appropriate rehabilitation of the lines.

The proposed seismic activity will occur within a 100m buffer area around the proposed seismic line, of which only a 4 m width will be impacted. The buffer area allows for the micro-siting of the seismic line, to mitigate any potential environmental impacts. This will include avoiding large trees, choosing the least impact location to cross watercourses, and reducing clearing.

Seismic lines will be prepared using a grader to allow access to the survey vehicles. The majority of the seismic lines will be traversed 'blade up' to minimise environmental impact, however due to the nature of the environment the blade may be needed for short sections. This will include when encountering dense vegetation, erosion channels, holes etc.

### Seismic line methodology

Seismic acquisition is undertaken to 'image' below the surface and identify where oil and gas deposits may have accumulated. This method has a long history in the Australian petroleum industry and is used to identify and delineate geological structures and boundaries.

The seismic line survey is undertaken using vibrator trucks as energy sources to create acoustic waves, which travel through the earth and are then reflected from geological structures below the earth's surface. These reflections are recorded in a digital format and relayed to a seismic data processing centre to produce a 'cross-section' of the layers of the earth's crust - Figure 3-3. This data is interpreted to identify future drilling locations.



Figure 3-3. Seismic acquisition explanation

Figure 3-4 depicts an example of a seismic survey vibrator truck, which uses a pad lowered onto the ground to produce a series of vibrations. These trucks typically work in groups of three of four, regularly lowering the vibrator pads.



Figure 3-4. Seismic survey vibrator truck.

Data will be recorded in a recording truck, and a number of additional light vehicles will be required for movement of support staff.

### 3.1.2 EP144

No seismic line activities are being conducted for EP144.

### 3.1.3 EP154

The proposed seismic activity is comprised of six seismic lines with a total length of 31.77 km. Their location is shown in Figure 3-2, with further information in Table 3-2. Line 2 has centre coordinates, as this line changes direction slightly in the centre. The other five lines do not have centre coordinates as they are direct from the start coordinates to the end coordinates.

Lines 2 – 5 are located on either side of Hodgson River road and are within Alawa 1 Aboriginal Land Trust. Lines 1 and 1A are located further north of the other lines are located in the Alawa 1 and Mangarrayi Aboriginal Land trusts.

Lines 2-5 will be accessed from the Hodgson River Road, while the remaining lines will be accessed along station tracks. Line 3 crosses Hodgson River Road and at this location the seismic survey will stop at the edge of the road reserve and re-start on the opposite edge to ensure no work is undertaken within the road reserve.

Activities will be confined to within the boundary of EP154 and there is no requirement to work outside this area.

Line Name	Length (km)	Start latitude	Start longitude	Centre point latitude	Centre point longitude	End latitude	End longitude
Line 2	11.86	-15.09551	133.94112	-15.047	133.969	-15.09551	133.94112
Line 3	6.77	-15.03308	133.95897	-	-	-15.03308	133.95897
Line 4	7.85	-15.03464	134.01516	-	-	-15.03464	134.01516

Table 3-2. Location of seismic lines for EP154

Line Name	Length (km)	Start latitude	Start longitude	Centre point latitude	Centre point longitude	End latitude	End longitude
Line 5	5.3	-15.09293	133.96665	-	-	-15.09293	133.96665

The 2D seismic crew will be made up of approximately 25-30 people including surveyors and support people. Survey line preparation is expected to take four days and data acquisition is expected to take approximately five days, however, this will depend on access and terrain, it is expected that approximately 5-10 km will be undertaken per day.

# 3.2 Stratigraphic Core Drilling

The following sections provide a general overview of the stratigraphic core drilling methodology, and specific details relevant to each EP144 and EP154.

### 3.2.1 General information

Stratigraphic drilling is not directly comparable to drilling exploratory oil or gas wells. Its purpose is only to investigate the sub-surface geology (stratigraphy and structure) to provide confirmation that the lithologies and structures encountered may be prospective for the accumulation of hydrocarbons. It will also inform possibly succeeding seismic surveys of the location of signature reflectors.

The exploration stratigraphic drill holes are typically less than 100 mm in diameter. The drilling equipment and methods used cannot be directly compared to conventional oil well drilling using large drilling platforms. The methods are more akin to mineral exploration drilling. Figure 3-5 shows a gas-compliant drill rig used for fully-cored stratigraphic drill holes. Because the planned holes are for shale gas exploration in a granted exploration permit, the DITT Petroleum Operations branch requires that the drill rig be fully compliant with gas-drilling regulations. Minerals Australia will adhere to this requirement.

There is no requirement for the establishment of gravel pits within EP144 or EP154.



Figure 3-5: Example drilling rig (Source: DDH1 Drilling)

Activities associated with the drilling of stratigraphic core holes include:

- Establishment a drilling-operations camp.
- Clearing of access for drilling equipment.
- Preparation of drill pads for the size of rig shown above in Figure 3-5. The pads will be a minimum of 100 m x 100 m as required by the regulations. All ancillary drilling requirements are incorporated with the rig on the drill pad.
- Drilling operations on day and night shifts using crew of two drillers and four offsiders.
- Down-hole geophysical logging and hole completion. Holes to be plugged and sealed permanently.
  - The method for plugging will be in accordance Section B.4.15.3 Table 5 of the Code of *Practice: Onshore Petroleum Activities in the Northern Territory (2019)*
- Site rehabilitation.

#### Drill pad preparation

Access for drill pads will be via seismic lines and station roads for both EP144 and 154. Approximately 2.25 ha will be cleared to accommodate each 150 m x 150 m drill pad.

The drill pads will be designed to minimise new disturbance where practicable, with consideration to the likelihood of flooding or sheet flow pathways. There is no indication of concentrated overland flow on the proposed location of drill holes in either EP144 or EP154. The well pads will all be located at least 2 km from any existing dwelling and will not be visible from any public road.

Drill pads will be fully fenced and stock-proof, with all entry points equipped with gates or grids. Fencings and gates/grids are expected to keep most wildlife out of the drill pad area.

Within each drill pad, two sumps will be excavated: one for fresh water only and one lined to contain drilling fluids/drill cuttings. These sumps hold the necessary materials to assist the drilling process, and contain any wastes from the drill hole. The sumps for the rig of the type planned for use will have a capacity of approximately 500 <sup>m3</sup> with a 1.2 m freeboard which is significantly less than for a standard oil field rotary rig. The capacity of drill fluid and cuttings sumps drilling sump will be dictated by the specifications of actual rig to be used. Baseline soil samples will be taken prior to sump construction.

Drilling sumps and cuttings pits will be designed, constructed and operated with sufficient freeboard toprevent overtopping in a 1 in 1000 rainfall event, and with 0.5 m high bunds to prevent water entry from overland flow. Freeboard figures were calculated using the industry-accepted methodology associated with practices such as dam risk assessments. The methodology and calculations are provided in Appendix Q and Appendix R. Additionally, sumps will be fenced to minimise interactions with wildlife stock and humans with drilling fluids.

The drilling waste sump will be lined as required with the following specifications:

- Coefficient of permeability of less than 10-9 m/s tested in accordance with ASTM E96 Standard Test Methods for Water Vapor Transmission of Materials.
- Resistance to tearing >0.5 kN (ASTM D 4073).
- Static puncture >0.5 kN (ASTM D 4833).
- Tensile strength >20 kN/m (ASTM D 7275).

### Drill operations

Drilling operations will be 24 hours, 7 days using crews of two drillers and four offsiders. After establishment of the drill pad, drilling will commence using a rig akin to that in Figure 3-5.

For stratigraphic drilling chemicals to be used, they must have been approved for use in drilling petroleum wells by the Commonwealth Government, Department of Health and listed on the Australian Inventory of Chemical Substances which is maintained under the National Industrial Chemicals Notification and Assessment Scheme. No drilling fluid additives that are used in the process contain benzene, toluene, ethylbenzene or xylene. Drilling fluids will be selected and managed to ensure all products used during well operations on petroleum wells are used in accordance with the manufacturer's recommendations and relevant safety data sheets (See Appendix M). The name, type and quantity of each chemical used on each well throughout the well construction process will be recorded.

During mud drilling operations, the fluid is re-circulated down the hole. Of the total volume of drilling mud used, only small volumes have the potential to move beyond the well bore to the formations due to the filter cake properties of the mud and their design. In addition, when drilling through local aquifers, and until these aquifers are isolated by a minimum of two verified barriers, chemicals or other substances that have potential to leave a residual toxic effect in the aquifer, will not be added to the drilling mud in compliance with the Code. The drilling fluid and surface gas handling system for drilling operations will allow for the removal of gas from the drilling fluid.

Drilling mud will be recycled during the drilling operation to minimise the quantity of water and chemicals required and reduce disposal requirements. The cuttings/sludge from the returned drill fluid will be directed into the drilling sump. The drilling sump will be marked with the required level of freeboard; levels will be monitored daily during drilling operations, so that they are managed below the freeboard requirement. Drilling activities to cease if sufficient freeboard is not maintained in cuttings pits and sumps, unless authorised by DEPWS to continue operations.

Freeboard levels to be maintained for EP144 are 0.5 m in dry season and 0.65 m in wet season, and for EP154 they are 0.5 m in dry season and 1.2 m in wet season.

Fully-cored drill holes do not create coarse rock chip cuttings as do normal oilfield open-hole drilling methods, but rather a very fine sandy sludge contained within the re-circulating drilling fluids. The sludge will be contained within the lined sump. Open hole drilling will be used in the top-hole section of the core hole, where drilling losses are likely to be encountered. Casing will be set over this section to allow continuous coring operations. Core diameter will likely be 'HQ' standard size with diameter 63.5 mm. For HQ drilling the hole diameter is 96 mm.

All cores will be placed into standard metal core trays and stored on site for lithological logging and analysis. Cores will eventually be transported to the DITT core storage library in Darwin.

Leachability testing of drill cuttings will be undertaken in accordance with the Australian Standard Leaching Procedure (Australian Standards AS4439.2 and 4439.3) by a NATA accredited laboratory. The analytes and method for drilling waste assessment for this assessment are shown in Table 9 of the Code of Practice for Onshore Petroleum Activities NT (the Code).

If certification cannot be obtained for on-site disposal, then this waste will be transported using a licensed transporter and disposed of at a licensed facility. Residual drilling mud in the drill cuttings sump that does not evaporate and fails to meet disposal requirements as outlined in the Code will be removed from site, preferably before the onset of monsoon rains, for disposal at a licensed facility. If chemicals or wastewater are required to be transported during the wet season, the track will be scouted to check it meets the below criteria prior to transport:

- Track is traversable and has not been impacted by increased rainfall, such as;
  - There are no washouts along the track.
  - There are no bogs or ponding water.
- Personnel are familiar with spill response procedures and the appropriate spill response materials are available.

#### Aquifers

Drilling operations generally have potential to intersect underlying aquifers. The aquifers relevant to EP144 and EP154 are described below.

#### Drilling in EP144

Based on NT Government water bore records, drilling in EP144 it is expected to intersect the Camooweal Dolostone and Wonarah Formation aquifers. These aquifers are classified as low yielding but having fresh groundwater. The underlying Kalkarindji Volcanic Group and Mesoproterozoic South Nicholson Group are low yielding, where freshwater is only scarcely available in shallow fractures and weathered zones.

As per Clause B.4.10.2(i) only air, water or water-based drilling fluids will be used when drilling through local aquifers and until these aquifers are isolated by a minimum of two verified barriers and chemicals or other substances that have potential to leave a residual toxic effect in the aquifer, will not be added to the drilling mud in compliance with the Code.

A minimum of two verified barriers will isolate all aquifers encountered.

To ensure verified isolation from the aquifers and well integrity; the following controls will be implemented:

- Critical controls and hold points throughout the well construction,
- Verification of each stage of the process by a drilling supervisor, who will confirm that the aquifer has been isolated by construction according to the Code, before proceeding to the next stage,
- barrier verifications and monitoring throughout well construction, maintaining primary and secondary well control measures,
- A cemented production casing string to provide additional protection barrier between producing hydrocarbon bearing zones and shallow aquifers,
- Pressure testing of the cement to ensure overall integrity of the production casing,
- Multiple strings of steel casing and

- cement grouted to the surface and multiple engineered and system mitigations to adequately detect water quality threats to the aquifer
- Well barrier integrity validation reporting (WBIV report) for each well demonstrating compliance with the Code and to be provided to the regulator (DPIR) for approval,

#### Drilling in EP154

The McArthur basin that underlies EP154 has been identified to contain several aquifer formations that are small, disconnected and or confined with little or no recharge (Imperial Oil and Gas 2017; Knapton 2009; Pietsch et al. 1994; Zaar 2003). The dominant rock formation in the basin comprised of dolomite, siltstone and shale which are considered to make lower quality aquifers, as they are fine grained and have low porosity and permeability. The majority of aquifers in this region are discontinuous, local, no longer connected to recharge points or have secondary mineral overgrowth which has destroyed previously existing permeability and/or porosity (Imperial Oil and Gas 2017). The nearest significant aquifers to EP154 are the Tindall Limestone aquifer located 60 km to the west and a dolostone aquifer located 76 km to the northeast.

Any aquifers identified during drilling will be isolated using the same procedures described for EP144.

Only groundwater will be used to support the conduct of the regulated activity.

### 3.2.2 EP144

Two stratigraphic core drill holes are proposed within EP144 – the locations of these are shown in Figure 3-1, with further information in Table 3-3. For the purpose of the work program and environmental and significant site surveys, the location of the planned holes has been assigned as the centre of a 1 km radius buffer area. The final location for the stratigraphic hole could be anywhere within this buffer area. The driller's camp will be located within the same buffer area. The drill holes will be approximately 100 mm in diameter. Water for drilling on EP144 will be obtained from station bores. Only groundwater will be used to support the conduct of the regulated activity.

Hole 1 is approximately 19 km west of Mittiebah Road. Access to the site will be via the Mittiebah Road off Ranken Road for approximately 65 km, and then 19 km along an existing station road. Proposed Hole 2 is located adjacent to Mittiebah Road.

The proposed drill pad layout is shown in Figure 3-1. Drilling is scheduled to be undertaken between May and November 2023 and is expected to take approximately two to three months to complete.

Drill Hole Name	Depth (m)	Latitude	Longitude
Hole 1	~500	-18.789388	136.924924
Hole 2	~1000	-18.897579	137.110851

Table 3-3. Location of stratigraphic core dill holes for EP144 (GDA94 Zone 53)

### 3.2.3 EP154

One stratigraphic core drill hole is proposed within EP154 - location shown in Figure 3-2, with further information in Table 3-4. The core collected will be 63.5 mm in diameter.

The proposed drill pad layout is shown in Figure 3-2. Drilling is scheduled to be undertaken between May and November 2023 and is expected to take approximately two to three months to complete.

Table 3-4. Location of stratigraphic core dill holes For EP154 (GDA94 Zone 53)

Drill Hole Name	Depth (m)	Latitude	Longitude
Hole 1	~1000	-15.083513	133.951334

## 3.3 Support facilities for the Program

The Program requires support facilities and management for the duration of the proposed activities. These are described in the following sections.

### 3.3.1 Campsites

Campsites will be required to accommodate workers during the Program. This includes storage of chemicals as well as sewage and waste management. Requirements for EP144 and EP154 are described below.

### EP144

The campsite on EP144 will be approximately 1 ha. This camp will accommodate approximately 30 people. A typical crew camp is shown in Figure 3-6. The camp will be sited on a central location on Alexandria/Mittiebah station on ground conducive to camping, and the location is shown in Figure 3-1.



Figure 3-6. Typical crew camp layout.

The driller's camp houses all of the personnel required to operate the drill rig. Because of the special equipment required to operate the rig approximately 20-30 drill contractor employees and geological specialists will be on site, as well as around 10 vehicles. The camp will occupy an area approximately 100 m by 100 m in size.

The storage of fuel at the camp site is contained within tankers utilising safety features such as double-skins, safety cut-off valves, top accessing or transportable bunding to minimise or eliminate the potential for spills. Drip trays are provided to contain minor drips and spills which may occur during re-fuelling operations. Any uncontained spillage is chemically treated, and the ground ripped and any resultant contamination remediated.

The camp will utilise its own mobile wastewater treatment plant to recycle the generated grey and black water. These sewage treatment plants are designed to treat camp generated effluent to the required environmental guidelines for advanced secondary effluent (Class "B"), to enable disposal via evaporation irrigation. The effluent will be piped to an evaporation sump about 50 m outside the camp for evaporation. The pit will be backfilled when no longer required.

Recyclable materials will be segregated on camp sites and transported to a licensed waste facility in Katherine or Darwin. Punctured or ruined tyres will be returned to Katherine or Darwin for repair, recycling or disposal.

Once the camp site has been vacated, rehabilitation will be undertaken, including ensuring no rubbish or any man-made items are left in situ and, when necessary and terrain permitting, the area is type ripped to relieve compaction and wheel tracks and ruts. Shoulders of adjacent formed tracks are reinstated, and the area left to rehabilitate.

### EP154

No campsite will be required for EP154. Accommodation will be organised at Flying Fox Station.

Seismic operations will be completed prior to commencement of drilling operation in EP154. As both operations require essentially the same size, workforce accommodation at Flying Fox station will be required for up to 30 people. Occupancy for the seismic crew is expected to be May-June 2023 and for the drilling crew from June to August 2023 with no overlap.

### 3.3.2 Existing access tracks and maintenance

Existing roads, station access tracks and seismic lines on EP144 and EP154 will be used for access to drill pads, camp site and seismic lines. The only non-existing access track required will be a 1.8 km stretch along the seismic line at EP154, this will be 4 m wide.

Access tracks intersect the NTG road reserves along Barkly Highway, Tableland Highway, Ranken Road and Hodgson River Road. DIPL Corridor Management will be contacted to obtain a temporary access approval to use the existing tracks.

Maintenance of tracks may be requiring before, during and following project activities. This may include grading, patching and watering.

### 3.3.3 Weed management

As required by new environmental regulations, a weed survey will be completed as part of the Environmental Management Plan to be approved by the DEPWS.

All light vehicles and plant and equipment entering the area of both EPs and/or non-consent ALRA land will be appropriately washed down and inspected at a vehicle wash facility at point of origin, likely Darwin or Alice Springs. A hygiene declaration will be completed to ensure all vehicles, plant and equipment are checked and certified to be clean prior to heading to site.

As there are currently no wash-down facilities within the areas surrounding the EPs, the most appropriate and applicable cleaning procedures on site will be visual inspection and dry removal. This will identify any vegetation or vegetative matter caught within the body of vehicles, and this material can be removed manually or with the assistance of compressed air. These inspections will be completed at the same location, and all vegetative matter will be disposed of. These sites will be inspected for weeds and treated accordingly.

Inspection and removal will be conducted when vehicles and plant leave or enter the EP area or travel through an area with visible weeds.

A summary of weed mitigation measures that are to be implemented on site for the various activities is presented in Table 7-8.

### 3.3.4 Erosion and sediment control

ESCP control measures are addressed in detail in Appendix F and Appendix G. ESCP measures will be required for:

- Roads and tracks
- Campsites

- Drill pads
- Stockpiles

A summary of erosion and sediment control mitigation measures that are to be implemented on site for the various activities is presented in Table 7-2.

### 3.3.5 Water and energy sources demand

A wide range of activities will all require water and energy sources. It is expected that all energy requirements will be supplied via diesel generators. Water will be required for campsite use, drilling and dust suppression. Only groundwater will be used to support the conduct of the regulated activity.

Water for drilling on will be obtained from station bores. For works on EP144, it is expected that approximately 0.75 ML of water will be required, and works on EP154 are expected to require 0.6 ML of water. Monthly volumes of groundwater extracted from the bore will recorded from the gauge on the pump, which will be regularly calibrated by appropriately trained staff.

The actual bore to be utilised cannot be identified at this time. That will be entirely up to the station owners and managers to decide immediately prior to commencing operations to minimise disturbance to stock operations. Any bore utilised will be recorded as required by Clause B.4.10.2(f) of the Code.

As the bore to be utilised can't be identified the aquifer is also unknown, however, the potential aquifers to be used are identified in section 4.1.8.

If a suitable bore cannot be found, then water will be sourced from a licenced provider.

### 3.4 Chemicals and other substances

Diesel will be used and stored on site. The storage of fuel will be contained within tankers utilising safety features such as double-skins, safety cut-off valves, top accessing or transportable bunding to minimise or eliminate the potential for spills. Drip trays are provided to contain minor drips and spills which may occur during re-fuelling operations. Any uncontained spillage is chemically treated, and the ground ripped and any resultant contamination remediated.

Lubricants and hydraulic oil will also be used and stored on site in appropriately bunded containers.

Wells are designed to be drilled using water-based muds and drilling fluids. All chemicals to be used have been approved for use in drilling petroleum wells by the Commonwealth Government, Department of Health and listed on the Australian Inventory of Chemical Substances which is maintained under the National Industrial Chemicals Notification and Assessment Scheme. No drilling fluid additives that are used in the process contain benzene, toluene, ethylbenzene or xylene. These items will also be used and stored on site in appropriately bunded containers. Appendix M outlines the spill response management process for the project and outlines the chemicals that will be utilised a part of the drilling works.

Drilling fluids will be managed as per the Code of Practice for Onshore Petroleum activities within the NT.

### 3.5 Maintenance and Rehabilitation

The rehabilitation methods, criteria and monitoring are further outlined in Appendix O.

Existing access tracks will be utilised during site activities, with the exception of 1.8 km of access track to be constructed along the seismic line on EP154. General maintenance of tracks may be required during and following project activities, undertaken in agreement with Station owners. This may include grading, patching and watering.

The proposed rehabilitation approach is assisted natural regeneration in areas that have been cleared, and natural regeneration for the seismic line areas. Wherever practicable, vegetation will not be cleared, and vehicles will traverse over or around the vegetation instead. This approach is most suitable for open lightly wooded areas and grasslands and will result in minimal ground disturbance and rehabilitation efforts.

Rehabilitation of the seismic lines will be carried out in a progressive manner, following behind with the completion of each survey line. This will ensure that land is stabilised as soon as possible after disturbance to reduce the occurrence of erosion, sedimentation, loss of topsoil and weed invasion.

The following methods will be adopted:

- Access tracks that have been established as part of this project will be rehabilitated by ripping and seeding where required.
- Seismic lines will result in minimal impact, so it is expected that most areas will regenerate naturally. More heavily impacted areas will be treated using assisted regeneration methods, with light surface scarification and ripping.
- Drill pads will be proactively treated, e.g. ripped, to assist natural regeneration.
- Drill holes to be plugged and sealed permanently.
- All surface infrastructure will be removed.

### 3.6 Proposed timetable

Largely, activities on EP144 and EP154 are proposed to be completed between May and November 2023. However, slightly difference timetables are required for each due to the difference in proposed activities. Proposed timetables for both are described below.

### 3.6.1 EP144

Minerals Australia commits to all requirements including relevant notifications and approvals prior to works commencing.

As per Section 67(1) of the *Petroleum Act 1984*, it is required that Minerals Australia shall provide a notice of commencement of drilling of a well or for a seismic survey to the Minister no less than 28 days before the operations are commence. Additionally, as per Clause 301 Schedule of Onshore Petroleum Exploration and Production Requirements, an accepted Well Operations Management Plan must be in force before regulated well activities can commence.

Prior to commencement of the drill holes, Minerals Australia will ensure that the following people are notified of the proposed commencement date and duration for the project:

- the Minister,
- the occupier of the land, and;
- the owner of the land.

Minerals Australia propose the following schedule for project activities on EP144 (Table 3-5).

Activity	Duration	Dates
Drill pad clearing and drilling	8 weeks duration	Dates yet to be confirmed, will depend on obtaining all approvals and access conditions – between May-November 2023
Drill pad and access track rehabilitation	1 week duration	Dates yet to be confirmed, will depend on obtaining all approvals and access conditions – between May-November 2023
Rehabilitation monitoring	End of wet season following rehabilitation works Yearly for 3 years post	Dates yet to be confirmed, will depend on obtaining all approvals and completion of works – will begin at the end of wet season (February to June) following rehabilitation

### Table 3-5. Schedule of activities EP144

rehabilitation until	works
criteria have been met.	

### 3.6.2 EP154

Minerals Australia commits to all requirements including relevant notifications and approvals prior to works commencing.

As per Section 67(1) of the Petroleum Act 1984, it is required that Minerals Australia shall provide a notice of commencement of drilling of a well or for a seismic survey to the Minister no less than 28 days before the operations are commence. Additionally, as per Clause 301 Schedule of Onshore Petroleum Exploration and Production Requirements, an accepted Well Operations Management Plan must be in force before regulated well activities can commence.

Prior to commencement of the exploration activities, Minerals Australia will ensure that the following people are notified of the proposed commencement date and duration for the project:

- the Minister,
- the occupier of the land, and;
- the owner of the land.

Minerals Australia propose the following schedule for project activities on EP154 (Table 3-6).

Activity	Duration	Dates
2D Seismic line clearing, survey and pointing	4 weeks duration	Dates yet to be confirmed, will depend on access conditions – between May and November 2023
2D seismic data acquisition	4 weeks duration	Dates yet to be confirmed, will depend on access conditions – between May and November 2023
2D seismic line rehabilitation	1 week duration	Dates yet to be confirmed, will depend on access conditions – between May and November 2023
Drill pad clearing and drilling	4 weeks duration	Dates yet to be confirmed, will depend on access conditions – between May and November 2023
Drill pad and access track rehabilitation	1 week duration	Dates yet to be confirmed, will depend on access conditions – between May and November 2023

### Table 3-6. Schedule of activities EP154

### 3.7 Greenhouse Gas Emissions

The greenhouse gas (GHG) emissions estimates for the exploration programs are provided in Table 3-7. Vegetation clearing, fuel consumption and emissions resulting from the exploration programs on EP144 and 154 have been included in the GHG estimate. Given that few materials are to be transported, and machinery sourced locally where available, GHG emissions have been based solely on fuel consumption related to exploration activities.

GHG emissions calculations have adopted the formula specified in the *National Greenhouse Accounts Factors* (DEE, 2017). i.e.,  $E_{ij} = (Q_i \times EC_i \times EF_{ijoxec}) \div 1,000$ . As such, GHG emissions related to diesel fuel consumption is  $E_{ij} = (kilolitres diesel \times 38.6 \times 70.2) \div 1,000$ . Assumptions and estimates are as follows:

- Drill pad preparation is carried out by dozer or grader equipped with 175 kW engine. Fuel consumption averages 500 L/day. Drill pad preparation for EP144 carried out over 6 days (maximum seven days), for EP154 carried out over 3 days (maximum four days).
- Drilling equipment is equipped with a 400 kW engine. Fuel consumption averages 2500 L/day. Drilling for EP144 carried out over 60 days (maximum 72 days), EP154 carried out over 35 days (maximum 42 days).
- Vibroseis truck is equipped with a 330 kW engine. Fuel consumption averages 64 L/km for line preparation, 227 L/km for line acquisition and 17 L/km for line rehabilitation. Seismic line preparation, acquisition and rehabilitation carried out over a conservative 50 km.
- Drill pad rehabilitation is using a grader with 175 kW engine. Fuel consumption averages 400 L/day. Rehabilitation for EP144 carried out over 6 days (maximum seven days), EP154 carried out over 3 days (maximum four days).
- Seismic line and drill pad preparation, drilling and rehabilitation carried out 12 hours per day. Three vibroseis trucks will be used.

GHG emissions from land clearing have been calculated using the 2020 Full Carbon Accounting Model (FullCAM). FullCAM is a fully integrated Carbon Accounting Model (CAM) for estimating and predicting all biomass, litter and soil carbon pools in forest and agricultural systems and accounts for changes in major GHGs and human-induced land use practices. FullCAM is the model used to construct Australia's national GHG emissions account for the land sector and is appropriate for the assessment of emissions from land clearing for the seismic survey. While unlikely, it is noted that a total of approximately 20.45 ha of ground cover, grasses, shrubs and small trees may be impacted as part of the projects. However, all impacted areas will be rehabilitated to their previous state resulting in minimal long-term reduction in carbon sequestration.

The GHG calculations are shown below in Table 3-7. This includes the expected GHG emissions and the maximum GHG emissions under a worst-case scenario.

GHG emissions source	Fuel consumption (kL)	GHG Emissions (tonnes)	Max Fuel consumption (kL)	Max GHG Emissions (tonnes)
EP144				
Drill pad preparation	3	8.13	3.6	9.76
Drilling holes	150	406.46	180	487.75
Transport vehicles	9	24.39	10.8	29.27
Drill pad rehabilitation	2.4	6.5	2.88	7.8
Demobilisation	5	13.55	6	16.26
Land clearing (Up to 5.5)	-	247.5	-	247.5
EP144 Total	169.4	706.53	203	798.34

### Table 3-7. GHG emission estimates

GHG emissions source	Fuel consumption (kL)	GHG Emissions (tonnes)	Max Fuel consumption (kL)	Max GHG Emissions (tonnes)
EP154				
Drill pad preparation	1.5	4.06	1.8	4.88
Drilling holes	87.5	237.10	105	284.52
Transport vehicles	5.25	14.23	6.3	17.07
Drill pad rehabilitation	1.2	3.25	1.44	3.90
Seismic line preparation	3.182	8.62	3.8184	10.35
Seismic line acquisition	11.364	30.79	13.6368	36.95
Seismic line rehabilitation	0.866	2.35	1.0392	2.82
Demobilisation	5	13.55	6	16.26
Land clearing (Up to 14.95)	-	672.75	-	672.75
EP154 Total	115.86	986.70	139.03	1,049.49
Total both EP144 and EP154	285	1,693	342	1,848

### 3.8 Land clearing requirements

Land clearing is required on both EP144 and EP154. This is described below.

### EP144

It is estimated that at most, up to 5.5 ha of land will be cleared for the drill pads and camp, access tracks have been excluded as they are already disturbed/cleared. The majority of this is typically described as clay pans. An assessment of land systems for the disturbance footprint is included in Table 4-2 of Section 4.1.3.

### EP154

An assessment of each seismic line is presented above in Section 4.1.10.

It identifies a total of approximately 12.7 ha being disturbed/cleared for the preparation of the seismic lines. For this assessment blade up removal of above ground vegetation is not regarded as land clearing, removal of rootstock along with impacts to the ground surface are regarded as land clearing.

It is estimated that 2.25 ha will need to be cleared for drill pads. The majority of this is typically described as sandstone plains and rises. An assessment of land systems for the disturbance/clearing footprint is included in Table 4-4 of Section 4.1.3.

### 3.9 Vehicle movements

Various vehicles are required across the proposed works Program, with requirements depending on the proposed activities on each EP144 and EP154. Vehicle movements are described below.

### EP144

There will be approximately 17 truck movements for the exploration program on EP144. These truck movements consist primarily of road trains arriving at the start of the operations and again at the end of operations during demobilisation, being approximately four truck movements each way. The balance of the movements will be the delivery of fuel, being approximately one truck movement per week

There will be approximately five light vehicles per day for the duration of the exploration program.

The estimated traffic volume for the exploration program is shown in Table 3-8.

The DIPL Annual Traffic Report (DIPL 2021) indicated that the annual average daily traffic from nearby recording stations is approximately 60 - 90 vehicles per day. The estimated operational vehicles movements are significantly less than the average daily total, therefore are expected to have a minimal impact on traffic.

#### EP154

There will be approximately 17 truck movements for the exploration program on EP154. These truck movements consist primarily of road trains arriving at the start of the operations and again at the end of operations during demobilisation, being approximately six truck movements each way. The balance of the movements will be the delivery of fuel, being approximately one truck movement per week

There will be a daily commute by 4WD to mobilise and demobilise Civil Construction and Seismic acquisition crews from Flying Fox Station to the Location of the Regulated Activity for the duration of those operations. There will be approximately ten light vehicles per day for the duration of the exploration program.

The estimated traffic volume for the exploration program is shown in Table 3-8.

The DIPL Annual Traffic Report (DIPL 2021) indicated that the annual average daily traffic from nearby recording stations can range from 2 - 46 vehicles per day. The estimated operational vehicles movements are less than what the region experiences without the project, therefore are expected to have a minimal impact on traffic.

Activity	Total Truck Movements (per Activity)	No. Weeks per Activity	Average Truck Movements per Week – During that Activity	
EP144				
Mobilisation	4	1	4	
Drill pads/holes	8	8	1	
Demobilisation	4	1	4	
EP154				
Mobilisation	6	1	6	
Line Clearing and Acquisition, Drill pads/holes	4	4	1	
Demobilisation	6	1	6	

Table 3-8.	Estimated o	perational	trucking	requiremen	nts for I	EP144 and 154
	EStimated 0	perational	uaoning	requirement		

This section provides a summary of the key findings of the Ecological Assessment Reports for EP144 and EP154 (Appendix A and Appendix B).

Ecological assessments of the project footprints were undertaken using available desktop information and the results of a field-based surveys. This section presents a summary of these reports.

# 4.1 Physical environment

Climate, bioregion, landforms and soil are all key indicators and factors of the physical environment of a site. The physical environment influences potential risks the project poses to the environment and determines appropriate mitigations.

The physical environment at both EP144 and EP154 are described in the following sections.

### 4.1.1 Climate

Climate is the long-term weather pattern in an area. Rainfall in particular is an important consideration in scheduling works and minimising erosion risks from land clearing and disturbance. The climate at EP144 and EP154 are described below.

### EP144

The region experiences a hot desert climate generally, characterised by hot dry summers and cool dry winters, with a low average annual rainfall restricted between October to April. The closest long-term Bureau of Meteorology weather station is Brunette Downs (station number 015085), located within EP144. Mean annual maximum temperature recorded at that station is 33.6 °C, while the mean annual minimum is 18.8 °C. Extremes averages oscillate between 10.6 °C in July and 38.3 °C in December. Median annual rainfall is 370.9 mm; however, the amount of rainfall in the region is highly variable. For example, 2000 experienced 1092.4 mm of rain, while 2019 experienced 112.3 mm of rain. If heavy rainfall occurs, it is generally in the December, January, February quarter and can result in flash flooding in the waterways (BoM 2021). Figure 4-1 presents the BOM (2021) data showing the average monthly rainfall and temperatures extremes for Brunette Downs weather station.

### EP154

The project footprint is located in the transition between the hot arid steppe and tropical climates of the Northern Territory – respectively *BSh* and *Aw* – according to the Köppen–Geiger classification (Beker et al. 2018). The area is characterised by hot dry summers and cool dry winters, with a high average annual rainfall restricted between December and March. The closest long-term Bureau of Meteorology weather station is located in Ngukurr Airport (station number 014299), approximately 90 km northeast of the project footprint. Mean annual maximum temperature recorded at that station is 35.6 °C, while the mean annual minimum is 21.2 °C. Extremes averages oscillate between 14.3 °C in July and 40.1 °C in November. Median annual rainfall is 717.3 mm with extremes in the past ten years reaching 1068.4 mm of rain in 2014, and 443.4 mm of rain in 2019. If heavy rainfall occurs, it is generally in January, coinciding with the monsoon storms in the north that can result in flash flooding in the waterways (BoM 2021). Figure 4-2 presents the average monthly rainfall and temperatures extremes for Ngukurr Airport weather station.



Figure 4-1. Average monthly rainfall and temperature at Brunette Downs Station



Figure 4-2. Average monthly rainfall and temperature at Ngukurr Airport (014299) from 2012 to 2021 (source: BoM, 2021).

### 4.1.2 Bioregion

Bioregions are relatively large land areas characterised by broad, landscape-scale natural features and environmental processes that influence the functions of entire ecosystems. They capture the large-scale geophysical patterns across Australia. These patterns in the landscape are linked to fauna and flora assemblages and processes at the ecosystem scale, thus providing useful means for simplifying and reporting on more complex patterns of biodiversity. NT bioregions are described in Baker et al. (2005).

The bioregions relevant to EP144 and EP154 are described below.

### EP144

EP144 occurs within two bioregions – Mitchell Grass Downs (southern side of EP144), and the Gulf Fall and Uplands (northern side of EP144). The Davenport Murchison Range bioregion is immediately to the southwest.

The Gulf Fall and Uplands bioregion is characterised by undulating terrain with scattered low, steep hills. Soils are mostly skeletal or shallow sands. Woodland (*Eucalyptus* spp. or *Corymbia* spp.) over spinifex grasslands (*Triodia* spp.) communities dominate this bioregion. The Mitchell Grass Downs bioregion is mostly under pastoral tenure and consists largely of treeless plains with some occasional ridges, rivers and gorges. The dominant vegetation type is Mitchell Tussock Grasslands (*Astrebla* spp.) on cracking clay soils, with some intermittent lakes.

### EP154

EP154 occurs within two bioregions – the Sturt Plateau (western side of EP154), and the Gulf Uplands and Falls (eastern side of EP154). Sturt Plateau comprises flat to gently undulating plains of predominant Eucalypt woodlands or tall shrublands and woodlands of Bullwaddy and Lancewood. In more open areas, perennial grasses predominate. Soils are mainly lateritic, but deep sands occur in the south and cracking clays in the south-east. Gulf Falls and Uplands is characterised by undulating terrain with scattered low, steep hills. Soils are mostly skeletal or shallow sands. The most extensive vegetation is dominated by Darwin Stringybark and variable Barked Bloodwood over a spinifex understory and woodland dominated by Northern Box over tussock grasslands.

### 4.1.3 Land Systems

Christian and Stewart (1968) define a land system as 'an area or group of areas throughout which there is a recurring pattern of topography, soils and vegetation'. These have been mapped across the NT by different surveys and are at a significantly smaller scale than a bioregion (i.e. bioregions constitute many different land systems). Within each land system, a set of component land units is defined. In some areas of the NT, mapping has been undertaken to the level of detail of land units.

Land systems relevant to EP144 and EP154 are described below.

### EP144

Land system mapping of the region was undertaken by Christian et al. (1954) at a scale of 1:250,000. This mapping shows that EP144 intersects 21 land systems that are described in Appendix A of Appendix A and shown in Figure 4-3. EP144 is dominated by clay plains (1,078,652 ha), sandstone plains and rises (201,382 ha), lateritic plains and rises (175,433 ha), sandstone hills (21,749 ha), rugged quartz sandstone plateaux and hills (12,667 ha), basalt hills (4,360 ha) and alluvial flood plains (5,398 ha) associated with Lake Sylvester, Lake de Burgh, the Playford River and its tributaries. The project footprint intersects four of these land systems: clay plains (Barkly 1, 2 and 3) and sandstone plains and rises (Yelvertoft) (Table 4-1 and Appendix A.

Land System	Landform	Soil	Vegetation
Clay plains	S		
Barkly 1	Level to gently undulating clay plains (black soil plains); cracking clay soils. Up to 20% contains gravelly rises	Vertosols	Astrebla tussock grassland

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Land System	Landform	Soil	Vegetation
Barkly 2	Level to gently undulating clay plains (black soil plains); cracking clay soils. Up to 20-60% contains gravelly or stony rises		
Barkly 3	Level to gently undulating clay plains (black soil plains); cracking clay soils. Over 60% contains gravelly or stony rises		Mixed species tussock grassland
Sandstone	plains and rises		
Yelvertoft	Undulating terrain	Skeletal soils and truncated gravelly lateritic red earths	Dominated by <i>Eucalyptus</i> brevifolia or <i>E.</i> dichromophloia woodlands



Path: 2/101 EbOz\_Documents104 EbOz Vantage GIS/EZ19191 - Hanoock - EMP EP144/101 Project Files/Report maps/Figure 2 3. Map of land systems within and surrounding EP 144.mxd

Figure 4-3. Map of land systems within and surrounding EP144

Table 4-2 summarises the project footprint within each land system traversed by the proposed exploration works. Note this does not mean this entire area will be developed, as the access tracks are existing. This is based on environmental survey observations and data that are presented in Appendix A.

Land Systems	Barkly1	Barkly2	Barkly3	Yelvertoft
Landforms		Sandstone plains and rises		
Access Track	5.59 ha	10.95 ha	11.61 ha	4.96 ha
Drill Hole 1	-	-	-	2.25 ha
Drill Hole 2	-	2.25 ha	-	-
Camp site	-	1 ha	-	-

Table 4-2. Summary of project footprint for each land system traversed in EP144

### EP154

Land system mapping of the region at a scale of 1:250,000 shows that EP154 intersects 48 land systems. These are described in Appendix A of Appendix B and mapped in Figure 4-4. Land systems are grouped into landscape classes. EP154 is dominated by eight landscape classes described as lateritic plains (243,174 ha), sandstone plains and rises (173,165 ha), rugged quartz sandstone plateaux and hills (51,090 ha), alluvial floodplains (32,904 ha) associated with several river systems, sandstone hills (31,842 ha), lateritic plateaux (9,859 ha), small areas of basalt plains and rise (2,549 ha) and basalt hills (132 ha). The project footprint intersects twelve land systems within six landscape classes (Table 4-3).

The dominant land systems and their landscape classes to occur along all seismic lines are: Sandstone plains and rises (landscape classes: Arnold, Emmerugga, Kangaroo, McLeod,), with occasional alluvial floodplain (landscape classes: Lindsay and McArthur) associated with Packsaddle, Blackwater and Deadmans Creeks. The seismic access track intersects Basalt hills and rises (landscape class: Nutwood) and Lateritic plains and rises (landscape class: Langdon)– see Figure 4-4. This is further described in Appendix B.

Land System	Landform	Soil	Vegetation	
Sandstone plain and rises				
Arnold	Very gently sloping pediplains, pediments, colluvial slopes and some alluvium, rarely sedentary.	Yellow earths, yellow podzolics, and other soils with hard, mottled B horizons.	Low open woodland of <i>Melaleuca citrolens</i> with some <i>E. pruinosa</i> .	
Emmerugga	Undulating to rolling low hills on mainly argillaceous sediments	Lithosols and shallow yellow earths	Mid-high open woodland of C. latifolia, C. grandifolia, E. tectifica, C. confertiflora, Erythrophleum chlorostachys over Chrysopogon fallax, Themeda triandra, Sorghum plumosum.	
Kangaroo	Gently undulating to undulating rises on mainly argillaceous sediments	Shallow yellow earths and yellow podsolics	Mid-high open woodland of <i>E. tectifica, C. terminalis, Erythrophleum chlorostachys, Terminalia platyphylla, Brachychiton diversifolius over Chrysopogon fallax, Sorghum plumosum, Heteropogon triticeus.</i>	
McLeod	Gently undulating plains and low plateaux with	Leptic Tenosols and	Mid-high open woodlands of <i>E. tetrodonta, Callitris intratropica, C. ferruginea,</i>	

Table 4-3. Summary of the land systems relevant to the EP154 project footprint

Land System	Landform	Soil	Vegetation	
	frequent steeply incised valleys on sub- horizontally bedded massive sandstones and siltstones	Rudosols	Erythrophleum chlorostachys, E. miniata over Plectrachne pungens, Eriachne obtusa, Aristida hygrometrical.	
Patterson	Low hills, rises and undulating area on reddish platy sandstones and siltstones, often micaceous	Leptic Rudusols and Leptic Tenosols, shallow red and brown Kandosols	Mid-high open woodland of <i>E. leucophloia</i> , <i>Acacia shirleyi</i> , <i>E. tectifica</i> , <i>C. grandifolia</i> , <i>C. ferruginea</i> over very sparse grass cover ( <i>Plectrachne pungens</i> , <i>Eriachne obtusa</i> , <i>Chrysopogon fallax</i> ).	
Seigal	Gently undulating to undulating rises with abundant, often linear rocky outcrops	Lithosols, minor siliceous and earthy sands	Mid-high open woodland of E. miniata, <i>E. tetrodonta</i> , <i>C. ferruginea</i> , <i>C. dichromophloia</i> , <i>Callitris intratropica</i> over <i>Plectrachne pungens</i> , <i>Sorghum plumosum</i> .	
Rugged quar	tz sandstone plateaux and	hills		
Bukalara	Rugged rocky plateaux and steep, linear ridges, on massive sandstones such as the Bukalara and Kombolgie Sandstones	Lithosols and shallow siliceous sands	Mid-high open woodland of C. dichromophloia, E. miniata, E. tetrodonta, Erythrophleum chlorostachys over Plectrachne pungens, Chrysopogon fallax, Eriachne obtusa.	
Lateritic plair	ns and rises			
Langdon	Gentle colluvial slopes, mainly below areas of argillaceous rocks with some poorly drained depressions	Yellow Kandosols, some Chromosolic Redoxic Hydrosols and Aquic Vertosols	Mid-high open woodland of <i>E. tectifica</i> , <i>Erythrophleum chlorostachys</i> , <i>Brachychiton</i> <i>diversifolius</i> , <i>C. latifolia</i> , <i>C. confertiflora</i> over mid-dense grass cover ( <i>Chrysopogon</i> <i>fallax</i> , <i>Sorghum plumosum</i> , <i>Sehima</i> <i>nervosum</i> ).	
Basalt plains	and rises			
Nutwood	Plains and low rises on basalt and associated basic igneous rock	Brown, grey and red Vertosols, red Ferrosils and brown and red Kandosols	Mid-high open woodland of <i>Lysiphyllum</i> <i>cunninghamii</i> , <i>C. terminalis</i> , <i>C. confertiflora</i> , <i>E. pruinosa</i> , <i>E. patellaris</i> , <i>Erythroxylum</i> <i>ellipticum</i> over mid-dense grass cover ( <i>Chrysopogon fallax</i> , <i>Aristida latifolia</i> , <i>Panicum</i> spp.).	
Basalt hills				
Cliffdale	Gentle undulating to hilly terrain on basalt, dolerite, agglomerate and tuff, some dolerite; mostly rock outcrop with surface stone pockets of clayey soils	Leptic Rudosols, red Dermosols and black Vertosols	Mid-high open woodland of <i>E. pruinosa, E. tectifica, C. terminalis, Erythrophleum chlorostachys, Brachychiton diversifolius over Chrysopogon fallax, Sehima nervosum, Sorghum plumosum.</i>	
Alluvial floodplains				
Lindsay	Floodplains and terraced, some lower slopes and small swamps, drainage floors and flats, with fine sandy materials	Yellow and brown Kandosols and Chromosolic and Kandosolic Redoxic Hydrosols	Low open woodland of <i>M. viridiflora</i> , Grevillea pteridifolia, Brachychiton diversifolius over Chrysopogon fallax, Eriachne obtusa, Sorghum plumosum.	
McArthur	Broad or narrow fluvial corridors conducting regional drainage across various land systems towards the coast	Grey and brown clays, red and yellow earths and siliceous sands	Mid-high open woodland of <i>C. terminalis, E. microtheca, Excoecaria parvifolia, Lysiphyllum cunninghamii, C. papuana</i> over <i>Chrysopogon</i> spp., <i>Eulalia fulva, Iseilema vaginiflorum.</i>	



Path: 2:101 EcOz\_DocumentsID4 EcOz Vantage GISIEZ19193 - Hancock - EMP EP154/D1 Project Files/Report Maps/Figure 2.3. Map of land systems within and surrounding EP 154/mkd

#### Figure 4-4. Map of land systems within and surrounding EP154

Table 4-4 summarises the project footprint within each of the land systems traversed by the exploration works in EP154. These figures are not clearing figures, as the access tracks are existing and much of the seismic lines are not expected to be cleared. This is based on environmental survey observations and data that are presented in Appendix B.
Land Systems	Arnold	Emmerugga	Kangaroo	Langdon	Nutwood	Lindsay	McArthur
Landforms	sandstone plains and rises (ha)			lateritic plains (ha)	basalt plains and rises (ha)	alluvial	floodplains (ha)
Access track South	-	-	-	1.61	0.26	-	0.42
Line 2	-	2.11	2.58	-	-	-	0.23
Line 3	-	0.9	0.81	-	0.4	0.2	0.61
Line 4	1.5	0.47	-	-	0.65		0.52
Line 5	-	1.07	0.32	-	0.74	-	
Drill pad	-	-	2	-	-	-	-

#### Table 4-4. Summary of construction footprint for each land system traversed in EP154

## 4.1.4 Land units

Within each land system, a set of component land units is defined. In some areas of the NT, mapping has been undertaken to the level of detail of land units, whereas in some areas this mapping has not been undertaken.

Land units relevant to EP144 and EP154 are described below.

#### EP144

Land unit mapping was undertaken at a scale of 1:100,000 in the NT Portions 651 – Alroy Downs Station, 962 – Mittibah Station, and 1483 – Brunette Downs Station, and at a scale of 1:25,000 in the NT Portion 561 – Connells Lagoon Conservation Reserve. However, there is no land unit mapping for the NT Portion 1 – Alexandria Station, so for simplicity, land systems are used to characterise EP144 and the project footprint.

#### EP154

There is no land unit mapping for EP154.

## 4.1.5 Landform and soil

Landform and soils influence the habitat and vegetation that is present in a location, as well as the potential for impacts caused by erosion, flooding and clearing. This section describes the landform and soils found at each project location.

#### EP144

Landform and surface soils were described as part of the environmental site assessment (Appendix A).

The project footprint is located mostly within cracking clay plains, corresponding to the land systems within the Mitchell Grass Downs bioregion. The transition to land systems in the Gulf Falls and Uplands bioregion is very clear and occurs in the northern section of the access tracks (Figure 4-3), where the landscape is dominated by red sandy loam plains with varying concentrations of gravel. Waterways and drainage depressions are scattered throughout the area.

## EP154

Landform and surface soils were described as part of the environmental site assessment (Appendix B).

The project footprint is located mostly within sandstone plains and rises typical of the Gulf Fall and Uplands bioregion (Figure 4-4). Soils are mostly yellow earths with varying concentrations of sand. Waterways and drainage depressions are scattered throughout the area.

#### 4.1.6 Surface water

Surface water refers to any watercourses, drainage lines or springs present within the EP area, and the wider catchments within the project lies. This information is important for understanding water movement within the project area, and the potential site infrastructure may have on surface water flows.

#### EP144

EP144 predominantly lies within the Victoria River-Wiso catchment, except for the north-eastern corner of the EP which is within the Nicholson-Leichardt River catchment, and the south-eastern corner which is within the Diamantina-Georgina Rivers catchments (Figure 4-5). The EP area is crossed by two watercourses: Playford River (stream order 5) and one of its tributaries Buchanan Creek (stream order 3) (Figure 4-5). Mittiebah Creek is the other order 5 watercourses in the area, turning into Brunette Creek after encountering the Fish Hole Creek. All of these watercourses are ephemeral, flowing only after major rain events, however, they do support some permanent freshwater pools (e.g., Mitchiebo Waterhole, in the source of Playford River).

As identified by 1 in 100 year flood modelling the proposed well pad locations are unlikely to be affected as the locations are outside of the modelled flood extent, the well pads will only be present on site for a short period and works will be completed mostly in the dry season, with only a chance of extending into the wet season. If works continue into the wet season bunding of well pads will occur (Appendix Q).

#### EP154

The project footprint sits within the Roper River (west), Towns River (north-east) and Limmen Bight River (east) catchments – see Figure 4-6. The Roper River (stream order 6) is the dominant watercourse in the region, draining east into the Gulf of Carpentaria. Eleven creeks and their tributaries associated with the Roper River and Limmen Bight River are included within EP154. The watercourses within EP154 are intermittent – flowing only during the wet season – although there are some permanent spring-fed waterholes. Packsaddle Creek, Deadmans Creek and Blackwater Creek are crossed by the project footprint (i.e., seismic lines or access tracks). Limmen National Park and the Limmen Bight National Park are both downstream of the project site.

There are no wetlands of international or national significance within EP154. However, the Limmen River (Port Roper) Tidal Wetlands System is located downstream in the Limmen Bight River catchment.

As identified by 1 in 100 year flood modelling the proposed well pad locations are unlikely to be affected as the locations are outside of the modelled flood extent, the well pads will only be present on site for a short period and works will be completed mostly in the dry season, with only a chance of extending into the wet season. If works continue into the wet season bunding of well pads will occur (Appendix R).



Path: 2/01 EcOz\_Documents/04 EcOz Vantage GIS/EZ19181 - Hanoook - EMP EP144/01 Project Files/Report maps/Figure X-X map of important landforms and values.mxd

Figure 4-5. Map of river basins, waterways and important landforms and values within and surrounding EP144



Path: Z:/01 EcOz\_Documents/04 EcOz Vantage GIS/EZ19193 - Hanoock - EMP EP154/01 Project Files/Report Maps/Figure X-X - Map of important landforms.roxd

Figure 4-6. Map of river basins and waterways and important landforms and values within and surrounding EP154

## 4.1.7 Geology

Geological information relevant to project includes the underlying earth and rocks beneath the proposed work areas. Particularly relevant is the material beneath the drill holes that will be impacted by the proposed works.

#### EP144

EP144 is located within the Georgina Basin, which is a polyphase intracratonic basin containing unmetamorphosed Cryogenian to Devonian sedimentary rocks (Kruse et al 2013). It covers an area of 330,000 km<sup>2</sup> in the central-eastern NT and extends into western Queensland. In the central part of the Georgina Basin, where EP144 and the proposed drill holes are situated, the predominant outcropping rocks belong to the Cambrian Barkly Group (Camooweal Dolostone and Wonarah Formation), comprising dolostone. Dolomitic limestone, limestone, shale and siltstone. These rocks are underlain by the Kalkarindji Volcanic Group (Helen Springs Volcanics), which is unconformably underlain by the Mesoproterozoic South Nicholson Group, and then the Paleoproterozoic Lawn Hill Platform and Murphy Inlier; see the stratigraphic succession taken from the Mount Drummond, 1:250,000 Geological Series Sheet SE 53-12 in Figure 4-7.

#### EP154

EP154 is located within the Palaeo- to Mesoproterozoic McArthur Basin, which is exposed over an area of about 180,000 km<sup>2</sup> in the north-eastern NT (see Ahmad et al 2013). This sedimentary basin comprises an unmetamorphosed and relatively undeformed succession of sedimentary and minor volcanic rocks with a preserved thickness of up to 10 km. In the central part of the McArthur Basin, where EP154 is situated, the stratigraphic succession comprises the Upper Proterozoic Roper Group, which is unconformably underlain by the Lower Proterozoic McArthur Group and Tawallah Group; see stratigraphic succession taken from the Hodgson Downs, 1:250,000 Geological Series Sheet SD 53-14 in Figure 4-8.

In the area where the drill hole and seismic lines are proposed, rock outcrop comprises the Chambers River Formation and McMinn Formation. Dolerite sills are also present in the area, which were intruded into the Roper Group  $1324 \pm 4$  Ma.



Figure 4-7. Stratigraphic units underlying the EL144 area



Figure 4-8. Stratigraphic units underlying the EP154 area

# 4.1.8 Hydrogeology

Hydrogeology refers to the groundwater resources present beneath and surrounding the project area. This includes and present aquifers, and the quality, yield and other relevant uses of these aquifers.

## EP144

There is limited information available regarding the aquifers in the region surrounding and covering EP144, a summary of the available information is outlined here.

The aquifers beneath where the two drill holes are proposed within EP144, (i.e. the Camooweal Dolostone and Wonarah Formation) are classified as low yielding but having fresh groundwater; see Water Resources Map of Barkly/Gulf Study Region 2, 1998, Water Resources Division, NT Government. These aquifers have provided domestic and stock water across the tableland for nearly a century. Groundwater recharge is predominantly from rainfall infiltration, with recharge from surface water occurring during major rainfall events (Coffey 2009).

A review of water bores drilled within approximately 25 km of the proposed drill holes using NR Maps found 16 bores installed between 1980 and 2022 with a yield ranging from 0.5 - 5 L/s, however the majority of bores yield below 3 L/s, with only 2 bores yielding higher. The more recent bore reports indicate water quality is good, with pH from 5.8 - 6.5. Water bearing beds are typically 48-100 mBGL (DEPWS 2000).

#### EP154

There is also limited information available regarding the aquifers in the region surrounding and covering EP154, a summary of the available information is outlined here.

The McArthur basin that underlies EP154 has been identified to contain several aquifer formations that are small, disconnected and or confined with little or no recharge (Imperial Oil and Gas 2017; Knapton 2009; Pietsch *et al.* 1994; Zaar 2003). The dominant rock formation in the basin is comprised of dolomite, siltstone and shale which are considered to make lower quality aquifers, as they are fine grained and have low porosity and permeability. A review by Imperial Oil and Gas (2017) of the wider literature for the McArthur Basin indicated that the majority of aquifers in this region are discontinuous, local, no longer connected to recharge points or have secondary mineral overgrowth which has destroyed previously existing permeability and/or porosity. Additionally, most of the major north-eastern NT aquifers are not found within the McArthur basin.

This is supported by groundwater mapping from Tickell (2013), conducted for the Water Resources Division, which indicates that EP154 is located in an area that contains local scale aquifers only, with relatively low yields.

Based on the information available, the exact aquifer that underlies the project cannot be confirmed. A review of current bores at the nearby Hodgson Downs Station and Minyerri, as identified on NR Maps, shows 48 bores within 30 km of the proposed drill site. Installed between 1965 and 2017 these bores show a yield ranging from 0 - 15 L/s, however the majority of bores yield below 3 L/s, with only 7 bores yielding higher. The more recent bore reports indicate water quality is good, with pH from 7 – 8.5. Water bearing beds are typically 70-100 mBGL (DEPWS 2000).

The nearest significant aquifers to EPL154 are the Tindall Limestone aquifer located 60 km to the west and a dolostone aquifer located 76 km to the northeast.

## 4.1.9 EP144 field survey summaries

This section provides a summary of the key findings within each of the proposed works' areas. The summary outlines the key ecological values and threatening processes relevant to the various work components.

#### Ranken Road and other access tracks

The following characteristics apply to Ranken Road and other access tracks within EP144:

- Ranken Road is located off the Tablelands Highway and runs from near the north-west corner of EP144 in a south-east direct towards the southern boundary of the EP. Over 100 km of Ranken Road is located within EP144.
- Ranken Road intersects the following Landscape class (Land systems): clay plains (Barkly1, Barkly2, Barkly3) and sandstone plains and rises (Yelvertoft).

- There are two waterway crossings sites along Ranken Road (D1 Playford River and D5 Buchanan Creek) and three waterway crossing sites along the station access track (D4 Playford River, D3 Eastern Creek and D2 unnamed drainage line).
- Parkinsonia was recorded along the Buchanan Creek at D5. Both Noogoora Burr and Parkinsonia were recorded at D1, and only Noogoora Burr at WC3.
- All waterway crossing sites have a moderate erosion potential, except for D1 (Playford River) that is considered to have a low risk, and D3 (Eastern Creek) that is considered to have a high erosion risk.

#### Drill Hole 1

The following characteristics apply to the location of Drill Hole 1 within EP144:

- Drill hole 1 is located in the central north of EP144 and is accessed via Ranken Road and the station access track.
- The drill pad will occupy an area of approximately 2.25 ha (150 m x 150 m) in size.
- Drill hole 1 intersects the following Landscape class (Land systems): sandstone plains and rises (Yelvertoft).
- The proposed drill hole is located within good quality native vegetation, with no weeds and negligible impacts from pastoral activities.
- The closest registered bore RN033530 (3.4 km southwest), is further than the required 1 km away.
- The drill hole is unlikely to be affected by 1 in 100 year flood events as modelling indicates the locations are outside of the flood extent, the well pads will only be present on site for a short period and works will be completed mostly in the dry season, with only a chance of extending into the wet season.

#### Drill Hole 2

The following characteristics apply to the location of Drill Hole 2 within EP144:

- Drill Hole 2 is located in the north and accessed via Ranken Road and station access track.
- The drill pad will occupy an area of approximately 2.25 ha (150 m x 150 m) in size.
- Drill Hole 2 intersects the following Landscape class (Land systems): clay plains (Barkly2).
- Clay plains may support cracking clay soils that could provide potential habitat for the Plains Death Adder (listed as Vulnerable under TPWC Act and EPBC Act).
- The proposed drill hole is located within an area supporting good quality native vegetation, with low to no apparent cattle impact and no weeds.
- The closest registered bore RN000748 (7.3 km south), is further than the required 1 km away.
- The drill hole is unlikely to be affected by 1 in 100 year flood events as modelling indicates the locations are outside of the flood extent, the well pads will only be present on site for a short period and works will be completed mostly in the dry season, with only a chance of extending into the wet season.

#### Campsite

The following characteristics apply to the location of the campsite within EP144:

- The campsite will occupy an area approximately 1 ha in size.
- The campsite is located adjacent to Drill Hole 2 and accessed via the station access track.
- The campsite intersects the following Landscape class (Land systems): clay plains (Barkly2).
- Clay plains may support cracking clay soils that could provide potential habitat for the Plains Death Adder (listed as Vulnerable under TPWC Act and EPBC Act).
- The proposed campsite is located in an area supporting good quality native vegetation, with low to no apparent cattle impact and no weeds.
- It is recommended that the location of the campsite be moved from within the area supporting 'good' quality Mitchell grass Grassland to an area already degraded and denuded within Alexandria Station.

• The campsite has been moved south from the area that was originally surveyed to a location adjacent to an access track and fence line, while still remaining within the area surveyed by the heritage team and covered by the AAPA certificate.

## 4.1.10 EP154 field survey summaries

This section provides a summary of the key findings within each of the proposed works' areas. The summary outlines the key ecological values and threatening processes relevant to the various work components.

#### Seismic Line 2

The following characteristics apply to Seismic Line 2:

- Seismic Line 2 is 11.86 km in length.
- Seismic Line 2 will be accessed from the Hodgson River Road.
- The seismic line intersects the following Landscape class (Land systems): Sandstone plains and rises (Kangaroo) and alluvial floodplains (McArthur).
- There are three waterway crossing points along Seismic Line 2. Two of these were assessed during the field survey (WC4 and WC5).
- Environmental weed Sida spinosa was recorded at WC4. Declared weed Hyptis was recorded at WC5.

#### Seismic Line 3

The following characteristics apply to Seismic Line 3:

- Seismic Line 3 is 6.77 km in length.
- The seismic line intersects the following Landscape class (Land systems): sandstone plains and rises (Emmerugga, Kangaroo), alluvial floodplains (Lindsay, McArthur) and basalt plains and rises (Nutwood).
- There are four waterway crossing points along Seismic Line 3. Two of these crossing sites were assessed during the field survey including: Blackwater Creek that crosses Seismic Line 3 at the eastern end (Water crossing site WC7) and a first order stream near its western end that supports large old hollowing bearing trees (WC6).
- Declared weed Hyptis was recorded along the drainage line at both water crossing sites (WC6 and WC7).
- Potential habitat along waterways / riparian areas for TPWC-listed Mertens Water Monitor.
- Blackwater Creek is mapped as a known Groundwater Dependant Ecosystems and is crossed by Seismic Lines 3 and 4 along the eastern and southern sections, respectively.

#### Seismic Line 4

The following characteristics apply to Seismic Line 4:

- Seismic Line 4 is 7.85 km in length.
- The seismic line intersects the following Landscape class (Land systems): sandstone plains and rises (Arnold, Emmerugga), alluvial floodplains (McArthur) and basalt plains and rises (Nutwood).
- There are two waterway crossing points along Seismic Line 4. These include, Deadmans Creek (WC8) and Blackwater Creek (WC7) at the southern end.
- Potential habitat along waterways / riparian areas for TPWC-listed Mertens Water Monitor.
- Declared weed Hyptis was recorded at WC8 and WC7. Stylosanthes sp. were recorded at WC 8.
- Blackwater Creek is mapped as a known Groundwater Dependant Ecosystem and is crossed by Seismic Lines 4 at the southern end.

#### Seismic Line 5

The following characteristics apply to Seismic Line 5:

- Seismic Line 5 is 5.3 km in length.
- The seismic line intersects the following Landscape class (Land systems): sandstone plains and rises (Emmerugga, Kangaroo) and basalt plains and rises (Nutwood).
- There are no waterway crossing sites along Seismic Line 5.
- Weed species *Stylosanthes scabra* and *Sida spinosa* were recorded along or adjacent to this seismic line.

#### Access Track South

The following characteristics apply to Access Track South:

- The seismic access track intersects the following Landscape class (Land systems): Basalt hills and rises (landscape class: Nutwood), Lateritic plains and rises (landscape class: Langdon) and Rugged quartz sandstone plateaux and hills (landscape class: Bukalara).
- Packsaddle Creek (east branch) is crossed by the northern access track (WC1).
- Deadmans Creek is crossed by Hodgson River Road. This crossing was not assessed during the field survey.
- No weeds were recorded along Hodgson River Road.
- Potential habitat along waterways / riparian areas for TPWC-listed Mertens Water Monitor.

#### Drill hole

The following characteristics apply to EP154 Drill Hole:

- The stratigraphic drill hole is located in the middle of seismic line 5.
- Access to the drill pad will be via seismic lines and station roads.
- Approximate clearance area of 2.25 ha to accommodate the 150 m x 150 m drill pad.
- The seismic access track intersects the following Landscape class (Land systems): sandstone plains and rises (Kangaroo).
- Environmental weed Sida spinosa was recorded within the drill pad.
- Significant vegetation (remnant vegetation supporting large old hollowing bearing trees) is present within the drill pad area.
- The closest registered bore RN035870 (14 km southeast), is further than the required 1 km away.
- The drill hole is unlikely to be affected by 1 in 100 year flood events as modelling indicates the locations are outside of the modelled flood extent, the well pads will only be present on site for a short period and works will be completed mostly in the dry season, with only a chance of extending into the wet season.

# 4.2 Natural environment

Vegetation communities, flora, fauna and relevant areas of significance are all key indicators and factors of the natural environment. The natural environment influences potential risks the project poses to the environment, and determines appropriate mitigations.

The physical environment at both EP144 and EP154 are described in the following sections.

## 4.2.1 National Parks and Reserves

#### EP144

The Connells Lagoon Conservation Reserve is located within EP144, however is approximately 30 km west of project activities, and will not be impacted.

Limmen National Park is located approximately 50 km east of the EP154 project area.

## 4.2.2 Sites of Conservation Significance

In the NT there have been sites identified as the most important sites for biodiversity conservation that need further protecting. These are called Sites of Conservation Significance (SoCS) and indicate an area is of national or international importance for biodiversity conservation.

#### EP144

There are no SoCS within or surrounding EP144.

#### EP154

There are no SoCS within or surrounding EP154. The nearest is Limmen Bight and surrounds SoCS approximately 100 km downstream of EP154 (Figure 4-6).

## 4.2.3 Sites of Botanical Significance

Sites of botanical significance (SoBS) are considered important for plant conservation and specifically for conserving significant plant taxa (White et al. 2000).

#### EP144

EP144 intersects three SoBS (see Figure 4-5). These are:

- Connells Lagoon Conservation Reserve is located in the centre of the Barkly Tableland. The reserve was established for the conservation of Mitchell grass grassland communities. Species significant to the reserve include the Flock Bronzewing Pigeon (*Phaps histrionica*), Pictorella Manikin Finch (*Heteromunia pectoralis*), Red-chested Button-quail (*Turnix pyrrhothorax*) and the Australian Bustard (*Ardeotis australis*).
- Brunette Creek Waterholes extend from the termination of Brunette Creek at Lake Sylvester and continues upstream to Lily Woodcutter waterhole. It supports suitable habitat for Tobermony Melon (*Austrobryonia argillicola*), listed as Vulnerable in the NT under the Territory Parks and Wildlife Conservation Act (TPWC Act).
- Buchanan Rises comprises a low but extensive rise, composed of Mittebah Sandstone (crossbedded quartz sandstone) and minor outcroppings of tertiary limestone, dolomite, siltstone and gypsum. The site also includes the rather abrupt ecological boundary between the sandstone rises and the surrounding black soil plains.

Only Ranken road goes through the SOBS areas, and no work will be done on Ranken Road, therefore there is minimal risk to the SOBS sites.

## EP154

There are no SoBS within or surrounding EP154.

## 4.2.4 Vegetation communities

Vegetation and dominant flora species have been described as part of the environmental site assessment (Appendix A), which include site specific flora descriptions and a general flora species list from the survey. The communities are closely linked to landform types that were summarised in Section 4.1.5.

The main vegetation types are listed below.

The main vegetation types relevant to EP144 are:

- The clay plains are characterised by flat to gently undulating terrain supporting Mitchel Grass (*Astrebla* spp.) tussock grasslands growing over cracking clay, and small occurrences of sparse Whitewood (*Atalaya hemiglauca*) woodland over tussock grasslands.
- The sandplains are characterised by flat to gently undulating terrain supporting *Eucalyptus* spp. woodland over Spinifex (*Triodia pungens*) hummock grassland.
- There are no permanent watercourses within or near the project footprint. Nevertheless, waterways are very distinct from the surrounding landscape given the well-marked banks populated by Coolibah trees (*E. microtheca*).

## EP154

The main vegetation types relevant to EP154 are:

- Sandstone rises are the most common landform in the EP area. They are composed of gently undulating to undulating rises and rolling low hills on mainly argillaceous sediments with some linear rocky outcrops and shallow sandy soils. It supports mid-high open eucalypt woodland, often dominated by *Eucalyptus tectifica*, *Eucalyptus terminalis* and *Erythrophleum chlorostachys*.
- Sandstone plains are very gently sloping pediplains, pediments, colluvial slopes and some alluvial to gently undulating plains and low plateaux with frequent, steeply incised valleys on subhorizontally bedded massive sandstones and siltstones. Sandstone plains supports open eucalypt or *Melaleuca* woodlands.
- Alluvial floodplains are broad or narrow fluvial corridors conducting regional drainage across various land systems towards the coast fringed by floodplains and terraces, some lower slopes and small swamps, drainage floors and flats, with fine sandy materials. This landform supports open eucalypt woodland dominated by *Eucalyptus polycarpa* or tall *Melaleuca* fringing riparian vegetation.
- Rugged Quartz Sandstone plateaux and hills Rugged rocky plateaux and steep, linear ridges, on massive sandstones such as the Bukalara and Kombolgie Sandstones. Typical vegetation is mid-high open woodland of *E. dichromophloia* with *E. miniata*, *E. tetrodonta* and *E. leucophloia*.
- Basalt plains and low rises Plains and low rises on basalt and associated igneous rocks. Typical vegetation structure is mid-high open woodland of *Lysiphyllum cunninghamii* and *E. terminalis* with some *E. patellaris*.
- Lateritic plains Gentle colluvial slopes, mainly below areas of argillaceous rocks with some poorly drained depressions. Dominant vegetation is mid-high open woodland of *E. tectifica*.

## 4.2.5 Threatened flora and fauna

Threatened species (flora and fauna) which are vulnerable to extinction are listed as threatened under the NT TPWC Act and/ or the Commonwealth EPBC Act and are afforded legislative protection under these Acts. Consequently, these species need special consideration.

The process for determining potential impacts to these species is described here. A sophisticated analysis of the likelihood of presence and the habitat requirements of each threatened species within each EP is presented in Appendix A for EP 144 and Appendix B for EP 154. Critical habitat (as defined under the EPBC Act) has not been determined for the species being assessed here, in lieu of that literature has been reviewed and habitat for each species is presented in the relevant appendices. This information is summarised in the tables below for those species considered to have some likelihood of being present.

To determine the likelihood of an impact on each species the area of each habitat type within each EP (using the Land systems vegetation communities) is compared to the area of each habitat type potentially impacted by this activity.

In instances where riparian vegetation or aquatic habitats are an important habitat variable for species, the following method was utilised to determine potential habitat impacted. The available area of riparian habitat within each EP was calculated by buffering each watercourse with the riparian buffer distances from the Land Clearing Guidelines, and then-by GIS query determine the amount of seismic line (4 m wide) intersecting the riparian zone (Table 4-7) (Figure 6-4).

#### EP144

The potential impact to threatened species by this activity is considered to be low due to only a small area of habitat potentially being impacted (Table 4-5).

A comprehensive threatened species assessment was conducted for the project and is presented in Appendix A, that assessment determines the likelihood of occurrence for threatened species within the EP area, and gives them a high, medium or low likelihood of occurrence. Only the two species considered to have a high likelihood of occurrence within EP144 are discussed below.

Other threatened species considered low to medium likelihood of occurrence in the EP (Appendix A), are the Gouldian Finch, Crested Shrike-tit, Painted Honeyeater, Yellow-spotted Monitor, Merten's Water Monitor, Gulf Snapping Turtle, and Common Brushtail Possum. The site selection adopted to avoid these species is outlined in Section 6.1.

#### Grey Falcon (Falco hypoleucos)

Grey Falcons (listed as Vulnerable under *TPWC* Act and *EPBC* Act) live in lightly-timbered lowland plains, typically on inland drainage systems, where the average annual rainfall is less than 500 mm. They occur at low densities and are mostly seen as singles or pairs. Grey Falcons use nests built by other species, preferably in the tallest trees along watercourses. They are found through much of the arid and semi-arid areas of Australia and have been recorded in all Australian mainland states and territories. The majority of records from the Northern Territory are from the southern half, but records exist all the way north to Darwin (Ward, 2012).

The NT Fauna Atlas records nine undated observations of Grey Falcons within EP144, mostly in pairs. There were no sightings of this species or its nests during the July 2021 field survey. As individuals of this species are highly mobile, it is unlikely that it will be affected by the proposed works. However, habitat for this species should be protected through the avoidance of large old trees – in particular large Coolibah trees along the watercourses – and minimising the impact to riparian vegetation. If an active Grey Falcon nest (or suspected nest) is encountered, a minimum buffer of 300 m should be maintained around the active nest to reduce disturbance and potential impacts.

If present, Grey Falcons may be disturbed by the presence and operation of vehicles, plant and equipment, particularly within proximity to any nesting sites.

#### Plains Death Adder (Acanthophis hawkei)

The Plains Death Adder (listed as Vulnerable under *TPWC* Act and *EPBC* Act) has a patchy distribution and is known to occur on the cracking soils on floodplains of the Adelaide, Mary and Alligator Rivers, the Barkly Tableland on the Northern Territory / Queensland border, and the Mitchell Grass Downs of western Queensland. Radio tracking data suggests they are nomadic and do not have definable home ranges. There is currently no data on the conservation status of the Barkly Tablelands populations although the species is known to occur in lower densities in the region compared to the coastal floodplains of the NT Top End (Phillips, 2012). One of the main threats to the Plains Death Adder is ingestion of toxic Cane Toads (*Rhinella marina*). The drier conditions of the Barkly Tablelands prevent the spread of Cane Toads; however, they have been sporadically observed in the region (Phillips et al., 2010).

No sightings of Plains Death Adders were made during the July 2021 field survey. There are three records of this species within EP144 in The NT Fauna Atlas, all within Alexandria Station. One of them from 1978

within riparian vegetation along the Playford River, 1.5 km away from the Ranken Road crossing. The other two records are not dated and are located greater than 5 km away from the project footprint. The Plains Death Adder is considered to have a high likelihood of occurrence within the EP area based on the presence of suitable habitat (e.g. cracking clay soils), the low suitability of the environment to support Cane Toad populations, and the number of historic records. Ideally, the species occurrence should be investigated during the wet season, when it is known to be more mobile (Phillips, 2012). Where possible, project works will avoid impacts to cracking clay soils to minimise impacts to this species.

If present, the Plains Death Adder may be impacted by direct interaction with vehicles, plant or equipment during operation. This may result in fauna strike, potentially causing injury and/or death to the individual. Other impacts may include loss of habitat.

# Table 4-5. Threatened species 'likelihood of occurrence' assessment for EP 144

Likelihood of	Common			Statu	S		Potential Impact	Area of habitat available/	Mitigation	Impact likelihood
presence*	name	Scientific name	Class	EPBC	TPWC	Important habitat		area potentially impacted/ % area		
HIGH	Grey Falcon	Falco hypoleucos	Bird	VU	VU	Lightly-timbered lowland plains	Loss of habitat	Available: 1,666,918 ha Potential impact: 2.25 ha % impacted: <0.00015%	300 m buffer will be applied to active nests if detected.	Low: only a small amount of habitat impacted.
HIGH	Plains Death Adder	Acanthophis hawkei	Reptile	VU	VU	Cracking clays	Loss of habitat	Available: 90,059 ha Potential impact: 2.25 ha % impacted: <0.0025%		Low: only a small amount of habitat impacted.
MEDIUM	Gulf Snapping Turtle	Elseya lavarackorum	Reptile	EN	-	Calvert and Nicholson River systems	Impact to waterholes that may contain the species (noting a low likelihood of presence)	No riparian habitat impacted.		Low: no waterbodies directly impacted and erosion and sedimentation plans in place to ensure no sedimentation
MEDIUM	Mertens' Water Monitor	Varanus mertensi	Reptile	-	VU	Coastal and inland waterways	Removal of watercourse habitat	No riparian habitat impacted.		Low: No riparian habitat impacted.
LOW	Floodplain Monitor/Yellow- spotted Monitor	Varanus panoptes	Reptile	Nominated for listing	VU	Various – incl. coastal beaches, floodplains, grasslands and woodlands	Removal of habitat (noting low probability presence)	Available: 1,666,918 ha Potential impact: 2.25 ha % impacted: <0.00015%		Low: only small amount of habitat impacted.
LOW	Gouldian Finch	Erythrura gouldiae	Bird	EN	VU	Breeds on slopes with Snappy Gum ( <i>Eucalyptus leucophloia</i> )	Loss of nesting habitat which may be Eucalyptus trees with trunk diameter >25 cm at 1.3 m above ground level	Available: 797,254 ha Potential impact: 2.25 ha % impacted: <0.0003%	No felling of Eucalypts with a trunk diameter >25 cm at 1.3 m above ground level.	Low: no loss of nesting trees
LOW	Red Goshawk	Erythrotriorchis radiatus	Bird	VU	VU	Breeding habitat in tall trees esp. riparian in this area	Removal of large trees for nesting or habitat for feeding	N/A impact relates to specific tall trees not a vegetation community	No felling of Eucalypts with a trunk diameter >25 cm at 1.3 m above ground level.	Low: no loss of nesting trees, small area of habitat impacted.
LOW	Ghost bat	Macroderma gigas	Mammal	VU	-	Cave roosts	Removal of cave roosts	N/A impact relates to caves not a vegetation community		Low: No caves impacted
LOW	Freshwater or Largetooth sawfish	Pristis pristis	Fish	VU	VU	Rivers	Impact to rivers through sedimentation.	No riparian habitat impacted.		Low: no watercourses impacted and erosion and sedimentation plans enacted.
LOW	Carpentarian Grasswren	Amytornis dorotheae	Bird	EN	EN			Available: 724,355 ha Potential impact: 2.25 ha % impacted: <0.00031%		Low: only a small amount of habitat impacted.
LOW	Crested Shrike-tit (northern subspecies)	Falcunculus frontatus whitei	Bird	VU	-	Eucalyptus and Corymbia open woodland nesting and foraging habitat	Loss of habitat	Available: 1,666,918 ha Potential impact: 2.25 ha % impacted: <0.00015%		Low: only a small amount of habitat impacted.
LOW	Painted Honeyeater	Grantiella picta	Bird	VU	VU	Acacia and Eucalyptus- dominated woodlands and open forest,	Loss of habitat	Available: 1,666,918 ha Potential impact: 2.25 ha % impacted: <0.00015%		Low: only a small amount of habitat impacted.

Likelihood of	Common			Statu	IS		Potential Impact	Area of habitat available/	Mitigation	Impact likelihood
presence*	name	Scientific name	Class	EPBC	TPWC	Important habitat		area potentially impacted/ % area		
LOW	Masked Owl (northern subspecies)	Tyto novaehollandiae kimberli	Bird	VU	VU	Mainly in Eucalyptus tall open forests	Loss of habitat	Available: 1,666,918 ha Potential impact: 2.25 ha % impacted: <0.00015%		Low: only a small amount of habitat impacted.
LOW	Mitchell's Water Monitor	Varanus mitchelli	Reptile	-	VU	Inhabits margins of freshwater watercourses, swamps and lagoons	Loss of riparian habitat	No riparian habitat impacted.		Low: No riparian habitat impacted.
LOW	Pale Field-rat	Rattus tunneyi	Mammal	-	VU	Primarily in dense vegetation along creeks	Loss of riparian habitat	Available: 1,666,918 ha Potential impact: 2.25 ha % impacted: <0.00015%		Low: only a small amount of habitat impacted.
LOW	Greater Bilby	Macrotis lagotis	Mammal	VU	VU	Various, prefers grasslands on sandy soils.	Loss of habitat	Available: 2,619,037 ha Potential impact: 4.5 ha % impacted: <0.00017%		Low: only a small amount of habitat impacted.
LOW	Princess Parrot	Polytelis alexandrae	Bird	VU	VU	Highly nomadic, can be present in various habitats.	Loss of habitat	Available: 2,619,037 ha Potential impact: 4.5 ha % impacted: <0.00017%		Low: only a small amount of habitat impacted.
LOW	Night Parrot	Pezoporus occidentalis	Bird	EN	EN	Grasslands on clay pans or floodplains	Loss of habitat	Available: 2,619,037 ha Potential impact: 4.5 ha % impacted: <0.00017%		Low: only a small amount of habitat impacted.
LOW	Brush-tailed Rabbit-rat	Conilurus penicillatus	Mammal	VU	EN	Eucalypt open forest or woodland.	Loss of habitat	Available: 2,619,037 ha Potential impact: 4.5 ha % impacted: <0.00017%		Low: only a small amount of habitat impacted.

\* \*Refer to Appendix A for justification of likelihood of occurrence for these species and habitat requirements.

The process for determining potential impacts to these species is described here. A sophisticated analysis of the likelihood of presence and the habitat requirements of each threatened species presented in Appendix B. Critical habitat (as defined under the EPBC Act) has not be determined for the species being assessed here, in lieu of that literature has been reviewed and habitat for each species is presented in the relevant appendices. This information is summarised in the tables below for those species considered to have some likelihood of being present.

To determine the likelihood of an impact on each species the area of each habitat type within each EP (using land systems) is compared to the area of each habitat type potentially impacted by this activity. **Error! Reference source not found.** shows the vegetation communities used for threatened species impact assessment.

Species that are considered to have a high likelihood of occurrence have been discussed in greater detail in this section, including habitat requirements and potential impact pathways (though see Appendix B for further details).

The potential impact to threatened species by this activity is considered to be low due to only a small area of habitat potentially being impacted (Table 4-6).

A comprehensive threatened species assessment was conducted for the project which is presented in. This assessment determines the likelihood of occurrence for the species within the project area, and gives them a high, medium or low rating. Only the two species considered to have a high likelihood of occurrence (Appendix B) within EP154 are discussed below.

Threatened species considered low to medium likelihood of occurrence in the EP (as per Appendix B), are the Crested Shrike-tit, Painted Honeyeater, Yellow-spotted Monitor, Gulf Snapping Turtle, and Common Brushtail Possum. The site selection adopted to avoid these species where possible is outlined in Section 6.1.

#### Mertens' Water Monitor (Varanus mertensi)

Mertens Water Monitor is classified as Vulnerable under the *TPWC Act* and has been nominated for listing as Endangered under the Federal *EPBC Act*. This species has a broad geographic range, occupying coastal and inland waters across the far north of Australia from the Kimberley to the west side of Cape York Peninsula. It has been recorded across most of the North End and the Gulf Region in the NT. It is a semi-aquatic monitor seldom seen far from water and feeds mainly on fish, frogs and carrion, and also eat insects and small terrestrial vertebrates. Mertens Water Monitor is highly susceptible to Cane Toad poisoning (Ward et al 2006). Whilst population numbers have declined because of Cane Toads (Ward et al. 2006), there does not appear to be a range contraction for this species, since there are still many records across its historic distribution after toads entered their habitat range.

There were no sightings of Mertens Water Monitor during the July 2021 field survey. However, there are 19 records of this species within 50 km of EP154 in the NT Fauna Atlas, all within the Gulf Fall and Uplands bioregion, and eight of them in the Roper River. As such, this species is considered to have a high likelihood of occurrence within EP154 and the project footprint during the wet season, and more broadly throughout the whole Roper River basin.

If present, Merten's Water Monitor may be impacted by direct interaction with vehicles, plant or equipment during operation. This may result in fauna strike, potentially causing injury and/or death to the individual. It may also be impacted by habitat loss. Minimisation of impacts to riparian vegetation and implementation of an erosion and sediment control plan for waterway crossings will reduce the potential impacts to Mertens Water Monitor habitat.

#### Gouldian Finch (Erythrura gouldiae)

The Gouldian Finch is classified as Vulnerable under the TPWC Act and listed as Endangered under the EPBC Act. This species formerly occurred from the Cape York Peninsula in Queensland, through the Top

End of the Northern Territory and through to the Kimberly region in Western Australia. In the last 100 years, this species has undergone significant population reduction and contraction across its range. The decline of this species has been attributed to habitat modification and reduced availability of grass seed from pastoral activity and altered fire regimes in savannah woodlands (O'Malley 2006).

Gouldian Finch occupy two different regions of the landscape on an annual cycle (Dostine et al. 2001). In the dry season and part of the late wet season, between February and October, the species lives within wooded hills that contain a group of smooth-barked *Eucalyptus* species commonly referred to as Snappy and Salmon Gums – including *Eucalyptus leucophloia, E. tintinnans* and, to a lesser degree, *E. miniata*. Hollows in these trees provide critical nesting sites. During this period, the species forages on the ground, feeding on seeds of native sorghum, and utilises small rocky waterholes that remain within the hills until the next wet. In the wet season, Gouldian Finches move from the hills into lowland drainages to feed upon seeds of perennial grasses, typically available from mid- December. These grasses include Soft Spinifex (*Triodia pungens*), Cockatoo Grass (*Alloteropsis semialata*) and Golden Beard Grass (*Chrysopogon fallax*) (Dostine and Franklin 2002). In the non-breeding season birds can disperse widely (Garnett et al. 2011), greatly increasing the possible range of this species.

The NT Fauna Atlas records 276 observations of Gouldian finches within 50 km of EP154. These records show they are widespread across the region. There were no sightings of this species during the July 2021 field survey. The proposed exploration activities present a potential threat to this species through the removal habitat, particularly the loss of large hollow bearing trees for nesting (in particular large *E. leucophloia*). Clearing of trees (including Corymbia and Eucalypt species) with a trunk diameter greater than 25 cm at 1.3 m above the ground will be avoided.

If present, the main impact to the Gouldian Finch may be during clearing for seismic lines causing potential habitat loss, and disturbance by project activities.

Likelihood of	Common			Statu	s		Potential Impact	Area of habitat available/	Mitigation	Impact likelihood
presence*	name	Scientific name	Class	EPBC	TPWC	Important habitat		area potentially impacted/ % area		
HIGH	Mertens' Water Monitor	Varanus mertensi	Reptile	-	VU	Coastal and inland waterways	Removal of watercourse habitat	Available: 18408 ha Potential impact: 0.787 ha % impacted: <0.005%		Low: only a small area of watercourses impacted
нідн	Gouldian Finch	Erythrura gouldiae	Bird	EN	VU	Breeds on slopes with Snappy Gum ( <i>Eucalyptus leucophloia</i> )	Loss of nesting habitat which may be Eucalyptus trees with trunk diameter >25 cm at 1.3 m above ground level	Available: 294,718 ha Potential impact: 10.62 ha % impacted: <0.0037%	No felling of Eucalypts with a trunk diameter >25 cm at 1.3 m above ground level.	Low: no loss of nesting trees
MEDIUM	Northern Brushtail Possum	Trichosurus vulpecula arnhemensis	Mammal	VU	-	Woodlands	Removal of habitat	Available: 547,571 ha Potential impact: 10.62 ha % impacted: <0.002%		Low: only small amount of habitat impacted.
MEDIUM	Red Goshawk	Erythrotriorchis radiatus	Bird	VU	VU	Breeding habitat in tall trees esp. riparian in this area	Removal of large trees for nesting or habitat for feeding	N/A impact relates to specific tall trees not a vegetation community	No felling of Eucalypts with a trunk diameter >25 cm at 1.3 m above ground level.	Low: no loss of nesting trees, small area of feeding habitat impacted.
MEDIUM	Ghost bat	Macroderma gigas	Mammal	VU	-	Cave roosts	Removal of cave roosts	N/A impact relates to caves not a vegetation community		Low: No caves impacted
MEDIUM	Freshwater or Largetooth sawfish	Pristis pristis	Fish	VU	VU	Rivers	Impact to rivers through sedimentation.	Available: 18408 ha Potential impact: 0.787 ha % impacted: <0.005%		Low: no large rivers impacted and erosion and sedimentation plans enacted.
MEDIUM	Northern Brushtail Possum	Trichosurus vulpecula arnhemensis	Mammal	-	VU	Various	Loss of habitat	Available: 547,571 ha Potential impact: 10.62 ha % impacted: <0.002%		Low: only small amount of habitat impacted.
LOW	Gulf Snapping Turtle	Elseya lavarackorum	Reptile	EN	-	Calvert and Nicholson River systems	Impact to waterholes that may contain the species (noting a low likelihood of presence)	Available: 18408 ha Potential impact: 0.787 ha % impacted: <0.005%		Low: no waterbodies directly impacted and erosion and sedimentation plans in place to ensure no sedimentation
LOW	Floodplain Monitor/Yellow- spotted Monitor	Varanus panoptes	Reptile	Nominated for listing	VU	Various – incl. coastal beaches, floodplains, grasslands and woodlands	Removal of habitat (noting low probability presence)	Available: 547,571 ha Potential impact: 10.62 ha % impacted: <0.002%		Low: only small amount of habitat impacted.
LOW	Grey Falcon	Falco hypoleucos	Bird	VU	VU	Lightly-timbered lowland plains	Loss of feeding habitat (noting too far north for breeding and low likelihood of presence)	Available: 547,571 ha Potential impact: 10.62 ha % impacted: <0.002%		Low: only small amount of feeding habitat impacted.
LOW	Crested Shrike-tit (northern subspecies)	Falcunculus frontatus whitei	Bird	VU	-	Eucalyptus and Corymbia open woodland nesting and foraging habitat	Loss of habitat	Available: 547,571 ha Potential impact: 10.62 ha % impacted: <0.002%		Low: only a small amount of habitat impacted.
LOW	Partridge Pigeon	Geophaps smithii	Bird	VU	VU	Suitable Eucalyptus woodland habitat	Loss of habitat	Available: 547,571 ha Potential impact: 10.62 ha % impacted: <0.002%		Low: only a small amount of habitat impacted.

## Table 4-6. Threatened species impact assessment for EP 154

Likelihood of	Common			Status			Potential Impact	Area of habitat available/	Mitigation	Impact likelihood
presence*	name	Scientific name	Class	EPBC	TPWC	Important habitat		area potentially impacted/ % area		
LOW	Painted Honeyeater	Grantiella picta	Bird	VU	VU	Acacia and Eucalyptus- dominated woodlands and open forest,	Loss of habitat	Available: 547,571 ha Potential impact: 10.62 ha % impacted: <0.002%		Low: only a small amount of habitat impacted.
LOW	Masked Owl (northern subspecies)	Tyto novaehollandiae kimberli	Bird	VU	VU	Mainly in Eucalyptus tall open forests	Loss of habitat	Available: 547,571 ha Potential impact: 10.62 ha % impacted: <0.002%		Low: only a small amount of habitat impacted.
LOW	Common Brushtail Possum	Trichosurus vulpecula vulpecula	Mammal		EN	Various	Loss of habitat	Available: 547,571 ha Potential impact: 10.62 ha % impacted: <0.002%		Low: only a small amount of habitat impacted.
LOW	Mitchell's Water Monitor	Varanus mitchelli	Reptile	-	VU	Inhabits margins of freshwater watercourses, swamps and lagoons	Loss of riparian habitat	Available: 18408 ha Potential impact: 0.787 ha % impacted: <0.005%		Low: only a small amount of habitat impacted.
LOW	Plains Death Adder	Acanthophis hawkei	Reptile	VU	VU	Cracking clays	Loss of habitat	No habitat present.		Low: No habitat within project footprint
LOW	Pale Field-rat	Rattus tunneyi	Mammal	-	VU	Primarily in dense vegetation along creeks	Loss of riparian habitat	Available: 547,571 ha Potential impact: 10.62 ha % impacted: <0.002%		Low: only a small amount of habitat impacted.

\*Refer to Appendix B for justification of likelihood of occurrence for these species and habitat requirements.

## Table 4-7. Riparian habitat impact assessment for EP154

		Total area available				
	level 1	level 2	level 3	level 4	level 5	(ha)
Total riparian area within EP (ha)	7786.105652	3811.756791	3703.178104	1206.334699	1900.758517	18408.13
Potential riparian area intersected by 4 m seismic line (ha)	0.369932554	0.177856246	0.239334903	0	0	0.787123703
% of total area in EP	0.004751188	0.004665991	0.00646296	0	0	0.004276

## 4.2.6 Watercourse crossings and Groundwater Dependent Ecosystems (GDE)

## EP144

No watercourse crossings or GDE's in EP144.

## EP154

A field survey of EP154 was undertaken including an assessment of watercourse crossings (Appendix B), watercourses intersected by the activity are described in Table 4-8 and shown in Figure 4-9. There are four watercourses intersected: three on seismic lines (WC 4, 7 and 8) one on an access track (WC 14). (Other watercourses are nearby to the end of seismic lines which have had their length reduced to avoid the watercourse, these are WC5 and WC 6).

There are two known terrestrial Groundwater Dependent Ecosystems (GDE's) in the project footprint, namely Blackwater Creek and the floodplain of one of its tributaries, both supporting Melaleuca woodlands. Blackwater Creek is crossed by Seismic Lines 3 and 4 (e.g. WC7), within the eastern and southern sections of the seismic lines respectively.

The specific location of WC 7 is in an area of sparse trees and the ecological assessment did not record the melaleuca woodlands that define the GDE. Nevertheless, the activity does cross a section of the GDE (Figure 4-9), so, to further reduce any environmental impact the following special conditions will apply to this part of the seismic:

In the section of seismic line numbers 3 between Hodgson Downs Road and the southern end of seismic line 4 an experienced field technician will precede the seismic team flagging a path to further reduce impacts to this important area.

Works must aim to minimise impacts on GDEs associated with Blackwater Creek through the control of erosion, minimisation of vegetation loss and rehabilitation post-works.

This is captured in the implementation strategy (see Table 7-1).

Watercourse Crossing label	Stream order	Original proposal	Final footprint	GDE potential
WC4	1	Seismic	Seismic	Low
WC5	2	Seismic	Not impacted, near end of seismic line now starts 50 m from edge of riparian zone.	
WC6	1	Seismic	Not impacted, near end of seismic line but not impacted, seismic line now starts 25 m from edge of riparian zone.	
WC7	2	Seismic	Seismic	Known
WC8	3	Seismic	Seismic	
WC14	2	Access track	Access track	

Table 4-8.	Watercourse	crossings	intersected.



Path: Z:\01 EcOz\_Documents\04 EcOz Vantage GIS\EZ19193 - Hancock - EMP EP154\01 Project Files\Report Maps\Figure X-X - waterpourse crossings.mxd

## 4.2.7 Weeds

Some species of introduced flora are declared weeds under the NT Weeds Management Act because of the harm they can cause. Class A weeds must be eradicated by landowners and occupiers. Class B weeds must have their growth and spread controlled by landowners and occupiers. The remaining introduced flora species are referred to as environmental weeds. The Commonwealth Government has also categorised some species as Weeds of National Significance (WoNS).

Weed distribution is often related to environmental disturbances caused by the construction of roads and tracks, cattle grazing and feral animals. Weeds are most prevalent on land under pastoral lease, with infestations generally concentrated around infrastructure such as water points, fence lines, tracks, and also along the banks of watercourses where cattle and feral animals tend to congregate.

Weeds relevant to EP144 and EP154 are described below.

#### EP144

A review of the NT Weed Branch weed dataset shows that there are very few weed species recorded within EP144 and within a 100 km radius. This does not necessary mean that there are few weed infestations in the region; instead it may reflect remoteness of the area has prevented extensive surveys. By far the most frequently reported species in the area is Parkinsonia (*Parkinsonia aculeata*). This Class B weed grows in a wide range of climates and soil types.

EP144 lies within the *Tennant Creek Regional Weeds Strategy 2021-2026* (DEPWS 2021). That plan focusses on weeds that are most important to the region, categorising them as either:

- Category 1 Priority weeds (present in the region, widely considered feasible to eradicate from the Region, typically evaluated as very high risk and have isolated and restricted distributions).
- Category 2 Priority weeds or strategic control including the eradication of outliers (species warranting strategic control across the landscape due to the high impact they have on land managers and on broader economic and environmental values).
- Category 3 Weeds of concern (assessed by the weed risk management system as a medium to high risk, or have not been assessed, but have been identified by stakeholders as posing a threat to the values of the region).
- Category 4 Hygiene and biosecurity weeds (it is important for landholders to implement weed hygiene and other biosecurity measures to prevent the spread of weeds into clean areas, and to control these species where the opportunity arises).
- Category 5 Alert weeds (have the potential to have a high level of impact to the region should it become established, the likelihood of the species naturalising and spreading in the region is perceived to be high).

Table 4-9 outlines the weeds listed in the Tennant Creek Regional Weeds Strategy. Buffel Grass (*Cenchrus ciliaris*) is described in the plan as a significant threat but, because of its value to pastoralists, is not a declared weed.

Table 4-9.	Weed species relevant to EP144 identified in the Tennant Creek Regional Weeds Strategy
	2021-2026 (DEPWS 2021)

Common name	Botanical name	Class	WoNS	Status in the management plan
Bellyache Bush	Jatropha gossypiifolia	А	Yes	Category 1
Mesquite	Prosopis spp.	А	Yes	Category 1
Prickly Acacia	Acacia nilotica	А	Yes	Category 1
Athel Pine	Tamarix aphylla	А	Yes	Category 2
Parkinsonia	nia Parkinsonia aculeata		Yes	Category 2

Common name	Botanical name	Class	WoNS	Status in the management plan
Rubber Bush	Calotropis procera	В	No	Category 2
Burr – Noogoora	Xanthium strumarium	В	No	Category 3
Buffel Grass	Cenchrus ciliaris		No	Significant threat

The NT Government Weed Management Branch was consulted on the survey approach and agreed that the lists covered all weeds for which surveys should be conducted. The agreed approach was to walk all disturbance areas to search for weeds.

Weed species recorded during the field survey are listed and described in Table 4-10 and their occurrence is shown in Figure 4-10. Results indicate that weeds are mainly concentrated along the major drainage lines. No Category 1 species were recorded during the survey.

Parkinsonia (*Parkinsonia aculeata*) – a Category 2 weed – is widespread along the drainage lines, including within the project footprint. This species is also a declared WoNS and listed as a Class B weed in the NT. The field survey recorded multiple infestations in close proximity to the access tracks that represent high risk of spread. The location of identified weeds are presented in Figure 4-10.

Noogoora Burr (*Xanthium strumarium*) – a Category 3 weed – was recorded in a moderate infestation within the project footprint. It is also a declared Class B weed in the NT. The risk of spreading this weed is high due to the infestations location at the intersection between Ranken Road and Playford River (see location of records within Figure 4-10).

Athel Pine (*Tamarix aphylla*) – a Category 2 weed – was observed at a single location outside the project footprint. It is a declared WoNS and a Class A species in the Barkly Region. Although this infestation was located outside of the project footprint adjacent to a turkey nest dam on Alexandria Station (location shown in Figure 4-10), prompt control measures and hygiene protocols must be implemented to ensure that it is not spread further.

Species	Status	Occurrence	Comment
Parkinsonia (Parkinsonia aculeata)	Class B Category 2 (Very High Priority)	Six sites (two along the Playford River, one along Eastern creek, two along Buchanan Creek, and one in a minor drainage in Ranken Rd.)	This is a WoNS. It is widespread in the Playford River and Buchanan Creek banks within Alexandria Station (DEPWS 2021a).
Noogoora Burr (Xanthium strumarium)	Class B Category 3 (High Priority)	One site (along the Playford River crossing in Ranken Rd.)	There is no plan or strategy published for the management of this weed species. Seeding plants were widespread.
Athel Pine (Tamarix aphylla)*	Class A Category 2 (Very High Priority)	One site adjacent to a turkey nest dam	This species is a WoNS. The project footprint is located within the Athel Pine Weed Eradication Zone (Class A) (DEPWS 2021b).

Table 1 10	Wood opening		a field ourseour		1111 2004
1 able 4-10.	weed species	s observed durin	a neid survevs	S ON EP 144. J	
				, -	

\* Found outside of project footprint however, important to be avoided to prevent spread and further infestations.



Path: Z101 EcOz\_Documents/04 EcOz Vantage GISIEZ19191 - Hancock - EMP EP14401 Project Files/Report maps/Figure 5.4. Map of weed occumences and drainage within, or adjacent to, the project footprint.mxd

Figure 4-10. Map of weed occurrences within, or adjacent to, the project footprint on EP144

A review of the NT Weed Branch weed dataset shows that there are over 2,300 weed records for the general area of EP154 (within approximately a 20 km buffer). By far the most frequently reported species are:

- Chinee Apple (*Ziziphus mauritiana*) (Class A)
- Parkinsonia (*Parkinsonia aculeata*) (Class B)
- Hyptis (*Mesosphaerum suaveolens*) (Class B)
- Lantana (Lantana camara) (Class B)
- Neem (Azadirachta indica) (Class B)
- Bellyache Bush (Jatropha gossypiifolia) (Class B)

EP154 lies within the *Katherine Regional Weed Strategy 2021-2026* (DEPWS 2021). This plan focusses on the weeds that are most important to the region, categorising them as either:

- Category 1 Priority weeds (present in the region, widely considered feasible to eradicate from the Region, typically evaluated as very high risk and have isolated and restricted distributions).
- Category 2 Priority weeds or strategic control including the eradication of outliers (species warranting strategic control across the landscape due to the high impact they have on land managers and on broader economic and environmental values).
- Category 3 Weeds of concern (assessed by the weed risk management system as a medium to high risk, or have not been assessed, but have been identified by stakeholders as posing a threat to the values of the Region).
- Category 4 Hygiene and biosecurity weeds (it is important for landholders to implement weed hygiene and other biosecurity measures to prevent the spread of weeds into clean areas, and to control these species where the opportunity arises).
- Category 5 Alert weeds (have the potential to have a high level of impact to the region should it become established, the likelihood of the species naturalising and spreading in the region is perceived to be high).

All such weeds are listed in Table 4-11.

Common name	Scientific name	WoNS	NT Class	Category in regional strategy	Records within project footprint (20km buffer)
Mesquite*	Prosopis spp.	Yes	A	1	-
Prickly Acacia*	Vachellia nilotica (previously Acacia nilotica)	Yes	A	1	Yes
Parthenium	Parthenium hysterophorus	Yes	А	1	Yes
Rubber Vine	Cryptostegia spp.	Yes**	A	1	-
Mimosa*	Mimosa pigra	Yes	A	1	Yes
Salvinia	Salvinia molesta	Yes	В	1	-
Gamba Grass*	Andropogon gayanus	Yes	A	2	Yes
Devils Claw	Martynia annua	-	A	2	Yes
Chinee Apple*	Ziziphus mauritiana	-	А	2	Yes
Bellyache Bush*	Jatropha gossypiifolia	Yes	A/B***	2	Yes
Grader Grass*	Themeda quadrivalvis	Yes	В	2	Yes
Neem*	Azadirachta indica	-	В	2	Yes
Parkinsonia	Parkinsonia aculeata	Yes	В	3	Yes

# Table 4-11. Weed species relevant to EP154 identified in the Katherine Regional Weed Strategy 2021-2026 (DEPWS 2021)

Common name	Scientific name	WoNS	NT Class	Category in regional strategy	Records within project footprint (20km buffer)
Lantana	Lantana camara	Yes	В	3	Yes
Rubber Bush <sup>†</sup>	Calotropis procera	-	В	3	Yes
Snake Weed	Stachytarpheta spp.	-	В	4	Yes
Hyptis	Mesosphaerum suaveolens	-	В	4	Yes
Sida species	Sida acuta, S. cordifolia, S. rhombifolia	-	В	4	Yes
Pond Apple	Annona glabra	Yes	А	5	-
Water Hyacinth	Eichhornia crassipes	Yes	А	5	-
Cabomba*	Cabomba caroliniana	Yes	А	5	-
Siam Weed	Chromolaena odorata	Yes	С	5	-
Brazilian Pepper	Schinus terebinthifolius	-	А	-	-

\* Species must be eradicated or managed as directed by its Statutory Weed Management Plan

\*\* Cryptostegia grandiflora is a WoNs

\*\*\* Most of EP154 is within a Class B management zone. The easternmost area is Class A.

<sup>†</sup> Rubber Bush is considered high priority on the Sturt Plateau but declared class B only south of 16°30' S latitude

A total of 40 sites were assessed for the occurrence of weeds within the project footprint. These sites include waterway crossing sites, analogue vegetation sites and other specific weed survey sites (Figure 4-11).

Four weed species were detected within the project footprint and are described further below in Table 4-12.

Species	Status	Occurrence
Hyptis (Mesosphaerum suaveolens)	Class B in the NT and Category 4 in Katherine Regional Weed Strategy.	WC2, WC5, WC6, WC7, WC8, WC10, WC12, and WC14
Spiny Sida ( <i>Sida</i> <i>spinosa</i> )	Environmental weed	Seismic lines 2 (WC4), seismic line 5 and the drill pad
Stylosanthes hamata	Environmental weed	Seismic line 4
Stylosanthes scabra	Environmental weed	Seismic line 5

Table 4-12. Weed species observed during the field survey on EP154

Thirteen occurrences of Hyptis (*Mesosphaerum suaveolens*), a declared weed species, was recorded during the July 2021 field survey. It is listed as Category 4 – Hygiene and biosecurity weed – in the Katherine Regional Weed Strategy and Class B – to be controlled – in the NT. It is widespread along the drainage lines, including within the project footprint. The field survey recorded multiple infestations near the seismic lines that represent a high risk of spread. The location of identified Hyptis infestations are presented in Figure 4-11. Sites where this weed species was recorded include (water crossing sites - WC2, WC5, WC6, WC7, WC8, WC10, WC12, and WC14). These areas of infestation are considered a high risk for spread.

Three other invasive species (environmental weeds) were recorded in the project footprint. Spiny Sida (*Sida spinosa*) infestations were recorded along seismic lines 2 (WC4), seismic line 5 and the drill pad. *Stylosanthes hamata* infestations were observed along seismic line 4 while *S. scabra* along seismic line 5. Spiny Sida is native to the neotropics and parts of tropical Asia, having become invasive in temperate parts of Australia. *S. hamata* and *S. scabra* were introduced as pasture plants and also have the potential to become weeds. The risk of spreading these species is high due to the location of the infestations in close

proximity to the seismic lines increasing the likelihood of them being transported by machinery to other disturbed areas. Their location is mapped in Figure 4-11.



Path: Z101 EcOz\_Documents/04 EcOz Vantage GISIEZ19103 - Hancock - EMP EP154/01 Project Files/Report Maps/Figure 5 3. Map of weed occurrences and drainage within, or adjacent to, the project footprint.nxxd

Figure 4-11. Map of weed occurrences within, or adjacent to, the project footprint on EP154

## 4.2.8 Feral animals

Feral animals are a key threatening process to many threatened species and to overall ecosystem health. Additionally, some feral animals are listed under the EPBC Act as key threatening processes.

Feral animals relevant to EP144 and EP154 are described below.

#### EP144

According to the NT Fauna Atlas, the introduced fauna species listed in Table 4-13 are widespread and abundant within the region, and hence likely to occur within EP144. Feral cats and pigs are both listed as a Key Threatening Process under the *EPBC Act*. Wild dogs refer to feral dogs (e.g. descended from domestic dogs) and not to the native Dingo (*Canis lupus dingo*).

Common name	Scientific name	Habitats	Impacts
Feral Cattle	Bos taurus	Various	
Feral Horse	Equus caballus	Grassland and shrubland	trampling and consumption of native flora, and sedimentation and increased nutrient levels in
Feral donkey	Equus asinus	Various	watercourses
Wild Dog	Canis lupus familiaris	Various	Prey on many species of native animals
Feral Cat	Felis catus	Various	
Feral Pig	Sus scrofa	Riparian areas and wetlands	Physical damage to wetlands
House Mouse	Mus domesticus	Various	Compete with native species. May impact upon native vegetation via seed predation
Black Rat	Rattus rattus	Various	May impact upon vegetation and outcompete native species
One-humped Camel	Camelus dromedarius	Various	Trampling, suppression of plant recruitment, damage to wetland and riparian areas, and competition with native animals for food and shelter
Rock Pigeon	Columba livia	Various	Compete with native species. May impact upon native vegetation via seed predation

Table 4-13. Pest animals that may occur within EP144 (NT Fauna Atlas)

## EP154

According to the NT Fauna Atlas, the introduced fauna species listed in Table 4-14 are widespread and abundant within the region, and hence likely to occur within EP154. Donkeys especially occur in high densities in parts of the region and contribute considerably to overgrazing. Cane Toads, Feral Cats and Feral Pigs are each listed as a Key Threatening Process under *EPBC Act*.

Table 4-14.	Pest animals	that may	occur within	EP154 (NT /	Atlas)
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Common name	Scientific name	Habitats	Impacts
Feral Cattle	Bos taurus	Various	Erosion of soil and watercourses, weed spread,

Common name	Scientific name	Habitats	Impacts
Water Buffalo	Bubalus	Riparian areas & wetlands	trampling and consumption of native flora, and sedimentation and increased nutrient levels in
Donkey	Equus asinus	Various	watercourses
Horse	Equus caballus	Grassland & shrubland	
Wild Dog	Canis lupus	Various	Proving many aposion of nativo animala
Feral Cat	Felis catus	Various	Frey on many species of native animals
Feral Pig	Sus scrofa	Riparian areas & wetlands	Physical damage to wetlands
House Mouse	Mus domesticus	Various	Compete with native species. May impact upon native vegetation via seed predation
Cane Toad	Rhinella marina	Various	Known to cause population reductions in a range of predatory species (due to poisoning by ingestion)
Asian House Gecko	Hemidactylus frenatus	Buildings & adjacent woodlands	Compete with, and predate upon, native species
Yellow Crazy Ant	Anoplolepis gracilipes	Monsoon rainforest	

# 4.3 People and communities

This section provides an overview of the surrounding social, economic, cultural and human health values in relation the project area, which may be affected by the regulated activity.

#### EP144

The area immediately surrounding the project area is sparsely populated as the areas are pastoral properties. There are five areas within the EP that are not covered under the EP grant area and are not part of a pastoral lease. These areas are Connells Lagoon Conservation Reserve which is a Special Purpose Lease, Mittiebah Aboriginal Land (contains the remote community of Connells Lagoon) and Gulgunnor Aboriginal Land (contains the remote community of Illuwurru) which are Aboriginal Land that is managed under the *Aboriginal Land Rights Act* (ALRA), a small parcel of land for Government purposes and a parcel of land that is reserved along the Ranken Road. Adjacent to the EP there are numerous remote Aboriginal communities / living areas, including Corella Creek, Gulunguru, Murun Murula, Ngunarra and Wangalinji. These remote areas are very small with each area containing a small number of houses and facilities. The social and economic data available for these communities / living areas is discussed below in Section 4.3.1

## EP154

The majority of the area immediately surrounding the project area is sparsely populated as the areas are pastoral properties or Aboriginal freehold land. The town of Mataranka is approximately 85 km west of the work location. There are a number of Aboriginal communities within and adjacent to the EP including, Minyerri, Kewulyi, Mole Hill and Jilkminggan. Kewulyi and Mole Hill are very small communities containing few houses and facilities, with Minyerri and Jilkminggan being significantly larger.

## 4.3.1 Social and economic

Social and economic factors include the human settlements and communities in the region, and the industries the operate within the area.

Corella Creek is a small Aboriginal community that is located 385 kilometres northeast of Tennant Creek, and approximately 128 km northwest of the regulated activities of EP144. This community is the most developed of all the communities in close proximity to EP144 as it contains primary school, community store and health care facilities (JCAC 2020). There is no Australian Bureau of Statistic (ABS) data available for Corella Creek.

The Connells Lagoon Conservation Reserve is managed by Parks and Wildlife Commission rangers based at Tennant Creek and the only reserve in Australia primarily established for the conservation of Mitchell grassland vegetation (NTG 2020a). There is minimal information available for the remote communities of Gulunguru, Illuwurru, Murun Murula, Ngunarra and Wangalinji. No ABS data is available. All of the remote communities depend on groundwater bores as a water resource.

The pastoral leases that the EP covers are some of the largest pastoral lease properties in the Northern Territory and Australia.

#### EP154

Kelwulyi and Mole hill are located approximately 5 and 10 km respectively north of the work locations for EP154. The small remote communities both have a population less than 20 people and have limited services and facilities (NTG 2020c & NTG 2020e).

Minyerri community is the most developed of the communities in close proximity to the regulated activities of EP1534, and is located outside of the boundary of EP154, 23 km southeast of the work location. This community has a population of 726 people (ABS 2016) and contains a school, community store, police station, aerodrome and health care facilities (NTG, 2020d). Jilkminggan is located approximately 65 km west of the works location has a population of 354 and contains a school, community store, regional council service centre and health centre (NTG, 2020b). All of the remote communities depend on groundwater bores or as a water resource.

## 4.3.2 Aboriginal sacred sites

Aboriginal sacred sites refers to areas if importance to the local Aboriginal people and are protected under the *Aboriginal Sacred Sites Act.* AAPA certificates outline the sacred sites relevant to the project.

#### EP144

An AAPA Certificate (201908471) has been granted to Minerals Australia over the areas covered by EP144, for regulated activities authorised under the *Petroleum Act 1984*. The certificate shows that EP144 contains two restricted work areas. In accordance with the *Aboriginal Sacred Sites Act* these areas identified will be avoided, to eliminate the potential impacts associated with the regulated activities.

#### EP154

An AAPA Certificate (201908530) has been granted to Minerals Australia over the areas covered by EP154, for regulated activities authorised under the *Petroleum Act 1984*. The certificate shows that EP154 contains two restricted work areas. In accordance with the *Aboriginal Sacred Sites Act* these areas identified will be avoided, to eliminate the potential impacts associated with the regulated activities.

## 4.3.3 Heritage sites

Heritage sites refers to areas of historical importance or significance as are protected by the NT *Heritage Act*. This can include, but is not limited to, archaeological sites of Aboriginal origin and some historical features associated with the post-contact to modern period.

The current project area has been subject to few if any comprehensive archaeological research to date. The NT Archaeological Database indicates a single stone artefact recorded approximately 45 km to the northnortheast of the Mittiebah Station homestead. The lack of comprehensive archaeological research in the project area is not due to the paucity of archaeological resources, but rather the lack of investigations in the region.

To supplement existing survey results, Earthsea were engaged by Minerals Austarlia to provide a Heritage Impact Assessment for the project – see Appendix C for the full report. An archaeological field assessment, coupled with a desktop study, was used to analyse potential risks to archaeological resources and areas of cultural significance within the proposed drill and campsite areas. Archaeologist Richard Woolfe and field assistant Raymond Daniell undertook the field assessment on site on October 5 and 6, 2021.



Recommendations of this report have been considered by Minerals Australia. The recommendations and actions taken are outlined below in Table 4-15.

Recommendation	Action taken
Project Area Drill Hole 1: the isolated artefacts and the Sacred Site Restricted Works Area (RWA) should be avoided as per above. It is recommended that the drill hole and access track should be placed to avoid these features	Drill hole 1 has been relocated approximately <b>Constant</b> , remaining within the AAPA certificate area and archaeological survey area, but increasing the distance from the RWA. This updated location avoids isolated artefacts.
Project Area Drill Hole 2 and campsite: avoid impacts on sites and artefacts where possible, otherwise seek permit to disturb as per Section 8.5 of Appendix C. An area of lower artefact density and it is recommended that the drill hole and camp site be placed in this area. If required, a permit to disturb archaeological artefacts, permitted under Section 2.1.2 of the NT <i>Heritage</i> <i>Act</i> , should also be considered with this approach. As the area has fewer artefacts, it may be possible to seek an administrative permit to disturb, as outlined in Section 8.5 of Appendix C.	Drill hole 2 has been relocated approximately the campsite will also be located within this area. This updated location avoids isolated artefacts. It is not expected a permit to disturb will be required.

Earthsea were engaged by Minerals Australia to provide a Heritage Impact Assessment. An archaeological field assessment, coupled with a desktop study, was used to analyse potential risks to archaeological resources and areas of cultural significance within the proposed seismic line, drill pad and campsite areas.

Archaeologist Richard Woolfe undertook the field assessment on site between 28 September and 2 October 2021. The field team consisted of Senior Traditional Owners Trevor Willie and Bradley Farrar, Earthsea Field Assistant Raymond Daniell and Richard Woolfe.



Recommendations of this report have been considered by Minerals Australia. The recommendations and actions taken are outlined below in Table 4-16.

Table /-16	<b>Recommendations</b>	of EP154	archaeological	eurvey and	actions taken
Table 4-10.	Recommendations	01 EF 134	archaeological	Survey and	actions taken

Recommendation	Action taken
Relocate the north western seismic line This will avoid impacts on	Northern seismic lines and access track no longer required. No impact.
Relocate the seismic lines away from Sites AS002 and AS003 is possible. If this is not possible, contact the Consultants to arrange a permit under Section 72 of the NT Heritage Act.	The seismic line is restricted to the AAPA clearance area Site will be avoided if possible, or this section of seismic line will be excluded from the survey to prevent impacts.
The Restricted Works Area associated with Sacred Site 5667-12 Any works to improve that track should avoid impact on the Sacred Site. Note: Sacred Site 5667-12 has already been impacted upon	Sacred site area will be flagged as a no-go area, therefore this site will not be impacted.
# 4.3.4 Sensitive receptors

The sensitive receptors nearby to the proposed program area for EP154 and EP144, are outlined below. It is worth noting that the short impact duration of the works helps to mitigate the potential for long term impacts to these receptors.

- Pastoral leases
- Homesteads and remote communities
- Petroleum reserved blocks
- Habitat for listed species
- Streams and watercourses
- Roads and tracks

### Table 4-17. Sensitive receptor separation distances to EP144 project area

Receptor	Nearest project component	Distance to receptor	How impact has been avoided/minimised
Surface water – major watercourses Playford River and Buchanan Creek, other minor streams and drainage depressions	Access road	Crossed by access road, with existing crossings	Streams only crossed in the dry season when they contain no water, no impact to riparian vegetation. Using existing crossings and not impacting on bank profile.
Buchanan Rises SoBS	Access road	3 km north	Existing access road will be utilised. Appropriate ESCP and chemical management to prevent any downstream impacts on this site.
Connells Lagoon SoBS, and Connells Lagoon Conservation Reserve	Drill hole 1	30 km west	Appropriate ESCP and chemical management to prevent any downstream impacts on this site.
Nearest homestead – Mittebah	Access road	1 km north of access road, 10 km north of drill hole 2	Distance from drill hole and mitigations ensure receptor will be unaffected by noise, dust and traffic impacts
Nearest community – Illuwurri	Access road	27 km northwest	Distance from site and mitigations ensure receptor will be unaffected by noise, dust and traffic impacts
Nearest road – Rankin Road	Access road	Access road entrance comes off Ranken Road	Small impact area with low traffic, speed restrictions minimise dust impacts on other road users
Petroleum reserved block – Title ID RB111 (located at Connells Lagoon)	Drill hole 1	70 km west	Significant distance from the site – no impact
Proposed petroleum reserved block – Connells Lagoon Conservation Reserve	Drill hole 1	45 km east	Significant distance from the site – no impact
Heritage sites – as per Appendix C	Drill hole 1, drill hole 2 and access track	Isolated artefacts and sacred site RWA's to the works areas.	Drill holes No works will take place in areas identified

Receptor	Potential impact	Nearest project component	Distance to receptor	How impact has been avoided/minimised
Habitat for Gouldian Finch – hilled regions supporting Snappy Gum ( <i>Eucalyptus</i> <i>leucophloia</i> ) (nesting habitat) (Franklin et al. 2005)	Loss of nesting habitat which may be Eucalyptus trees with trunk diameter >25 cm at 1.3 m above ground level	Various seismic lines	Seismic lines and access tracks have the potential to be near this habitat	No clearing of large trees (trunk diameter >25 cm at 1.3 m above ground level). Minimal habitat impacted by activities.
Habitat for Grey Falcon – woodland or sparsely timbered plains, nest in tall trees often along watercourses	Loss of nesting habitat which are large old hollow bearing trees	Various seismic lines and access tracks	Seismic lines and access tracks have the potential to be near this habitat	Not clearing large old hollow bearing trees
(Threatened Species Scientific Committee 2020).	Disturbance of nesting areas during project activities	Various seismic lines and access tracks	Seismic lines and access tracks have the potential to be near this habitat	If an active Grey Falcon nest (or suspected nest) is encountered, a minimum buffer of 300 m should be maintained around the active nest to reduce disturbance and potential impacts.
Habitat for Crested Shrike-tit – open woodland dominated by <i>Eucalypt</i> or <i>Corymbia</i> species (Threatened Species Scientific Committee 2016)	Loss of habitat	Various seismic lines and access tracks	This habitat is common within the project area and present nearby to works areas	No clearing of large trees (trunk diameter >25 cm at 1.3 m above ground level). Minimal habitat impacted by activities
Habitat for Painted Honeyeater – woodlands dominated by <i>Acacia</i> and/or <i>Eucalypt</i> species and open forests (Ward, S 2012)	Loss of habitat	Various seismic lines and access tracks	This habitat is common within the project area and present nearby to works areas	No clearing of large trees (trunk diameter >25 cm at 1.3 m above ground level). Minimal habitat impacted by activities.
Habitat for Yellow-spotted monitor – occupies a variety of habitats, including coastal beaches, floodplains,	Loss of habitat Fauna strike	Various seismic lines and access tracks	This habitat is common within the project area and present nearby to works areas	Minimal habitat impacted by activities. Clearing methodology minimises interaction with fauna (see Section 7.1)

Receptor	Potential impact	Nearest project component	Distance to receptor	How impact has been avoided/minimised
grasslands and woodlands (Ward et al 2012).				Restricting vehicle movement speed
Habitat for Mertens' Water Monitor – riparian vegetation near permanent watercourses (Packsaddle creek) (Ward et al. 2006)	Loss of habitat	All seismic lines and access tracks intersect watercourses	Intersected by seismic lines/access tracks	Streams only crossed in the dry season when they contain no water, with spring- fed permanent waterholes avoided Minimal habitat impacted by activities.
Habitat for Gulf Snapping Turtle – Large rivers and their associated overflow lagoons and oxbow lakes, particularly in areas of intact riparian vegetation (Packsaddle creek) (Department of Environment 2017)	Sedimentation into downstream habitat	Access track cross Playford River and Buchanan Creek	Intersected access road	Only existing crossings will be used. ESCP's will be implemented to minimise sedimentation, majority of the works to completed in the dry season.
Habitat for Common Brushtail Possum – in central Australia, riverine habitat that is close to rocky outcrops and moist gullies within the ranges or rocky slopes	Loss of habitat	All seismic lines and access tracks intersect watercourses	Intersected by seismic lines/access tracks	Impacts to riparian vegetation will be minimised by using existing crossings or selecting the path of least disturbance thought the area, which will avoid large trees and remain within the seismic buffer area.

Receptor	Nearest project component	Distance to receptor	How impact has been avoided/minimised
Surface water - Packsaddle Creek, Deadmans Creek and Blackwater Creek (several smaller drainage lines are also crossed)	All seismic lines	Throughout project area	Streams only crossed in the dry season when they contain no water, with spring-fed permanent waterholes avoided. Using existing crossings and not impacting on bank profile.
Limmen National park	Seismic line 4	50 km east	Appropriate ESCP and chemical management to prevent any downstream impacts on this site.
Limmen Bight and surrounds SoCS	Seismic line 4	50 km east	Appropriate ESCP and chemical management to prevent any downstream impacts on this site.
Nearest town - Mataranka	Seismic line 4	85 km west	Significant distance from the site – no impact
Nearest community – Kewulyi (Roper Valley)	Seismic line 4	5 km north east	Mitigations ensure receptor will be unaffected by noise, dust and traffic impacts
Nearest road – Hodgson River Road	Seismic line 3	Crossed by seismic line	Small impact area with low traffic, speed restrictions minimise dust impacts on other road users
Nearest highway – Roper Highway	Seismic line 4	5 km north	Mitigations ensure receptor will be unaffected by noise, dust and traffic impacts
Petroleum reserved block – Title ID RB66	Seismic line 4	70 km west	Significant distance from the site - no impact
Proposed petroleum reserved block – St Vidgeon Management Area	Seismic line 4	45 km east	Significant distance from the site – no impact
Heritage sites – as per Appendix D	Seismic line and drill hole	Isolated artefacts are present at varying distance to the works areas.	Sacred sites will be flagged and if sites cannot be avoided.

### Table 4-19. Sensitive receptor separation distances to EP154 project area

Table 4-20. Thr	reatened species sensitiv	e receptor separation d	distances to EP154 project area
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Receptor	Potential impact	Nearest project component	Distance to receptor	How impact has been avoided/minimised
Habitat for Gouldian Finch – hilled regions supporting Snappy Gum ( <i>Eucalyptus</i> <i>leucophloia</i> ) (nesting habitat) (Franklin et al. 2005)	Loss of nesting habitat which may be Eucalyptus trees with trunk diameter >25 cm at 1.3 m above ground level	Various seismic lines	Seismic lines and access tracks have the potential to be near this habitat	No clearing of large trees (trunk diameter >25 cm at 1.3 m above ground level). Minimal habitat impacted by activities.
Habitat for Grey Falcon – woodland or sparsely timbered plains, nest in tall trees often along watercourses	Loss of nesting habitat which are large old hollow bearing trees	Various seismic lines and access tracks	Seismic lines and access tracks have the potential to be near this habitat	Not clearing large old hollow bearing trees
(Threatened Species Scientific Committee 2020).	Disturbance of nesting areas during project activities	Various seismic lines and access tracks	Seismic lines and access tracks have the potential to be near this habitat	If an active Grey Falcon nest (or suspected nest) is encountered, a minimum buffer of 300 m should be maintained around the active nest to reduce disturbance and potential impacts.
Habitat for Crested Shrike-tit – open woodland dominated by <i>Eucalypt</i> or <i>Corymbia</i> species (Threatened Species Scientific Committee 2016)	Loss of habitat	Various seismic lines and access tracks	This habitat is common within the project area and present nearby to works areas	No clearing of large trees (trunk diameter >25 cm at 1.3 m above ground level). Minimal habitat impacted by activities.
Habitat for Painted Honeyeater – woodlands dominated by <i>Acacia</i> and/or <i>Eucalypt</i> species and open forests (Ward, S 2012)	Loss of habitat	Various seismic lines and access tracks	This habitat is common within the project area and present nearby to works areas	No clearing of large trees (trunk diameter >25 cm at 1.3 m above ground level). Minimal habitat impacted by activities.
Habitat for Yellow-spotted monitor – occupies a variety of habitats, including coastal beaches, floodplains,	Loss of habitat Fauna strike	Various seismic lines and access tracks	This habitat is common within the project area and present nearby to works areas	Minimal habitat impacted by activities. Clearing methodology minimises interaction with fauna (see Section 7.1)

Receptor	Potential impact	Nearest project component	Distance to receptor	How impact has been avoided/minimised
grasslands and woodlands (Ward et al 2012).				Restricting vehicle movement speed
Habitat for Mertens' Water Monitor – riparian vegetation near permanent watercourses (Packsaddle creek) (Ward et al. 2006)	Loss of habitat	All seismic lines and access tracks intersect watercourses	Intersected by seismic lines/access tracks	Streams only crossed in the dry season when they contain no water, with spring- fed permanent waterholes avoided Minimal habitat impacted by activities.
Habitat for Gulf Snapping Turtle – Large rivers and their associated overflow lagoons and oxbow lakes, particularly in areas of intact riparian vegetation (Packsaddle creek) (Department of Environment 2017)	Sedimentation into downstream habitat	Seismic line 1 and northern access track cross Packsaddle creek	Intersected by seismic line 1	ESCP's will be implemented to minimise sedimentation, majority of the works to completed in the dry season. Minimal habitat impacted by activities.
Habitat for Common Brushtail Possum – in central Australia, riverine habitat that is close to rocky outcrops and moist gullies within the ranges or rocky slopes	Loss of habitat	All seismic lines and access tracks intersect watercourses	Intersected by seismic lines/access tracks	Impacts to riparian vegetation will be minimised by using existing crossings or selecting the path of least disturbance thought the area. Minimal habitat impacted by activities.

# **5 STAKEHOLDER ENGAGEMENT**

Minerals Australia has established and continues developing relationships with the stakeholder groups in EP144 and EP154.

For the exploration program and the development of this EMP, Minerals Australia initiated contact with the affected stakeholders with the objective to ensure that they were engaged in the planning of the proposed activities and that specific issues could be considered and addressed.

# 5.1 EP144 stakeholders

The identified stakeholders for EP144 are:

- Traditional owners.
- Northern Land Council as the representative and agent of traditional Aboriginal owners in accordance with the Aboriginal Land Rights (Northern Territory) Act 19076 (Cth), whose functions in accordance with section 23 of the Act include ascertaining and expressing the wishes and opinions of Aboriginals living in the area as to the management of the land, to protect the interests of traditional Aboriginal owners and to consult with traditional Aboriginal owners with respect to any proposal relating to the use of that land.
- Pastoral Lease holders.

These are discussed in the following sections.

### 5.1.1 Traditional owner engagement

The Traditional Owners (TO's) of the work program area are represented by the Northern Land Council (NLC). All Minerals Australia contact with the TO's has consistently been through meetings arranged by the NLC. Representatives from Minerals Australia have attended all of the meetings where not restricted by Covid 19.

The initial meeting for EP144 was to approve the Exploration and Coexistence Deed negotiated by the NLC on behalf of the TO's. Under the Deed annual meetings are required to explain proposed exploration programs and to seek approval for those from the TO's. Prior to such meetings Minerals Australia submits a formal work program to the NLC containing details of all proposed exploration in EP144 for the year in question.

The most recent meeting was held in 2016 prior to the moratorium and enquiry into hydraulic fracturing and subsequent Covid 19 restrictions. The work program approved at that meeting is exactly the same as the work program subject to this EMP.

Details of meetings held are shown in Appendix P.

Prior to field work the NLC was contacted to nominate appropriate TO's to act as monitors during the surveys. Monitors were identified but could not commit to being available for the EcOz ecological field survey or archaeological survey. The AAPA Certificate process engaged the appropriate Site Custodians (Aboriginal elders responsible for sacred Sites in a particular area) in the Cultural Heritage assessment of the area.

The senior TO nominated agreed that monitors were not necessary for surveys along existing station roads.

### 5.1.2 Pastoral Lease Holder engagement

EP144 covers a number of pastoral properties on the Barkly Tableland. However, the work program applicable to this EMP is confined entirely to two pastoral leases over Alexandria and Mittiebah stations both

of which are owned by the North Australian Pastoral Company (NAPCO and/or subsidiaries) headquartered in Brisbane.

Minerals Australia has had frequent email contact with NAPCO to keep them informed of our planned activities, with information provided as per regulations 7(2) of the *Petroleum (Environment) Regulations 2016.* NAPCO have been kept informed of EMP field activities and consultants EcOz confirmed timing and duration of field activities with the station managers.

This agreement was modified by mutual agreement in December 2021 to extend its term to December 2023. The LACA was consequently accepted for registration by the Minister for Mining and Industry.

During the preparation of this EMP NAPCO was kept fully informed of planned field activities by EcOz and requested that EcOz contact station managers direct to notify their timing and activities.

Subsequently Minerals Australia provided NAPCO with a copy of the EcOz weed survey report for their use on the relevant properties.

A detailed list of all correspondence with NAPCO is shown in Appendix P.

# 5.2 EP154 stakeholders

EP154 is entirely over ALRA freehold land held by the Mangarrayi, Kewulyi, and Alawa 1 Aboriginal Land Trusts all of which are represented by the NLC. All Minerals Australia contact with the TO's has consistently been through meetings arranged by the NLC. Representatives from Minerals Australia have attended all of the meetings where not restricted by Covid 19.

No mineral tenements in EP154 are impacted.

The initial meeting for EP154 was held in 2012 at Minyerri to seek approval by the TO's for the NLC negotiate an Exploration and Coexistence Deed on behalf of the TO's. A second meeting was held in May 2013 to seek approval of the Deed negotiated by the NLC with the title holders. Significant sites surveys were completed by the NLC in 2013 (for tenements to be granted over ALRA land all significant sites in the application area must first be identified).

TO's also have the right to request areas from the EP application area be placed under moratorium. The grant of EP154 in 2015 thus excluded 51% of the original application area.

Under the Deed annual meetings are required to explain proposed exploration programs and to seek approval for those from the TO's. Prior to such meetings Minerals Australia submits a formal work program to the NLC containing details of all proposed exploration in EP154 for the year in question. The work program approved in 2016 and again in 2019 is exactly the same as the work program subject to this EMP.

Details of stakeholder engagement for EP154 are shown in Appendix P.

# 5.3 Future stakeholder engagement

Future stakeholder engagement will be to inform NAPCO about planned activities and provide them regular updates on the progress of those activities to ensure that there is minimal disruption to their cattle operations.

# 6 ENVIRONMENTAL IMPACTS AND RISKS ASSESSMENT

This section describes the approach and methods used to assess potential environmental risks and impacts associated with the project. The purpose of the assessment is to demonstrate that Minerals Australia have considered all potential environmental risks and impacts that may arise directly or indirectly from the project, and how these will be reduced to a level that is both ALARP and acceptable. Further, this assessment will be used to determine whether or not the project is likely to have a significant effect on the environment, and therefore require assessment under the *Environmental Protection Act 2019*.

The impact and risk assessment process considers the inherent risk posed to the environment by the regulated activity, and then identifies where additional measures are needed to reduce adverse impacts to a level acceptable to government regulators and the community. The outcomes of the assessment for each of the risks identified are documented in Section 6.4. These will inform DEPWS decision-making with respect to whether or not to approve this EMP and, if so, under what conditions.

# 6.1 Site selection

The purpose of EP144 and EP154 as granted is to permit the exploration for both conventional and unconventional hydrocarbons. Both permits cover known sedimentary basins and stratigraphy considered to be prospective for the occurrence of hydrocarbons.

The purpose of the proposed seismic program in EP154 is to confirm the local basin architecture and to define the potential of the formations within the region to contain unconventional and conventional gas and oil targets.

The purpose of the stratigraphic drilling in both EP144 and EP154 is to identify the sub-surface geology and any stratigraphic units which may have potential to host either conventional or unconventional hydrocarbons.

As such the justification for the survey is:

- It is consistent with the terms and intent of Exploration Permit.
- Its suitability as an exploration site due to the site's petroleum perspectivity.
- Current and future demand profiles for gas as an alternative to less greenhouse friendly energy sources; and
- Current and future demand for natural gas in the region.

The general principle of site selection was to avoid, where possible, or mitigate where required, any impact to ecological or cultural values. Initial site selection avoided National Parks, SoBS, SoCS and aimed to minimise creek crossings by locating sites higher in the landscape. As the areas being investigated are relatively flat, there is a network of watercourses and drainage lines crossing the landscape, all of which cannot be avoided.

Heritage and ecology survey work was performed to further identify values and, if required, relocation of sites to more suitable areas. The steps taken to avoid these values is outlined in Section 4.3.3.

The land clearing guidelines were considered during site selection, however the requirements of the seismic survey made it difficult for all the recommended buffers to be adopted. As there are several watercourses and drainage lines that cross throughout both EPs, these areas could not be totally avoided. Larger areas of clearing for drill pads and campsites have adopted the recommended buffers, and access tracks mostly utilise existing station tracks therefore no riparian vegetation will be impacted. Only seismic lines have the potential to impact on riparian vegetation, with mitigations adopted to minimise these impacts.

Figure 6-3 and Figure 6-4 show that even with the largest riparian buffer within the land clearing guidelines, which is only recommended for streams of level 5 and greater, the camps and drill holes relevant to the two EP areas are well outside the buffer zones.

Additionally, during the ecological field survey the watercourse crossings were assessed and it was found that of the 14 sites assessed 9 supported drainage line vegetation and only 5 were determined to support riparian vegetation, and this vegetation was considered narrow. Most crossings sites exhibited impacts from cattle and feral animals, with erosion present on the banks of 8 of the crossing sites.

The location of the 2D seismic lines will also move within the 2D seismic acquisition corridors to avoid areas such as archaeological artefacts, large trees, areas of erosion as well as to use the least sensitive path for water crossings and dune crossings. The 2D acquisition corridors are the planned seismic survey lines and any clearing required will be done by either grader or bulldozer. The corridors are a 4 m wide zone along each seismic line.

Existing access tracks were utilised to prevent the need to clear areas for new access tracks, and to minimise the overall disturbance footprint. Seismic lines will be used in some cases to access parts of the project area, and this helps to prevent additional access track from being formed and minimise the disturbance footprint.

Habitat for generalist species, such as the Grey Falcon, Crested Shrike-tit, Painted Honeyeater, Yellowspotted Monitor and Common Brushtail Possum, was unable to be avoided at the site selection phase, due to its presence across large parts of the EP areas. To minimise impacts to these species, mitigation strategies were developed to ensure the species were not significantly impacted. These mitigations are outlined in Section 7.1.

Species with specific habitat requirements, such as Gouldian Finch, Mertens' Water Monitor and Gulf Snapping Turtle were considered during site selection. Riparian habitat and watercourses were avoided by remaining high in the landscape where possible, and by crossing watercourses in the dry season when they will be dry. Additionally existing watercourse crossings will be used where possible, and a least impact path chosen where there is no existing crossing.

Further assessment of Mineral Australia's survey requirements has led to further reduction in the area required for the seismic work area (Figure 6-1). This change led to a reduction in the watercourse crossings from 14 to only four: three for seismic, one for access track (Table 6-1).



Path: Z:101 EcOz\_Documents104 EcOz Vantage GIS/EZ19193 - Hanoook - EMP EP154101 Project Files/Report Maps/Figure XX map showing changes seismic extent mxd

Figure 61. Map of changed project components and extents

Watercourse Crossing label	Stream order	Original proposal	Final footprint	GDE potential
WC1	3	Access track	Not required	
WC2	1	Access track	Not required	
WC3	1	Access track	Not required	
WC4	1	Seismic	Seismic	Low
WC5	2	Seismic	Not impacted, seismic line now starts 50 m from edge of riparian zone.	
WC6	1	Seismic	Not impacted, seismic line now starts 25 m from edge of riparian zone.	
WC7	2	Seismic	Seismic	Known
WC8	3	Seismic	Seismic	
WC9	4	Seismic	Not required	
WC10	3	Seismic	Not required	
WC11	1	Seismic	Not required	
WC12	3	Seismic	Not required	Known
WC13	1	Seismic	Not required	
WC14	2	Access track	Access track	

Table 6-1. Watercourse Crossings within the activity area: use, history and status

The retention of WC 7 within the seismic program and the intersection of the two seismic lines is critical for the success of the seismic campaign. The crossing of seismic lines (and the extent these lines) to understand the complex geology, without the crossing that the value of the seismic survey information will be significantly reduced.



Figure 6-2. Aerial view of seismic lines showing sparse vegetation and scolded soils



Path: 2101 EcOz\_Documents/04 EcOz Vantage GIS/E219191 - Hancock - EMP EP144/01 Project Files/Report maps/Figure X - land clearing guideline buffers.mxd

Figure 6-3. Map of Land clearing guideline buffers EP144



Path: Z101 Ec02\_Documents/04 Ec02 Vantage GIS/EZ10103 - Hancock - EMP EP154/01 Project Files/Report Maps/Figure XX Land clearing guideline buffers EP154.mxd

# 6.2 Assessment methodology

A risk assessment has been undertaken for both EP144 and 154. This involved assessing the likelihood and consequence of identified risks, the mitigation required, monitoring requirements and the residual risk rating. This assessment process is outlined below.

## 6.2.1 Impact analysis

The identification of potentially adverse impacts was informed by the regulated activity aspects outlined in Section 3 and the various technical studies prepared to support this EMP. The severity of each of the identified impacts (both direct and indirect), was assessed based on the categories relating to the scale, intensity and duration of the impact.

### 6.2.2 Risk assessment

For each potential environmental impact identified, the risk assessment considered the likelihood of the impact occurring and then the worst-possible consequence to the NT EPA environmental objectives. The consequence assessment was informed both by the outcomes of the impact severity analysis described in the previous section, and the importance/sensitivity of environmental values. The likelihood and consequence categories adopted in the environmental risk assessment are provided in Table 6-2 and Table 6-3. The likelihood and consequence ratings were combined to derive an overall risk rating using the matrix in Table 6-4.

#### Inherent risk

For each potential impact, an *inherent risk rating* was assigned by ranking the likelihood and consequence of the impact in the absence of any specific mitigation or management (i.e., it is a worst-case scenario). The inherent risk rating considered the project location and design, existing environmental conditions, impact sources and pathways, and the presence/absence of important and/or sensitive values and receptors.

#### Risk evaluation

Each inherent risk rating was evaluated with reference to the risk level and target action matrix in Table 6-5 to determine the level of mitigation and management attention required. Generally, the higher the inherent risk rating, the less tolerable/acceptable the risk is likely to be to stakeholders and regulators, and the greater the requirement for avoidance, mitigation and management.

#### Residual risk

Once all practicable mitigation and management measures were defined, each impact was re-assessed to assign a residual risk rating. The residual rating assigned to each impact reflects the level of risk that the particular element of the regulated activity poses to the environment (assuming effective implementation of the mitigation and management measures).

#### Level of scientific uncertainty

For each potential impact, any information gaps/uncertainties that preclude reliable assessment of risks, as well as any uncertainty about the effectiveness of proposed controls were identified. Each risk rating was assigned a level of certainty using the categories in Table 6-6.

Likelihood category	Description
Almost certain	The event/impact will occur or is expected to occur. The impact occurs regularly in association with similar projects and/or in similar environments.
Likely	The impact will probably occur in most circumstance but there is some uncertainty about the likelihood. The impact has occurred on more than one occasion in

Table 6-2.	Likelihood	categories	adopted in	risk assessment
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Likelihood category	Description
	association with similar projects and/or in similar environments.
Possible	The impact could occur in some circumstances. The impact has occurred infrequently on similar projects and/or in similar environments.
Unlikely	The impact is not expected to occur. The impact occurs very infrequently on similar projects and/or in similar environments.
Rare	The impact is very unlikely to occur. The impact has not occurred on similar projects and/or in similar environments.

#### Table 6-3. Consequence categories adopted in risk assessment

Consequence or severity of Impacts	Score	Terrestrial Flora & Fauna	Terrestrial Environmental Quality	Inland Water Environmental Quality	Hydrological processes	Social, Economic & Cultural Surrounds	Community Health & Safety
<ul> <li>A SEVERE impact has two or more of the following characteristics:</li> <li>Extensive</li> <li>High intensity</li> <li>Permanent – values will never recover.</li> </ul>	5	Impacts to terrestrial flora and fauna, extending beyond the EP area, that permanently alter biodiversity and/or ecological integrity.	Extensive soil disturbance, erosion or contamination that irreversibly alters the integrity of environmental values that rely on good soil quality, and/or significantly affects land- holder infrastructure.	Permanent major exceedance of water quality criteria for beneficial uses in a major watercourse or across multiple sub-catchments.	Catchment-wide reduction in surface water flow volumes and/or timing of flows/discharges that permanently alters the ecological health, land-uses and/or amenity. Drawdown of groundwater in a regional scale aquifer that permanently alters ecological health, land-uses and/or amenity.	Permanent impact that is felt by the majority of the regional population. Unauthorised destruction of Aboriginal Sacred Sites and/or heritage sites.	One or more fatalities. More than 1 people injured with permanent disabilities.
<ul> <li>A MAJOR impact has two or more of the following characteristics:</li> <li>Widespread</li> <li>Moderate to high intensity</li> <li>Long-term – felt for many years.</li> </ul>	4	Impacts to terrestrial flora and fauna, over a large proportion of the EP area, that alter biodiversity and/or ecological integrity for many years.	Widespread soil disturbance, erosion or contamination that compromises environmental values that rely on good soil quality, and/or affects some land-holder infrastructure.	Long-term major exceedance of water quality criteria for beneficial uses in a major watercourse Or Long-term minor exceedance of water quality criteria for beneficial uses across multiple sub- catchments	Reduction in surface water flow volumes, groundwater levels and/or timing of flows/discharges that compromises ecological health, land-uses and/or amenity for many years. Drawdown of groundwater in a regional scale aquifer that compromises ecological health, land-uses and/or amenity for many years.	Long-term impact that is felt by some of the regional population. Unauthorised damage/desecration of Aboriginal Sacred Sites and/or heritage sites such that site integrity is lost.	No fatalities. One injury with permanent disability. More than 10 injuries requiring hospitalisation.
A <b>MODERATE</b> impact has two or more of the following characteristics: • Localised • Low intensity • Medium-term – felt for months.	3	Impacts to terrestrial flora and fauna, extending a short distance beyond the disturbance footprint that alters the quality, abundance or distribution of environmental values in the medium-term, but has no measurable impact to biodiversity and/or ecological integrity.	Localised soil disturbance, erosion or contamination that alters soil characteristics but with no measurable impact to environmental values that rely on good soil quality.	Minor medium-term exceedances of water quality criteria for beneficial uses within a single sub-catchment.	Localised reduction in surface water flow volumes, and/or timing of flows/discharges with no impact on ecological health, land-uses and/or amenity. Localised drawdown of groundwater that alters ecological health, land-uses and/or amenity in the medium-term.	Medium-term impact, or one that is felt by a small number of people. Unauthorised entry to a Restricted Works established for protection of Aboriginal Sacred Sites but with no physical impact to the site. Unauthorised access to protected heritage sites but with no physical impact to the site.	No fatalities. No permanent disability. 5-10 injuries requiring hospitalisation.
<ul> <li>A MINOR impact has two or more of the following characteristics:</li> <li><i>Limited</i></li> <li><i>Very low intensity</i></li> <li><i>Short-term</i> – felt for days or a few weeks only.</li> </ul>	2	Impacts to terrestrial flora and fauna, limited to within the immediate disturbance footprint, and that does not noticeably alter the quality, distribution or abundance of environmental values, or does so only in the short-term.	Short-term and/or limited soil disturbance, erosion or contamination that is reversible without requiring significant remedial works.	Minor short-term exceedances of water quality criteria for beneficial uses within a single drainage line.	Limited reduction in surface water flow volumes, groundwater levels and/or timing of flows/discharges in the immediate sub- catchment area with no impact on ecological health, land-uses and/or amenity. Limited drawdown of groundwater that recovers rapidly, and/or does not alter ecological health, land-uses and/or amenity.	Short-term disruption/ nuisance that is felt by a small number of people. No impact to Aboriginal Sacred Sites and/or heritage sites.	No fatalities. No permanent disability. Less than 5 injuries requiring hospitalisation.
An <b>INSIGNIFICANT</b> impact has no noticeable or measurable impact to values.	1	No measurable impact to terrestrial flora and fauna.	No measurable soil disturbance, erosion or contamination	No measurable exceedance of pre-development water quality conditions.	No measurable change to hydrological regimes	No noticeable impact to stakeholder and/or community values. No impact to Aboriginal Sacred Sites and/or heritage sites.	No fatalities. No permanent disability. No injuries requiring hospitalisation.

		CONSEQUENCE						
			1	2	3	4	5	
			Insignificant	Minor	Moderate	Major	Severe	
	Е	Almost Certain	Moderate (11)	High (16)	High (20)	Very High (23)	Very High (25)	
0	D	Likely	Low (7)	Moderate (12)	High (17)	Very High (21)	Very High (24)	
ELIHO	С	Possible	Low (4)	Moderate (8)	High (13)	High (18)	Very High (22)	
LK	В	Unlikely	Low (2)	Low (5)	Moderate (9)	High (14)	High (19)	
	Α	Rare	Low (1)	Low (3)	Low (6)	Moderate (10)	High (15)	

#### Table 6-4. Risk matrix adopted in risk assessment

#### Table 6-5. Risk level and target action matrix used to evaluate risks

Risk level	Target action	
Very High	Risk is unacceptable. Specific action plans required to reduce risk to an acceptable level. Director/CEO level management attention required.	
High	Risk is generally unacceptable without action. Specific action plans required to reduce risk to 'as low as reasonably practicable' (ALARP). Senior management attention required.	
Medium	Risk is generally acceptable. Proactive action is required to reduce risk to ALARP. Requires routine monitoring and adaptive management in accordance with Environmental Management Plan (EMP). Line management attention is required.	
Low	Risk is acceptable. Management by routine policies and procedures.	

#### Table 6-6. Level of scientific uncertainty categories used to evaluate reliability of risk assessment

Category	Description
Low (1)	<ul> <li>Comprehensive data with strong evidence in multiple peer reviewed data</li> <li>Little disagreement between authors or experts</li> <li>Considerable and consistent on-ground experience and/or monitoring</li> </ul>
Medium (2)	<ul> <li>Some or incomplete data available</li> <li>Evidence provided based on a small number of references</li> <li>Authors or experts' conclusions vary</li> <li>Limited on-ground experience and/or monitoring</li> </ul>
High (3)	<ul> <li>Scarce or no data available; evidence provided in unpublished reports</li> <li>Few on-ground observations</li> <li>Authors and experts' conclusions vary considerably</li> </ul>

## 6.2.3 Residual impact or risk

For each environmental factor, residual risk ratings assigned through the risk assessment process were used as the basis for identifying residual impacts. These were considered in relation to the sensitivity/importance of the environmental values that are present.

## 6.2.4 ALARP and Acceptable

Section 6.5 considers the outcome of the risk assessment process and the hierarchy of controls (eliminate, substitute, engineering, administrative, personal protective equipment) to determine if all reasonably practicable control measures have been identified and implemented and that the risk to environmental factors has been reduced to ALARP as result of the proposed mitigation activities.

# 6.3 Cumulative risk assessment

In accordance with Section 3b of the *NT Petroleum (Environment) Regulations* the cumulative impacts of a project need to be assessed. A search of publicly available information has established the cumulative impacts of this and other projects.

Cumulative impacts are associated with groundwater extraction, flora and fauna, greenhouse gas generation, traffic, and social impacts. Irrespective of future production, the nature and scale of this activity will have negligible impact.

Table 6-7 provides a summary of the cumulative impacts associated with the project activities and takes into account other EMPs in the region.

Aspect	Summary
Groundwater extraction	The use of groundwater for the exploration programs is not expected to impact on other current and future water users due to the remote location and the minimal amount expected to be used.
Flora and fauna	Minerals Australia have planned access using existing access tracks, and seismic lines. Clearing is not expected to be required for existing tracks.
	A proposed total of approximately 20.45 ha has the potential to be disturbed or cleared for both EP144 and EP154, as access tracks mostly exist and have not been included in this amount. Current approved EMPs for petroleum activities equate to approximately 900 ha of clearing. Based on the size of the area these activities are located across, which covers thousands of square kilometres, this is very small proportional impact, particularly as typically these areas do not require complete clearing.
	Clearing for the 2D seismic lines is proposed under this EMP and cleared areas will utilise a blade up approach leaving groundcover intact as much as possible. This approach minimises the impact to the native flora and fauna by meandering around heavily wooded areas or large trees. This will also aid in rehabilitation success.
	Impacts associated with weed introduction are managed through the weed management plan.
	All other petroleum operators and pastoralists are required to have a weed management plan, and all visitors must sign a Weed Declaration which certifies equipment and machinery are weed free.
Greenhouse gases	The cumulative emissions from the proposed exploration activities are considered minor given that materials transported to site will be kept as minimal as possible and machinery will be sourced locally where available. Also, the majority of the clearing will be rehabilitated immediately after the 2D seismic survey program is complete.
Traffic	Impacts of traffic are anticipated to be minor considering the low traffic volumes associated with the project, and they will not significantly alter traffic volumes on

#### Table 6-7. Summary of cumulative impacts

	nearby roads.
Social	The 2D seismic survey activities are located in a remote area on private pastoral leases and accommodation will be onsite or at local accommodation at Flying Fox Station.
	Given the projects small footprint and temporary nature, cumulative impacts to social aspects and the local community are expected to be negligible.

# 6.4 Risk assessment

This section presents risks identified and mitigation measures relevant to both EP144 and EP154.

## 6.4.1 Impacts and risk mitigation

A total of 34 risks were identified for both EP144 and EP154 within Appendix E. Of those risks there are a total of five moderate and 29 low residual risk ratings. The five moderate residual risks are related to clearing of habitat, spills, direct impact or mortality of fauna, and fire. The outcome of the risk assessment process is documented in Section 7.1, with the full risk assessment outlined in Appendix E.

## 6.4.2 Measurement criteria

Measurement criteria are documented in Section 7.1, with the full risk assessment outlined in Appendix E.

# **7 IMPLEMENTATION STRATEGY**

This section outlines the systems, practices, and procedures that Minerals Australia will put in place to manage the environmental risks of the exploration works programme informed by risks identified in Section 6.

# 7.1 Environmental outcomes and performance standards

Minerals Australia is committed to ensuring that the drilling and 2D Seismic Exploration activities are conducted in a manner that minimises impacts to the environment. Minerals Australia's performance against its environmental goals and objectives is measured by setting environmental outcomes and environmental performance standards (Appendix E). The following summary tables detail risk mitigation measures, ALARP rationales, environmental outcomes, performance measures, monitoring and records, reporting and responsibility. Impacts from the Risk Assessment have been grouped for succinctness.

Table 7-	1 Habitat	loss and	flora and f	iauna or	vironmental	outcomes	and	norformanco	etandarde
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Habitat loss and flora and fauna				
Environmental outcome	<ul> <li>No permanent removal of habitat for threatened species.</li> </ul>			
ALARP rationale	<ul> <li>Selective clearing will ensure that the minimum area of vegetation will be cleared to complete the activities.</li> <li>Clearing is unavoidable in some areas and methodology design limits impacts on threatened species and their habitats.</li> </ul>			
Mitigation measures	<ul> <li>Avoid clearing all large trees, notably:         <ul> <li>Corymbia and Eucalypt species with a trunk diameter &gt;25 cm at 1.3m above ground level will be avoided to minimise any potential impacts to breeding habitat for EPBC-listed Gouldian Finches, and other species.</li> <li>All large old hollow bearing trees along the waterways (e.g., Coolibah) or woodland environments will be avoided.</li> </ul> </li> <li>Rebabilitation undertaken progressively following completion of works.</li> </ul>			
	<ul> <li>If an active Grey Falcon nest (or suspected nest) is encountered, a minimum buffer of 300 m should be maintained around the active nest to reduce disturbance and potential impacts.</li> <li>Site selection has adopted recommended buffers from the Land Clearing Guidelines where possible, with this guiding campsite and well pad locations, and seismic lines will be micro-sited as required to minimise impacts on riparian areas.</li> <li>In the section of seismic line number 3 between Hodgson Downs Road and the southern end of seismic line 4 an experienced field technician will precede the seismic team flagging a path to further reduce impacts to this important area.</li> </ul>			
Environmental Performance Standard (Performance Measure)	<ul> <li>No project activity outside the approved areas.</li> <li>No clearing of large i.e., trees with trunk diameter &gt;25 cm at 1.3 m above ground level.</li> <li>Impact on &lt; 10% of shrubs on seismic line 3 alongside Blackwater creek</li> <li>Rehabilitation undertaken progressively following completion of works</li> </ul>			
Measurement criteria (monitoring and records)	<ul> <li>Number of shrubs impacted in seismic line 3 alongside Blackwater creek.</li> <li>Area used for activity within approved footprint by:         <ul> <li>Ensuring GPS tracks of vehicles are within approved area.</li> </ul> </li> <li>Extent of seismic line rehabilitated</li> </ul>			
Reporting	<ul> <li>Annual environmental performance report will be submitted to DEPWS outlining:         <ul> <li>Report (with photos) of all shrubs impacted between in seismic line 3 alongside Blackwater Creek</li> <li>Activity extent including vehicle GPS tracks</li> <li>Reinstatement activity</li> </ul> </li> </ul>			

	Habitat loss and flora and fauna
	<ul> <li>As per Clause A.3.5, Minerals Australia will provide records of the nature, location and extent of disturbance of flora and fauna including geospatial information depicting areas cleared to the Minister</li> </ul>
Responsibility	Project Manager

#### Table 7-2. Erosion environmental outcomes and performance standards

	Erosion				
Environmental outcome	No impacts to soil integrity and quality caused by erosion from the project				
ALARP rationale	<ul> <li>Minimal clearing will ensure that the minimum area of vegetation will be cleared to complete the activities. Light machinery will lessen the impact on the areas that are cleared, and rehabilitation efforts will ensure cleared locations return to pre-clearing status.</li> <li>Implementing an ESCP developed by a suitably qualified professional that outlines industry standard controls will ensure risks are limited to ALARP.</li> <li>Watercourse crossings will only be used when dry to minimise erosion and impacts to soil.</li> </ul>				
Mitigation measures	<ul> <li>Development and implementation of an Erosion and Sediment control plan (ESCP) (Appendix F and Appendix G)</li> <li>Site selection has adopted recommended buffers from the Land Clearing Guidelines where possible, with this guiding campsite and well pad locations, and seismic lines will be micro-sited as required to minimise impacts on riparian areas</li> <li>Use existing roads, access tracks and seismic lines.</li> <li>Conduct any clearing during the dry season.</li> <li>Clearing only in small areas that are impassable, generally due to acacia thickets but still avoiding trees.</li> <li>Using lighter machinery such as graders or smaller bulldozers, taking care not to overwork tracks.</li> <li>Rehabilitation and stabilisation of disturbed areas as per the Rehabilitation plan (Appendix O).</li> <li>Works will cease if there is a forecast for 50mm of rain or more within the next 48 hours.</li> <li>Minimise number of creek/drainage line crossings to reduce erosion management.</li> <li>Well pads are unlikely to be inundated by 1 in 100 year flooding as modelling indicates the locations are outside of the flood extent, the well pads will only be present on site for a short period and works will be completed mostly in the dry season, with only a chance of extending into the wet season. If works continue into the wet season bunding of well pads will occur (Appendix Q and Appendix R)</li> </ul>				
Environmental Performance Standard (Performance Measure)	<ul> <li>No soil erosion and discharge of sediment or soil into waterways or established drainage systems.</li> <li>No new instances of erosion and sedimentation</li> <li>Erosion and sediment controls established</li> </ul>				
Measurement criteria (monitoring and records)	<ul> <li>ESCP implemented prior to commencement of the activity</li> <li>Monthly visual inspection and monitoring of existing tracks, seismic lines and water waterway crossings conditions. These will occur:         <ul> <li>During siting of seismic lines and drill pads (baseline assessment)</li> <li>After completion of a key phases of activity, such as construction of drilling/camp infrastructure, seismic line completion, completion of drilling and following the removal of site infrastructure.</li> <li>After the wet season to look for signs of erosion</li> <li>Annually (post wet) for up to 5 years.</li> </ul> </li> <li>Routine visual inspections of the creek and drainage line crossings. These will occur weekly or following a rainfall event (i.e. greater than 20 mm in a 24-hour</li> </ul>				

Erosion			
	period)		
Reporting	<ul> <li>Annual environmental performance report will be submitted to DEPWS including:         <ul> <li>Monthly track inspection reports</li> <li>ESCP schedule</li> <li>Creek and drainage line inspections</li> </ul> </li> </ul>		
Responsibility	Project Manager		

## Table 7-3. Fauna deaths environmental outcomes and performance standards

Fauna deaths				
Environmental outcome	No fauna injury or deaths			
ALARP rationale	<ul> <li>Limited vegetation clearing</li> <li>Fencing of ponds will reasonably limit fauna access to the area</li> </ul>			
Mitigation measures	<ul> <li>Clearing will be conducted in a single direction, allowing any fauna to move out of way of clearing activities.</li> <li>If fauna are spotted in immediate clearing area and are in danger, clearing will be stopped until safe to continue.</li> <li>Vehicle movement will be restricted to existing access tracks and 2D seismic lines.</li> <li>Common terrain or vegetation types will be favoured for access tracks because they will generally have lower habitat significance.</li> <li>Vehicle speed restrictions apply when travelling in permit (60 km/hr on station access tracks and signed limit on gazetted roads) or drive to conditions.</li> <li>Ensure site environmental inductions for all site personnel and contractors include the management of onsite vegetation and flora, including site personnel to stay within designated access roads and work areas.</li> <li>Drilling sumps will be appropriately fenced to prevent wildlife access Sumps will be inspected daily, and fence repaired as needed</li> </ul>			
Environmental Performance Standard (Performance Measure)	No injury or deaths to fauna			
Measurement criteria (monitoring and records)	<ul> <li>Monitoring of vehicle speeds.</li> <li>Record any fauna encounters, injuries or death as result of the activities on fauna register for the duration of works.</li> <li>Daily inspection of sumps and fencing.</li> <li>Induction records</li> </ul>			
Reporting	Annual environmental performance report will be submitted to DEPWS to include: <ul> <li>Any records of vehicles driving above speed limits</li> <li>Sump inspection and non-compliances</li> <li>Induction records</li> </ul>			
Responsibility	Project Manager			

Disturbance or damage to sacred sites or heritage	
Environmental outcome	<ul> <li>No significant impact to Indigenous or non-Indigenous artefacts, Sacred Sites or non-Indigenous heritage sites.</li> </ul>
ALARP rationale	<ul> <li>Risk is as low as possible as</li> <li>surveys have been conducted concluding no significant heritage values within the proposed footprint</li> <li>AAPA Certificate granted and the relevant stakeholders have been consulted</li> <li>All works will be done within the approved footprint.</li> <li>Operational staff will be trained in heritage identification during induction</li> </ul>
Mitigation measures	<ul> <li>Ensure all work is performed within the approved project footprint.</li> <li>Consultation with NLC in works Program meetings and ongoing engagement in relation to the Activity including annual updates</li> <li>All employees will undertake an induction that will include: <ul> <li>importance of staying within approved boundaries</li> <li>Any potential cultural heritage items that may be encountered and any No-Go Zones.</li> </ul> </li> <li>A stop works will be implemented if artefacts are located during activities on site.</li> <li>The Project Manager will be notified immediately, who will then liaise with the NT Heritage Branch, for further instructions.</li> <li>Recommendations of the Archaeological Surveys have been adopted, with campsites and seismic lines moved where required (see Table 4-15 and Table 4-16).</li> </ul>
Environmental Performance Standard (Performance Measure)	<ul> <li>No non-compliances with Native Title Holder Exploration and AAPA certificate conditions including:         <ul> <li>Project area</li> </ul> </li> <li>All staff inducted</li> </ul>
Measurement criteria (monitoring and records)	<ul> <li>Area used for activity within approved footprint by:         <ul> <li>Ensuring GPS tracks of vehicles are within approved area</li> </ul> </li> <li>Induction records showing that all personnel have had a site induction.</li> <li>Records of any on-country meetings</li> </ul>
Reporting	<ul> <li>Reporting to NT Heritage Branch if new finds are made.</li> <li>Annual environmental performance report will be submitted to DEPWS to include:         <ul> <li>Inductions</li> <li>Footprint used/activity area</li> <li>Number of on-country meetings</li> </ul> </li> </ul>
Responsibility	Project Manager

## Table 7-4. Sacred site and heritage environmental outcomes and performance standards

Dust pollution	
Environmental outcome	No dust disturbance to people and communities
ALARP rationale	• Industry standards for dust management has been adopted. Based on the remote location of the works these dust management methods should prevent any dust impacts on surrounding stakeholders/communities.
Mitigation measures	<ul> <li>Use existing road and tracks and ensure tracks are suitable for the intended purpose and volume of traffic required.</li> <li>Site environmental inductions for all site personnel and contractors in relation to reduction of dust through driving techniques</li> <li>Vehicle speed restrictions apply when travelling in permit (60 km/hr on station access tracks and signed limit on gazetted roads) or drive to conditions.</li> <li>Disturbed areas will be stabilised in accordance with the Rehabilitation Plan.</li> <li>Use water truck where applicable to manage dust emissions from vehicle movement on the site</li> </ul>
Environmental Performance Standard (Performance Measure)	<ul> <li>All disturbed seismic lines reinstated to promote revegetation.</li> <li>Dust plumes won't affect people and communities.</li> </ul>
Measurement criteria (monitoring and records)	<ul> <li>Rehabilitation completed as per the Rehabilitation Management Plan</li> <li>Number of complaints regarding nuisance dust during works.</li> </ul>
Reporting	<ul> <li>Annual environmental performance report will be submitted to DEPWS reporting on:         <ul> <li>Any dust complaints</li> <li>Reinstatement activities</li> </ul> </li> </ul>
Responsibility	Project Manager

## Table 7-5. Dust pollution environmental outcomes and performance standards

Noise pollution	
Environmental outcome	<ul> <li>No significant impacts to people or stock as a result of the activity.</li> </ul>
ALARP rationale	<ul> <li>Remote location</li> <li>Vehicles well maintained and speed will be limited when within proximity to people and communities.</li> </ul>
Mitigation measures	<ul> <li>Slow vehicles when passing cattle, people or sensitive receptors (administrative).</li> <li>Provide at least two weeks notification to households and businesses if operations are to be conducted within 10 km of their premises.</li> <li>All nuisance-related complaints from sensitive receptors investigated and reported upon.</li> <li>Ensure site environmental inductions for all site personnel and contractors include noise, vibration and light emissions requirements.</li> <li>Ensure vehicles, machinery and equipment is maintained in good working order.</li> <li>Daily and ongoing consultation with station managers and station personnel</li> </ul>
Environmental Performance Standard (Performance Measure)	<ul> <li>No significant nuisance noise levels on surrounding communities.</li> <li>No disruption to fauna and stock.</li> </ul>
Measurement criteria (monitoring and records)	Number of complaints
Reporting	<ul> <li>Complaints register identifying:         <ul> <li>How complaints resolved and corrective actions taken</li> </ul> </li> <li>Annual environmental performance report will be submitted to DEPWS including:         <ul> <li>Register of complaints</li> </ul> </li> </ul>
Responsibility	Project Manager

Table 7-6. Noise pollution environmenta	l outcomes and performance standards
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Greenhouse gas emissions	
Environmental outcome	Minimise greenhouse gas emissions.
ALARP rationale	<ul> <li>Clearing has been minimised to the smallest areas possible to complete the activity</li> <li>Vehicle emissions minimised.</li> </ul>
Mitigation measures	<ul> <li>Clearing only in small areas that are impassable, generally due to acacia thickets but still avoiding trees.</li> <li>Progressively rehabilitating cleared areas once works have been completed.</li> <li>All vehicles and equipment used on site will be well maintained to minimise emissions.</li> </ul>
Environmental Performance Standard (Performance Measure)	<ul> <li>Activity within approved footprint only.</li> <li>All clearing in approved areas, no unnecessary clearing.</li> <li>All vehicles serviced appropriately.</li> </ul>
Measurement criteria (monitoring and records)	<ul> <li>All vehicle service records current.</li> <li>Activity audits show project activity within approved areas.</li> </ul>
Reporting	<ul> <li>Annual environmental performance report will be submitted to DEPWS including:         <ul> <li>Vehicle service history.</li> </ul> </li> </ul>
Responsibility	Project Manager

Table 7-7 Greenhouse gas emissions environmental outcomes and	nerformance standards
Table 7-7. Oreenhouse gas emissions environmental outcomes and	periormanee standards

Introduction or spread of weeds and pests	
Environmental outcome	<ul> <li>No introduction of new or spread of existing weeds within the project area.</li> <li>No introduction of new or spread of existing pest species within the project area.</li> </ul>
ALARP rationale	<ul> <li>Weed management plan is in place and is guided by the Regional Weed management plan for Alice Springs. This management plan outlines standard practice management techniques for the NT, that are proven.</li> <li>Visual inspections are standard practice for identifying pests on vehicles and plant.</li> </ul>
Mitigation measures	<ul> <li>A Weed Management Plan will be implemented (Appendix H and Appendix I).</li> <li>All machinery and equipment to be certified weed free by a suitably qualified person prior to arrival at site.</li> <li>Control of declared weeds on-site as per the NT Weeds Management Act.</li> <li>All weeds removed will be disposed of appropriately to ensure no further spread of weeds.</li> <li>Identification of any declared weed will be reported to the Weeds Branch in accordance with the NT Weeds Management Act.</li> <li>All waste will be covered or contained within dedicated waste disposal bins that cannot be tampered with or opened by fauna, to reduce attraction of the site from feral animal and pest species.</li> <li>Staff will be informed of their duties regarding feral animals and will not encourage or entice them on site.</li> <li>All rubbish, including food packaging, is to be disposed of in an appropriate container as soon as possible, to be transported off site.</li> </ul>
Environmental Performance Standard (Performance Measure)	<ul> <li>No new weeds introduced into the area.</li> <li>No existing weeds spread.</li> <li>Rubbish managed appropriately.</li> </ul>
Measurement criteria (monitoring and records)	<ul> <li>All vehicles certified as weed and pest free prior to arrival on-site.</li> <li>Weed distribution not increased due to activity.</li> <li>Site audits showing wastes managed appropriately</li> </ul>
Reporting	<ul> <li>Annual environmental performance report will be submitted to DEPWS including:         <ul> <li>Weed certificates for all vehicles</li> <li>Locations of weed hygiene sites</li> <li>Records of plant and machinery inspections available</li> <li>Post wet-season weed survey will be conducted of seismic lines and access tracks</li> <li>Staff induction records</li> <li>Site audits including waste management</li> </ul> </li> </ul>
Responsibility	

	Vibration pollution	
Environmental outcome	No significant impacts to the community or stock from vibration	
ALARP rationale	<ul> <li>Remote location</li> <li>Landholders will be able to ensure cattle are located away from work area.</li> <li>Vehicles well maintained and speed will be limited when within proximity to receptors.</li> <li>Wildlife will be able to avoid the area of influence due to progressive work activities.</li> </ul>	
Mitigation measures	<ul> <li>Ensure operating hours for drilling and 2D seismic line operation are established and communicated to personnel and contractors.</li> <li>Consult with pastoral landholders and take into consideration stock movements.</li> <li>Provide at least 2 weeks notification to households and businesses if operations are to be conducted within 10km of the premises.</li> <li>All nuisance related complaints to be investigated and acted upon.</li> <li>Ensure site inductions for all site personnel include vibration requirements.</li> <li>Ensure vehicles, plant and equipment are maintained and in good order.</li> <li>Ongoing consultation with pastoral station manager and other relevant parties.</li> </ul>	
Environmental Performance Standard (Performance Measure)	No concerns from the community on vibration affecting people or stock.	
Measurement criteria (monitoring and records)	<ul> <li>Number of complaints</li> <li>Staff inductions</li> </ul>	
Reporting	<ul> <li>Complaints register identifying:         <ul> <li>Date and summary of issue</li> <li>How complaints were resolved and corrective actions taken</li> </ul> </li> <li>Annual environmental performance report will be submitted to DEPWS including:         <ul> <li>Register of complaints</li> </ul> </li> </ul>	
Responsibility	Project Manager	

# Table 7-9. Vibration pollution environmental outcomes and performance standards

# Table 7-10. Groundwater and soils contamination environmental outcomes and performance standards

Groundwater and soil contamination from spills	
Environmental outcome	No adverse impacts on soil, surface water or groundwater caused by hazardous substances utilised during the activity
ALARP rationale	<ul> <li>Chemicals and hazardous materials will be stored and per industry best practice.</li> <li>Appropriate spill kits and spill response procedures and materials will be available on site minimising the risk consequence</li> </ul>
Mitigation measures	<ul> <li>Designated waste storage will be located away from sensitive areas such as waterways or drainage lines <ul> <li>All loading, unloading and refuelling operations will take place in designated areas, with portable bunding and away from sensitive areas.</li> </ul> </li> <li>During the wet season, the transport of chemicals and wastewater on unsealed roads will be avoided if possible. If required, roads will be surveyed to ensure it meets the below criteria prior to transport: <ul> <li>Track is traversable and has not been impacted by increased rainfall, such as;</li> <li>There are no washouts along the track.</li> <li>There are no bogs or ponding water.</li> </ul> </li> <li>Personnel are familiar with spill response procedures and the appropriate spill response materials are available.</li> </ul>
	<ul> <li>Use, storage and handling of fuel, chemicals and oils on site:</li> <li>must comply with WHS legislation</li> <li>be in accordance with their approved safety data sheet</li> <li>must be stored to prevent release to the environment and to contain any spills</li> <li>liquid hydrocarbons, whether separated or mixed with other fluids at a concentration greater than 1% by volume, must not be stored in any open top structure or pit</li> </ul>
	<ul> <li>Any hazardous chemicals or those that may cause environmental harm are to be stored within secondary containment.</li> <li>Secondary containment must meet all of the following: <ul> <li>sufficient capacity to hold 100% of the volume of the largest container stored in the area plus 10%, unless the container is equipped with individual secondary containment</li> <li>permeability able to contain materials or waste until it can be removed or treated</li> <li>provide for separation of clean and dirty water</li> </ul> </li> </ul>
	<ul> <li>be compatible with the material or waste stored or used within the containment</li> <li>be resistant to physical, chemical and other failure during handling, installation and use</li> <li>be maintained in good order at all times</li> <li>secondary containment requirements can be met with double-lined or double-walled storage tanks.</li> </ul>
	<ul> <li>All secondary containment (when in use) shall be inspected weekly, unless being operated through the wet season during which they should be monitored daily. If the secondary containment is damaged or compromised, repairs must be carried out as soon as practicable.</li> <li>Materials that escape from primary containment or are otherwise spilled onto secondary containment shall be removed as soon as possible.</li> <li>In the event of a spill all contaminated material will be collected and disposed of via a licensed waste facility</li> <li>In spection reports and maintenance records of secondary containment shall be kept.</li> <li>In the event of a spill all contaminated material will be collected and disposed of via a licensed waste facility</li> </ul>

Groundwater and soil contamination from spills	
	<ul> <li>A spills management plan has been developed that outlines spill prevention, response procedure and spill clean-up processes (Appendix M).</li> <li>Materials that escape from primary containment or are otherwise spilled onto secondary containment shall be removed as soon as possible.</li> </ul>
Environmental Performance Standard (Performance Measure)	<ul> <li>No releases of contaminants</li> <li>No releases of contaminants during transport</li> </ul>
Measurement criteria (monitoring and records)	<ul> <li>Number of spills of chemicals or hydrocarbons.</li> <li>Spill response records</li> <li>Daily inspection of fuel and chemical storage areas, including containment areas and structures, containers and spill kits</li> <li>Staff inductions</li> </ul>
Reporting	<ul> <li>Spills reporting as needed</li> <li>Audits of fuel/chemical storage areas</li> <li>Staff inductions</li> <li>Annual environmental performance report will be submitted to DEPWS showing above records</li> </ul>
Responsibility	Project Manager

# Table 7-11. Light pollution environmental outcomes and performance standards

Light pollution	
Environmental outcome	No significant impacts to the community as a result of the activity.
ALARP rationale	<ul> <li>Remote location</li> <li>Lighting will only be utilised when absolutely necessary, and when used will be directional and used for the minimum time required.</li> <li>Landholders will be able to ensure cattle are located away from work fronts</li> </ul>
Mitigation measures	<ul> <li>Ensure site environmental inductions for all site personnel and contractors include light emissions requirements.</li> <li>Use directional lighting to limit light spread and emissions outside of the zone required.</li> <li>Lights will be turned off when no longer required, once activity has been completed.</li> </ul>
Environmental Performance Standard (Performance Measure)	<ul> <li>No nuisance light on surrounding communities, exploration workers, fauna and stock.</li> </ul>
Measurement criteria (monitoring and records)	Number of complaints
Reporting	<ul> <li>Complaints register identifying:         <ul> <li>Date and summary of issue</li> <li>How complaints were resolved and corrective actions taken</li> </ul> </li> <li>Annual environmental performance report will be submitted to DEPWS including:         <ul> <li>Register of complaints</li> </ul> </li> </ul>
Responsibility	Project Manager

#### Table 7-12. Waste and wastewater, including drilling fluids, environmental outcomes and performance standards

Management of waste and wastewater including drilling fluids	
Environmental outcome	No adverse impacts on soil, surface water or groundwater caused by wastewater management.
ALARP rationale	<ul> <li>All waste will be collected, treated and disposed of correctly. This reduces the risk to ALARP as there are no further actions that can be taken to reduce risk.</li> <li>The Code of Practice requires storages of wastewater to meet the 0.1% AEP freeboard requirement. This indicates that industry standard for wastewater management and storage have been adopted, limiting the risk.</li> <li>Drilling sumps and cuttings pits will be designed, constructed and operated with sufficient freeboard to prevent overtopping in a 1 in 1000 rainfall event.</li> </ul>
Mitigation measures	<ul> <li>A Waste Management Plan will be implemented (Appendix L).</li> <li>Designated waste storage area will be located away from sensitive receptors such as waterways or drainage lines</li> <li>During the wet season, the transport of chemicals and wastewater on unsealed roads will be avoided if possible. If required, roads will be scouted to check it meets the below criteria prior to transport: <ul> <li>Track is traversable and has not been impacted by increased rainfall, such as;</li> </ul> </li> </ul>
	<ul> <li>There are no washouts along the track.</li> <li>There are no bogs or ponding water.</li> <li>Personnel are familiar with spill response procedures and the appropriate spill response materials are available.</li> </ul>
	<ul> <li>Wastewater will be treated to the required environmental guidelines for advanced secondary effluent (Class "B")</li> <li>Removal and disposal of hazardous wastes to be in accordance with NT hazardous waste disposal requirements.</li> <li>Sufficient waste receptacles will be provided on site and any work areas.</li> <li>Waste will be segregated for ease of disposal.</li> <li>All staff to be informed of the waste management plan and regular inspections will ensure compliance.</li> <li>A Well Operations Management Plan (WOMP) will be developed to cover well activities. The Project will not commence until a WOMP has been approved</li> <li>Drilling sumps and cuttings pits will be designed, constructed and operated with sufficient freeboard to prevent overtopping in a 1 in 1000 rainfall event. Freeboard levels to be maintained are: <ul> <li>EP144 - 0.5 m in dry season and 0.65 m in wet season</li> <li>EP154 - 0.5 m in dry season and 1.2 m in wet season</li> <li>EP154 - 0.5 m in dry season and 1.2 m in wet season</li> <li>EP154 - 0.5 m in dry season and flow.</li> </ul> </li> <li>Drilling sumps and cuttings pits will be designed and constructed with 0.5 m high bunds to prevent water entry from overland flow.</li> <li>Drilling sumps and cuttings pits will be inspected daily to check integrity.</li> <li>For stratigraphic drilling chemicals to be used they must have been approved for use in drilling petroleum wells by the Commonwealth Government, Department of Health and listed on the Australian Inventory of Chemical Substances which is maintained under the National Industrial Chemicals Notification and Assessment Scheme. No drilling fluid additives that are used in the process contain benzene, toluene, ethylbenzene or xylene. Appendix M outlines the drilling chemicals that will be used.</li> </ul>
Environmental Performance Standard (Performance Measure)	<ul> <li>No releases of wastewater during transport.</li> <li>All wastewater treated to the required effluent class.</li> <li>No exceedance of freeboard in sumps.</li> <li>No release of wastewater.</li> </ul>
Measurement criteria	<ul><li>Number of spills of wastewater.</li><li>Spill response records</li></ul>

Management of waste and wastewater including drilling fluids		
(monitoring and records)	<ul> <li>Weekly inspection of wastewater disposal area.</li> <li>Daily inspections confirm wastewater levels do not exceed freeboard.</li> <li>Daily inspection of sump and wastewater areas.</li> </ul>	
Reporting	<ul> <li>Spills reporting as needed</li> <li>Audits of wastewater storage areas</li> <li>Staff inductions</li> <li>Annual environmental performance report will be submitted to DEPWS showing above records</li> </ul>	
Responsibility	Project Manager	

#### Table 7-13. Affecting landholders environmental outcomes and performance standards

Affecting landholders		
Environmental outcome	<ul><li>Minimise unwanted access to the project area.</li><li>No significant impacts to the community as a result of the activity.</li></ul>	
ALARP rationale	<ul> <li>Land access agreements and stakeholder consultation will ensure all parties are aware of access requirements and informed of activities.</li> <li>Regular contact with landholders will ensure land use isn't significantly affected by work activities.</li> <li>Working with neighbouring groups and communities to facilitate working relationships, as well as ensuring access tracks are closed and rehabilitated will limit the time that unwanted access is possible.</li> </ul>	
Mitigation measures	<ul> <li>Site inductions are to ensure that all personnel are aware of and understand social constraints of working within the permit area, including conditions specified in the Land Access Agreement with the host pastoral leaseholder.</li> <li>Work instruction to be issued to all contractors relating to access constraints.</li> <li>Prior to commencement onsite, communicate with pastoral leaseholders for access permission. Provide detail of the time and dates proposed to be on site, and the location, in advance of works commencing according to the regulations, including detailed maps showing pastoral infrastructure</li> <li>Ensuring that any site gates/access points are closed to prevent unwanted access.</li> </ul>	
Environmental Performance Standard (Performance Measure)	No concerns from landholders regarding unwanted access.	
Measurement criteria (monitoring and records)	Number of complaints	
Reporting	<ul> <li>Complaints register identifying:         <ul> <li>Date and summary of issue</li> <li>How complaints were resolved and corrective actions taken</li> </ul> </li> <li>Annual environmental performance report will be submitted to DEPWS including:         <ul> <li>Register of complaints</li> </ul> </li> </ul>	
Responsibility	Project Manager	

#### Table 7-14. Fire environmental outcomes and performance standards

Fire		
Environmental outcome	No fires caused by site activities.	
ALARP rationale	• The BMP outlines the industry standard controls that will be implemented to reduce the risk of fire. Fire extinguishing devices will be available at all work to control fires as needed. Equipment controls and safety mechanisms, as well as regular checking of fire danger will ensure this risk has been reduced to ALARP.	
Mitigation measures	<ul> <li>A Bushfire Management Plan (BMP) (Appendix J and Appendix K) has been developed that includes the following information: <ul> <li>Analysis of baseline fire information (at least 10 years)</li> <li>Analysis of impacts of the proposed activities on the existing fire management regime.</li> </ul> </li> <li>Coordination with the landholder and other land users and consistency with the landholder's fire management obligations and strategies.</li> <li>No hot works are permitted on total fire ban days.</li> <li>Implementation of the interest holder's appropriate fire mitigation measures such as: <ul> <li>Monitoring of seasonal conditions and fuel loads</li> <li>Maintenance of fire access trails and fire breaks around infrastructure</li> <li>Controlled burns</li> <li>Communication system for monitoring bushfire alerts in the area.</li> </ul> </li> <li>Monitor the NAFI website and adhere to total fire ban days. Updates provided at daily toolbox meetings.</li> <li>Fire extinguishers fitted to all vehicles.</li> <li>All personnel and contractors will be informed about the key features of the BMP as part of their induction.</li> <li>Clean out vehicle engine bay regularly, with special attention paid on red alert days, to prevent grass igniting on the hot vehicle components.</li> </ul>	
Environmental Performance Standard (Performance Measure)	No concerns from the community on fires started by the activity.	
Measurement criteria (monitoring and records)	<ul> <li>Number of complaints</li> <li>Staff inductions</li> </ul>	
Reporting	<ul> <li>Complaints register identifying:         <ul> <li>Date and summary of issue</li> <li>How complaints were resolved and corrective actions taken</li> </ul> </li> <li>Annual environmental performance report will be submitted to DEPWS including:         <ul> <li>Register of complaints</li> <li>Staff inductions</li> </ul> </li> </ul>	
Responsibility	Project Manager	

## Table 7-15. Groundwater impacts from drilling environmental outcomes and performance standards

Groundwater impacts from drilling operations		
Environmental outcome	<ul> <li>Quality and quantity of groundwater in the region is not adversely impacted</li> <li>No cross flow between aquifers</li> </ul>	
ALARP rationale	Methods implemented are industry best practice methodology will ensure success.	
Mitigation	All regional aquifers isolated by a minimum of two verified barriers during drilling	
	Groundwater impacts from drilling operations	
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measures	<ul> <li>operations</li> <li>Well barriers will be designed and installed by appropriately qualified people</li> <li>No use of chemicals or other substances that have potential to leave a residual toxic effect in the aquifer, will not be added to the drilling mud until aquifers have been isolated</li> </ul>	
Environmental Performance Standard (Performance Measure)	No flows between aquifers	
Measurement criteria (monitoring and records)	Record that drilling supervisor verified that aquifers isolated before proceeding to the next stage.	
Reporting	<ul> <li>Drilling supervisor records</li> <li>Annual environmental performance report will be submitted to DEPWS including above</li> </ul>	
Responsibility	Project Manager	

#### Table 7-16. Camp wastewater environmental outcomes and performance standards

	Wastewater from camp/accommodation
Environmental outcome	<ul> <li>No adverse impacts on soil, surface water or groundwater caused by wastewater management</li> </ul>
ALARP rationale	• All waste will be collected, treated and disposed of correctly. This reduces the risk to ALARP as there are no further actions that can be taken to reduce risk.
Mitigation measures	<ul> <li>Designated waste storage/irrigation area will be located away from sensitive receptors area such as waterways or drainage lines.</li> <li>Wastewater will be treated to the required environmental guidelines for advanced secondary effluent (Class "B")</li> <li>A Waste Management Plan will be implemented (Appendix L).</li> </ul>
Environmental Performance Standard (Performance Measure)	No release of wastewater
Measurement criteria (monitoring and records)	Weekly inspection of wastewater disposal area
Reporting	Annual environmental performance report will be submitted to DEPWS including: <ul> <li>Records of weekly inspection of wastewater disposal area</li> </ul>
Responsibility	Project Manager

#### Table 7-17. Traffic environmental outcomes and performance standards

	Increased traffic on roads due to project activities
Environmental outcome	<ul> <li>No impacts to the community as a result from increased traffic associated with the activity</li> </ul>
ALARP rationale	• Engagement with stakeholders will ensure they are aware of work activities and the increased traffic this will bring.
Mitigation measures	<ul> <li>Site inductions are to ensure that all personnel are aware of and understand social constraints of working within the permit area, including conditions specified in the Land Access Agreement with the host pastoral leaseholder</li> <li>Engagement with landholders and community to communicate expected timeline of works and estimates of increased road traffic.</li> <li>All complaints to be noted and responded to in a timely manner.</li> </ul>
Environmental Performance Standard (Performance Measure)	No complaints regarding increased traffic.
Measurement criteria (monitoring and records)	Number of complaints
Reporting	Annual environmental performance report will be submitted to DEPWS including that discussed above
Responsibility	Project Manager

# 7.2 Management systems, practices and procedures

Minerals Australia maintain a Health, Safety and Environment Management System (HSEMS) underpinned by its Health and Safety Policy and Environment Management Policy. Management of potential impacts associated with the project aligns with Minerals Australia HSEMS.

Other management plans developed to work alongside the HSEMS are detailed below.

#### 7.2.1 Management plans

The following management plans have been developed to reduce the impact of project activities on the surrounding environment and community.

Plan	Objective
This EMP	The objective of this EMP is to provide documented strategies to minimise environmental impacts and the risk of any unintended adverse outcomes resulting from exploration activities.
	Specifically, the EMP provides:
	<ul> <li>A description of the regulated activities.</li> </ul>
	<ul> <li>A description of the existing environment (physical, biological, social, cultural) including any particular values or sensitivities.</li> <li>An assessment of environmental impacts and environmental risks.</li> <li>Environmental outcomes and environmental performance standards.</li> <li>An implementation strategy</li> </ul>
ESCP Appendix F and	The erosion and sediment control plan (ESCP) has been prepared to

#### Table 7-18. Management plans for EP144 and EP154

Plan	Objective
Appendix G	<ul> <li>provide a best-practice framework for implementation of effective erosion and sediment control associated with Minerals Australia's 2D seismic acquisition and drilling programs.</li> <li>The objectives of the ESCP are to: <ul> <li>Provide risk-based erosion control measures for specific areas based on the best practice guidelines.</li> <li>To maintain, and where practical, enhance the land use capabilities of disturbed areas with respect to land's soil, water and vegetation attributes</li> <li>Guide erosion and sediment control requirements along proposed seismic lines based on soil risk factors.</li> <li>Prevent erosion, sedimentation and associated adverse impacts resulting from seismic line clearing.</li> <li>To ensure satisfactory stabilisation of the site at completion of works.</li> </ul> </li> </ul>
Weed Management Plan Appendix H and Appendix I	<ul> <li>The weed management plan has been prepared to outline the weed management measures that will be implemented to prevent the introduction and spread of weeds during the works associated with the Project.</li> <li>The objectives of the weed management plan are to: <ul> <li>Comply with all applicable legislation, regulations, conditions and regional weed management plans.</li> <li>Address the specific weed management requirements of station owners.</li> <li>Provide controls for all project activities to avoid introducing new weed species into the EP area.</li> <li>Avoid or control the spread of existing weed species into new areas within the EP area.</li> <li>Detail the monitoring, reporting and incident response procedures appropriate for the management measures.</li> </ul> </li> </ul>
Bushfire Management Plan Appendix J and Appendix K	<ul> <li>The Bushfire Management Plan has been prepared to ensure that the risk of bushfires resulting from activities associated with the Project are mitigated to protect public and private infrastructure and equipment, environmental and cultural values of the seismic survey area, and ensure the health and safety of operational personnel.</li> <li>Objectives of the Bushfire Management Plan are: <ul> <li>Minimise the risk of fire resulting from Minerals Australia's operations</li> <li>Minimise the risk to its operations from bushfires which may occur from elsewhere in the region</li> </ul> </li> </ul>
Waste Management Plan Appendix L	The Waste Management Plan has been prepared to detail the potential negative impacts from proposed works, and present management and monitoring strategies to limit these impacts, as well as assigning responsibilities to ensure these strategies are implemented.
Spill Response Plan Appendix M	The Spill Response Management Plan outlines appropriate procedures for reducing the likelihood of spills and the severity of impact from spills.
Rehabilitation Plan Appendix O	The Rehabilitation Plan details rehabilitation methods, monitoring procedures and defines rehabilitation success criteria.
Emergency Response Plan Appendix N	The Emergency Response Plan (ERP) describes processes to be followed by Minerals Australia in the event of an emergency during exploration activities at EP144 and EP154. The ERP is designed to guide the Minerals Australia response team for the project in conjunction with the support from the engineering and project management sub-contractors and relevant third parties to respond

Plan	Objective
	effectively and promptly to site-level emergencies and return the site to normal operations.

# 7.3 Measurement criteria

Measurement criteria have been identified for the project activities and risks. The criteria have been outlined in the Risk Assessment table (Appendix E).

# 7.4 Monitoring

To ensure that the EMP requirements have been effectively implemented and that the Environmental Outcomes and Environmental Performance Standards have been met, a daily checklist will be completed on site by the Civil Construction Superintendent. The checklist will ensure compliance with mitigation and management measures detailed in the Risk Assessment table (Appendix E).

Minerals Australia will undertake a suite of monitoring to implement this EMP and to deliver on the obligations described in the Risk Assessment table (Appendix E). Monitoring requirements are detailed below in Table 7-19.

Monitoring program	Description	Frequency	Responsibility
General monitoring	Monitoring local weather, climate information (BOM) and bushfire (NAFI)	Daily	Civil Construction Superintendent
	Monitoring of the 7-day forecast to determine the seismic works program around the forecasts	Daily	Civil Construction Superintendent
	Calibrations of monitoring equipment to assess the performance and accuracy of equipment being used.	In accordance with manufacturer calibration requirements	Project Manager
Induction monitoring	Ensure induction records are kept to demonstrate what was covered in the induction and who was inducted	After every induction	Civil Construction Superintendent
Erosion and Sediment Control	Visual inspection and monitoring of existing tracks, seismic lines, drill pads and water waterway crossings conditions Routine visual inspections of the creek and drainage line crossings. These will occur weekly or following a rainfall event (i.e. greater than 20 mm in a 24-hour period)	Monthly visual inspection will occur: During siting of seismic lines and drill pads (baseline assessment) After completion of a key phase of activity, such as construction of drilling/camp infrastructure, seismic line	Civil Construction Superintendent
		completion, completion of drilling and following the removal of site	

#### Table 7-19. Monitoring requirements

Monitoring program	Description	Frequency	Responsibility
		infrastructure. After the wet season to look for signs of erosion Annually (post wet) for up to 5 years.	
	Routine visual inspections of the creek and drainage line crossings	Weekly or following a rainfall event (i.e., greater than 20 mm in a 24-hour period) Any damage observed would be repaired as soon as practicable after the event	Civil Construction Superintendent
	Inspection of areas prone to concentrated surface water flows	Following heavy rainfall	Civil Construction Superintendent
Weeds	A post wet-season weed survey will be conducted of seismic lines, drill pads and access tracks. All weed monitoring and survey activities will be recorded in accordance with the NT Weed Data Collection Guidelines	Annual to coincide with the end of the wet season	Civil Construction Superintendent
Drill cuttings, fluid and muds characterisation	Characterise the quality of drill cuttings, and relevant fluids and muds to confirm disposal options.	Prior to disposal	Civil Construction Superintendent
Bushfire	Monitoring for bushfire alerts primarily via the https://securent.nt.gov.au/alerts and https://www.bushfires.nt.gov.au/incidentmap/ websites and notifying all site personnel of the risks of fire during toolbox meetings	Daily	Civil Construction Superintendent
Waste	Inspect waste storage	Weekly	Civil Construction Superintendent
	Maintain waste register, including receipts to verify waste has been properly disposed of	As occurs and record in the waste registers and waste disposal records	Civil Construction Superintendent
Drilling waste/fluids	Drilling sumps and cuttings pits will be inspected daily to check integrity and check the appropriate freeboard levels in sumps.	Daily	Civil Construction Superintendent
Spill response	Regular inspection of fuel and chemical storage areas, including containment areas and structures, containers and spill kits	Daily	Civil Construction Superintendent
Complaints register	Complaints reported to Minerals Australia and recorded in register and followed up	Immediately on receipt of complaint	Project Manager
Communications log	Communications log with station manager and Station Personnel to monitor any potential (but unlikely) disturbance to cattle and jointly arrive at reasonable solutions to mitigate any observed effects	Daily	Civil Construction Superintendent

Monitoring program	Description	Frequency	Responsibility
Air quality and emissions	Visual monitoring will be carried out to ensure that visibility for moving equipment and vehicles is not obscured. In this event, water carts will need to be applied to reduce dust.	Daily	Civil Construction Superintendent
Vegetation clearing	Record any fauna encounters, injuries or death as result of seismic survey on fauna register Number of shrubs impacted in seismic line 3 alongside Blackwater creek.	Duration of works	Civil Construction Superintendent
Rehabilitation monitoring	Rehabilitation success to be monitored in accordance with Rehabilitation Plan (Appendix O)	At the end of the wet season (February to June): approximately between six- and nine-months post rehabilitation works, yearly for the first three years post rehabilitation works and annually until successful rehabilitation criteria have been met and signed off by the Project Manager	Project Manager
Groundwater usage	Record groundwater take using an approved flow meter.	Weekly	Civil Construction Superintendent
Water use and storage	Water for drilling operations will be stored on site in a lined sump. This water quality will not be monitored because it is re-circulated during drilling. Volumes of water used will be recorded Water for usage in camps will be stored in commercial water storage tanks and monitored and tested regularly for quality. All sources of water and volumes used will be recorded.	Weekly	Civil Construction Superintendent
Heritage	Heritage register maintained.	Duration of works	Civil Construction Superintendent
Non-compliance reporting	Non-conformances reported as soon as possible, but within 24 hours at a minimum	Duration of works	Civil Construction Superintendent
Fauna	Monitoring of vehicle speeds. Record any fauna encounters, injuries or death as result of the activities on fauna register for the duration of works. Daily inspection of sumps and fencing.	Duration of works	Civil Construction Superintendent

# 7.5 Reporting

Reports on the performance standards will be produced by Minerals Australia's authorised representative and provided to the Minerals Australia management team and the DEPWS Petroleum Operations. The reporting frequency is outlined in Table 7-20.

Table 7-20.	Reporting	frequency
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Report	External submission	Recipient	
Annual Environmental Performance Report	Annually	Minerals Australia management team and the DEPWS Petroleum Operations	
Reportable Incident Report	2 hours following the incident OR Within 2 hours of becoming aware of the incident. An interim report will follow no more than 3 days after the incident, with a final report submitted 30 days after incident clean up or rehabilitation.	Minerals Australia management team and the DEPWS Petroleum Operations	
Quarterly Recordable Incident Report	Quarterly	Minerals Australia management team and the DEPWS Petroleum Operations	
A commencement of activity notification	Prior to the commencement of regulated activities	The minister for Environment and the occupier and owner of the land on which the activity is carried out	

### 7.5.1 Annual Environmental Performance Report

An annual environmental performance report will be developed by Minerals Australia and be submitted to DEPWS on an annual basis. This report will outline how the environmental objectives of the project are being met, and this EMP is being appropriately implemented.

The report will include:

- An overview of work activities conducted during the reporting period
- An analysis of compliance with the conditions of the EMP
- An evaluation of the environmental outcomes and performance standards within the EMP
- An analysis of reporting requirements for the project as per the Code and relevant Regulations
- A register of all incidents including cause of incident, and mitigation activities to avoid another incident of the same nature
- Results of all inspections and audits on site, and how findings have been addressed.

### 7.5.2 Incident reporting

Incidents can be defined as either *reportable incidents* or *recordable incidents*. These are both described below.

#### Reportable incident

The NT Petroleum (Environment) Regulations 2016 define a reportable incident as an incident arising from a regulated activity that has caused, or has the potential to cause, material environmental harm or serious environmental harm as defined under cl. 117AAB(1) the Petroleum Act.

For each incident on the project Minerals Australia will assess the incident to determine if they are classed as reportable. If an incident is considered reportable DEPWS will be notified either verbally or in writing. DEPWS must be notified as soon as is practicable but no more than two hours after the first occurrence of the incident, or after the incident is first noticed.

A reportable incident report must include the following information:

- Contact details of the interest holder
- All relevant facts and information regarding the incident
- Details of actions taken to avoid or mitigate material or serious environmental harm
- Information on corrective actions that are proposed or have been taken.

Once the reportable incident is confirmed, a written report is to be provided to the Minister within three days following the first occurrence of the incident. The written report will include details on the assessment of the incident, the controls that were in place, the nature and extent of environmental harm, actions taken and a root cause analysis.

A final report will be provided within 30 days of the clean up or rehabilitation of the affected area. Interim reports are to be provided to the Minister at least every 90 days during clean up and rehabilitation efforts.

#### Recordable incident

A recordable incident is a breach of an environmental objective of performance standard of this EMP but is not a reportable incident. Recordable incidents must be reported to DEPWS no greater than 15 days following the end of the reporting period (agreed period or each 90-day period after the day on which the EMP is approved).

# 7.6 Personnel

A variety of personnel are required to undertake the program of works on EP144 and EP154. The following section describes roles and responsibilities, training and awareness, and both general and medical emergency procedures.

#### 7.6.1 Roles and responsibilities

The key roles and responsibilities for regulated activities under this EMP are:

- Project Manager:
  - Oversees the whole planning and execution of the exploration program and is ultimately responsible for ensuring all other parties are working within the HSE guidelines.
  - The Project Manager's role is predominantly office-based.
- Civil Construction Superintendent:
  - Responsible for ensuring all areas of civil construction, 2D seismic acquisition and drilling are carried out following the EMP and Minerals Australia's HSE Policy.
  - All Civil Construction, Seismic Acquisition and Drilling contractors report to this position.
  - Act as the designated point of contact for any civil-related complaints and incidents following the pre-determined strategies in this EMP or relevant ERP.
  - $\circ$  This role will also cover the part of the Weeds Officer, who will be responsible for:
    - Planning and execution of weed monitoring requirements during civil construction and seismic acquisition.
    - Facilitate training all workers (including contractors) in weed management requirements, with support from the Northern Territory Government Regional Weed Officer – Onshore Shale Gas Development.
    - Oversight of implementation of weed control mechanisms, including but not limited to wash-downs and proactive weed control programs.
  - The Civil Construction Superintendent is field-based and reports to the Project Manager.
- Lead Contractor:
  - A nominated member within each contracting company (Civil construction, Seismic acquisition, Drilling) that are responsible for delivering the commitments outlined in this plan
  - The Lead Contractor for each service provider will comply with the nominated contractual terms and work instructions issued under this EMP.

- The Lead Contractor must ensure all staff are aware of their obligations, are appropriately trained and that procedures and controls are fully implemented and complied with.
- Field Personnel:
  - All staff, including Minerals Australia and contractors that are working in the exploration permit areas. Responsible for day-to-day management and reporting of environmental aspects.

#### 7.6.2 Training and awareness

All personnel, contractors and visitors to site will be required to undergo environmental and safety inductions for the site. The environment and safety inductions will include:

- Pastoral leaseholder requirements.
- Regulatory requirements including specific conditions on the exploration permit and AAPA certificates.
- Environmental considerations and special procedures to be used for environment protection and archaeological and cultural sites protection as well as the discovery of unrecorded artefacts. This is to include the ESCP, Weed Management Plan, Bushfire Management Plan, Waste Management Plan, Spill Response Plan and Rehabilitation Plan.
- Health and safety information for remote areas, including procedures for the safe use of vehicles and equipment as well as first aid and emergency response procedures.

Toolbox talks will be held daily for any updates to be communicated to all personnel.

#### 7.6.3 General emergency procedure

Due to the substantial land size, prior to works starting, Minerals Australia will contact the Tennant Creek and Mataranka Police Stations to organise at least three separate and clearly articulated designated sites for the NTPF to be met. This will aid in faster response times from the NTPF if required.

In the event of any incident, the first priority shall be the safety of all personnel and the community in the immediate vicinity. Following this, all practical steps should be taken to minimise the risk of further incidents/accidents as soon as possible after the event. The situation should be stabilised following the appropriate incident management or contingency plan procedures.

In the event of a serious emergency the following procedure will be implemented:

- Stop all work.
- All personnel will leave the work zone.
- All personnel will assemble at the emergency assembly area (this will be designated on the day of induction), and all personnel will be accounted for.
- If required, transport the injured person/s to the nearest medical facility or contact 000 to organise emergency services to respond if needed.

#### 7.6.4 Medical emergency procedure

The following medical emergency procedure applies to the project.

#### First Aid; DRABCD > Danger > Respond > Airway > Breathing > Circulation > Defibrillator

- Assess the Danger (to yourself, patient and others). Shut down equipment/machinery. Have someone check all personnel on site are accounted for.
- Evacuate spectators away from accident site. Delegate spectators to access First Aid kits, phones etc.

- Check the response of the injured person/s (consciousness level; breathing).
- Call 000 for emergency services if required.
- Administer First Aid to injured person.
- Patient should not be moved if there is any danger of spinal injury unless discussed with paramedics.

### 7.7 Records

Minerals Australia will ensure that records are kept for the longer of the following periods: 5 years following the period during which the petroleum interest for the activity is in force or 15 years after the record comes into existence. Records will also be recorded in a manner that makes retrieval of the reasonably practicable.

# 7.8 Management of change

Changes can only be implemented to optimise environmental outcomes or to improve operational efficiency where no new regulated activity, risk (including risk level) or impact is introduced. Where a new risk (including risk level) or impact is introduced, then a revision of the EMP is required under the Regulations.

To ensure any changes to activities are appropriately assessed and communicated and to ensure no additional unintended risks or impacts are introduced, a management of change process will be implemented. This allows adaptive management and the ability to use appropriate technologies.

# 7.9 Review of EMP

Implementation of the EMP will be continually monitored and the EMP reviewed with regards to monitoring and audit results, complaints, employee and stakeholder feedback and change to the program. A formal management review will be undertaken annually.

Minerals Australia management shall review the EMP as required to ensure that they meet operational requirements and relevant environmental legislation and standards.

Reviews of the EMP may occur as a result of the following:

- Identification of opportunities for improvement
- Following recommendations from audits
- Changes to operations or activities within the permit areas
- Changes to legislation.

### 7.10 Notice of commencement

Minerals Australia will notify the Minister for the Environment, the owner and occupier of the land on which activities will occur, of the proposed date of commencement of seismic surveys and drilling through the submission of a letter. The timing of the submission will be in accordance with the Code of Practice.

# 7.11 Rehabilitation

Rehabilitation will be completed as per the rehabilitation plan (Appendix O). All significantly disturbed land is to be rehabilitated.

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# APPENDIX A ECOLOGICAL ASSESSMENT EP144

Note: Ecological Assessments provide an overview of the ecological work conducted as part of this project. Changes to the EMP have been made following this assessment, and this is why different maps and areas are covered within this report.



# **EP144 Ecological Assessment**

# MINERALS AUSTRALIA



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# **EXECUTIVE SUMMARY**

Minerals Australia Pty Ltd is planning an exploration program within their Exploration Permit area (EP144), located in the Barkly Regional Council, Northern Territory, approximately 300 km east of Tennant Creek (centroid coordinates 18° 56' 10.79" S, 136° 55' 14.23" E). EP144 covers an area of 15,000 km<sup>2</sup> over several pastoral leases, surrounding Connells Lagoon Conservation Reserve, Mittiebah and Gulgunnorr Aboriginal Land Trusts. The exploration works will be regulated through an Environmental Management Plan (EMP) approved by the Department of Environment, Parks and Water Security (DEPWS). To inform the EMP, an assessment of the ecological values within EP144, and particularly the exploration program footprint, is required.

To address the potential impacts associated with the exploration activities a desktop and brief site assessment was undertaken between the 13 and 16 of July 2021 by two EcOz ecologists. The site assessment was limited to the project footprint (i.e. tracks, proposed drill holes and camp sites and immediate surrounding native vegetation). The assessment aimed to identify and record weed infestations, assess the likelihood of occurrence for threatened species and gather baseline data for representative analogue vegetation communities. The following ecological values were identified within the project area:

#### Significant vegetation

The project area supports riparian vegetation dominated by Coolibah (*Eucalyptus microtheca*), which provide habitat for a wide range of fauna species. In the Barkly Region, riparian vegetation is limited to the immediate stream banks (i.e. it rarely extends beyond 50 m from the watercourses). Ranken Road and the access tracks intersect riparian vegetation in two sites (D1 and D4) but given its narrow extent, it won't be affected by these crossings as long as the Coolibah trees are not disturbed and erosion control measures are put in place.

#### Large trees with hollows

The remnant vegetation within the project footprint supports large trees with hollows, namely Coolibahs along the riparian areas crossed by Ranken Road and other access tracks, and Snappy Gums (*Eucalyptus leucophloia*) in the woodland communities surrounding Drill Hole 1. Large old hollow-bearing trees provide critical shelter, breeding and roosting habitat for birds, mammals (including microbats) and reptiles.

#### Watercourses, wetlands and waterholes

The project footprint crosses two major watercourses, Playford River (stream order 5) and Buchanan Creek (stream order 3). These waterways are located within the Victoria–Wiso River Region and general drainage follows an east – west direction. There are smaller drainages to the east of EP 144, within the Nicholson and Diamantina-Georgina River Basins, which are not intersected by the project footprint. All watercourses in the region only flow after heavy rainfall events, although they maintain some permanent spring-fed waterholes which support higher biodiversity values than the surrounding area; they should be avoided by any drilling or seismic exploration program. Outside the project area, to the west of EP144, is the internationally significant Lake Sylvester System that supports extensive wetland habitats, broad areas of grassland and fringing areas of open eucalypt and acacia woodland.

#### Threatened species

The project area provides potential habitat for the following four threatened species:

- Grey Falcon (Falco hypoleucos) listed as Vulnerable under TPWC Act and EPBC Act
- Plains Death Adder (Acanthopsis hawkei) listed as Vulnerable under TPWC Act and EPBC Act
- Tobermony Melon (Austrobryonia argillicola) listed as Vulnerable under TPWC Act
- Floodplain Monitor (Varanus panoptes) listed as Vulnerable under the TPWC Act.

Targeted surveys for threatened species were not undertaken and no incidental records of threatened species were recorded during the field visit.



#### Weeds

Weed invasion and spread is a key risk to ecological values and pastoral activities. Exploration activities can be a vector for the transport of weed material. The *Tennant Creek Regional Weeds Strategy 2021-2026* identifies priority weeds. Seven priority weeds have been identified for the region and three of those species were recorded in the project area during the field assessment. These species require priority management attention within EP144 and are listed below.

Common name	Botanical name	NT Class	Weeds of National Significance	Recorded in the Field Survey
Athel pine	Tamarix aphylla	A	Y	Y
Bellyache bush	Jatropga gossypiifolia	Α	Y	
Noogoora Burr	Xanthium strumarium	B		Y
Mesquite	Prosopis spp.	Α	Y	e <del>l</del> o
Prickly acacia	Acacia nilotica	А	Y	1 7 <del>4</del> 5 4
Parkinsonia	Parkinsonia aculeata	В	Y	Y
Rubber bush	Calotropis procera	В		

#### Land Condition Assessment

The land condition rating for each of the analogue vegetation sites and waterway crossing sites has been provided in Appendix B and Appendix C, respectively. Of the six analogue sites assessed, four are considered to be in good condition (Vegetation Sites 2, 3, 5 & 6) and two sites in average condition (Vegetation Sites 1 and 4). These latter two sites are considered in average condition due to the disturbance impacts from cattle and loss of vegetation structure. Of the five waterway crossing sites assessed, two are considered in good condition (D2 & D4), one site in average condition (D1) and two sites are considered to have poor condition (D3 and D5). These latter two waterway crossing sites are subject to significant impacts from cattle, including trampling and removal of understorey vegetation.

The proposed drill holes and campsite are located in areas deemed in good condition. The access tracks cross areas in poor condition, especially in Alexandria Station, where the land is heavily affected by cattle and infested by weeds in the drainage lines. Ranken Road crosses areas of equally poor conditions, except for the Connells Lagoon Conservation Reserve that supports intact vegetation structure and no apparent weed infestations.

#### Recommendations

The drilling exploration program will include the removal of native vegetation and fauna habitat within the two proposed drill pads, camp site and potentially along access tracks. These works will include areas supporting significant vegetation as per the NT Land Clearing Guidelines (DNRE 2020): riparian vegetation, and areas supporting large hollow bearing trees. Further, there is potential for the works to impact on threatened species. However, the potential impacts to significant vegetation and potential habitat for threatened species can largely be avoided and/or minimised if appropriate control measures are undertaken. The introduction and spread of weeds and erosion has been identified as a major risk to the ecological values of the project area. As such, the following recommendations are made:

- Travel between project area sites using existing tracks, roads, and trails only.
- During exploration activities, all vehicles, plant, and equipment should be certified weed-free prior to
  entry into the project area. Weed hygiene protocols must be implemented to ensure that weeds are
  not introduced or spread through the site.
- All vehicles, plant, and equipment should be certified weed-free prior to entry into the project area.



- Control infestations and avoid the spread of Parkinsonia, Noogoora Burr and Athel Pines. Weed control to focus on waterway crossing points where infestations are established and any other area of disturbance.
- An erosion and sediment control plan must be developed as per the *NT Land Clearing Guidelines* (DEPWS 2021). This plan must outline measures to minimise impacts associated with waterway crossings and other erosion prone landforms.
- Where possible, avoid and minimise impacts to riparian and drainage line vegetation. Apply buffers to waterways according to their stream order as per the NT Land Clearing Guidelines (DNRE 2020). This will also avoid and minimise potential impacts TPWC Act-listed Tobermorey Melon.
- Avoid clearing all large old trees notably the Coolibah along watercourses and large Snappy Gums near Drill Hole 1.
- Consider moving the location of the campsite from within the area supporting 'good' quality Mitchell Grass Grassland to an area already degraded and denuded within Alexandria Station.
- Avoid or minimise impacts to cracking clay soils where possible that may provide habitat for the Plains Death Adder. Where excavation is occurring on cracking clay soils, a fauna spotter could be present to avoid impacts to this species.
- Produce a rehabilitation plan for all the disturbed areas, aiming to replicate the environmental conditions of the sites prior to the disturbances (i.e. refer to analogue sites).



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# **1** INTRODUCTION

Minerals Australia Pty Ltd is planning an exploration program within Exploration Permit area 144 (EP144), located in the Barkly Regional Council, Northern Territory, approximately 300 km east of Tennant Creek (see Figure 1-1).

The program involves drilling two exploratory stratigraphic core drill holes, one approximately 500 m depth and the second approximately 1000 m. It also includes use of existing access tracks and the establishment of a 1 ha camp site. These areas are depicted in Figure 1-1.

The exploration works will be regulated through an Environmental Management Plan (EMP) approved by the Department of the Environment, Parks and Water Security (DEPWS). To inform the EMP, EcOz was engaged by Minerals Australia to assess the ecological values within EP144, particularly within the exploration program footprint. Consequently, this report presents:

- A desktop review of the environment values (bioregions, surface water, significant areas, land systems, vegetation communities, threatening processes and flora and fauna records).
- The findings from the on-ground field assessment:
  - Weed survey of the proposed construction footprint (e.g. Drill holes 1 and 2 and the camp site, tracks / roads and creek crossings).
  - Land condition at analogue sites and waterway crossings.
  - The presence of potential habitat for threatened species and/or significant vegetation communities.
- A 'likelihood of occurrence' assessment for threatened species (based on the findings from the desktop assessment and field survey).
- Identification of the potential impacts associated with the exploratory activities and recommendations for avoidance and minimisation of impacts to environmental values.

The scope of the report is to assess the values and risks within areas of exploratory activities only. This report also does not assess ecological impacts and risks related to any development activities that may follow the exploratory phase of this project.



Path: 2/01 ErOz\_Documents/04 EroDz Vantage GIS/E219191 - Hanosok - EMP EP144/01 Project Files/Report maps/Figure 1 1. Map of the location of EP144, the proposed exploratory works and surrounding land use-mod

Figure 1 1. Map of the location of EP144, the proposed exploratory works and surrounding land use



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Figure 1-2. Map of key project infrastructure within EP 144



# 2 ENVIRONMENTAL CONTEXT

This section presents an overview of the existing environment within EP144.

# 2.1 Land Use

Land use within EP144 is predominantly pastoralism (cattle), with the project footprint occurring within three stations – Brunette Downs, Mittiebah and Alexandria. The area of EP 144 surrounds, but does not include, two aboriginal land trusts, Mittiebah and Gulgunnorr, reserved for traditional indigenous uses, and a Conservation Reserve – Connells Lagoon – the largest reserve for the conservation of Mitchell Grass communities in Australia (Figure 1-1).

# 2.2 Climate

The region experiences a hot desert climate generally, characterised by hot dry summers and cool dry winters, with a low average annual rainfall restricted between November to March. The closest long-term Bureau of Meteorology weather station is Brunette Downs (station number 015085), located within EP144. Mean annual maximum temperature recorded at that station is 33.6 °C, while the mean annual minimum is 18.8 °C. Extremes averages oscillate between 10.6 °C in July and 38.3 °C in December. Median annual rainfall is 370.9 mm; however, the amount of rainfall in the region is highly variable. For example, 2000 experienced 1092.4 mm of rain, while 2019 experienced 112.3 mm of rain. If heavy rainfall occurs, it is generally in the December, January, February quarter and can result in flash flooding in the waterways (BoM 2021). Figure 2-1 presents the BOM (2021) data showing the average monthly rainfall and temperatures extremes for Brunette Downs weather station.





Figure 2-1. Average monthly rainfall and temperature at Brunette Downs Station

# 2.3 Bioregion

Bioregions are relatively large land areas characterised by broad, landscape-scale natural features and environmental processes that influence the functions of entire ecosystems. They capture the large-scale geophysical patterns across Australia. These patterns in the landscape are linked to fauna and flora assemblages and processes at the ecosystem scale, thus providing useful means for simplifying and reporting on more complex patterns of biodiversity. NT bioregions are described in Baker et al. (2005).

EP144 occurs within two bioregions – Mitchell Grass Downs (southern side of EP144), and the Gulf Fall and Uplands (northern side of EP144). The Davenport Murchison Range bioregion is immediately to the southwest.

The Gulf Fall and Uplands bioregion is characterised by undulating terrain with scattered low, steep hills. Soils are mostly skeletal or shallow sands. Woodland (*Eucalyptus* spp. or *Corymbia* spp.) over spinifex grasslands (*Triodia* spp.) communities dominate this bioregion. The Mitchell Grass Downs bioregion is mostly under pastoral tenure and consists largely of treeless plains with some occasional ridges, rivers and gorges. The dominant vegetation type is Mitchell Tussock Grasslands (*Astrebla* spp.) on cracking clay soils, with some intermittent lakes.

# 2.4 Significant sites

Sites of botanical significance (SoBS) are considered important for plant conservation and specifically for conserving significant plant taxa (White et al. 2000). EP144 intersects three SoBS. These are:

• Connells Lagoon Conservation Reserve is located in the centre of the Barkly Tableland. The reserve was established for the conservation of Mitchell grass grassland communities. Species significant to the reserve include the Flock Bronzewing Pigeon (*Phaps histrionica*), Pictorella



Manikin Finch (*Heteromunia pectoralis*), Red-chested Button-quail (*Turnix pyrrhothorax*) and the Australian Bustard (*Ardeotis australis*).

- Brunette Creek Waterholes extend from the termination of Brunette Creek at Lake Sylvester and continues upstream to Lily Woodcutter waterhole. It supports suitable habitat for Tobermony Melon (*Austrobryonia argillicola*), listed as Vulnerable in the NT under the Territory Parks and Wildlife Conservation Act (TPWC Act).
- Buchanan Rises comprises a low but extensive rise, composed of Mittebah Sandstone (crossbedded quartz sandstone) and minor outcroppings of tertiary limestone, dolomite, siltstone and gypsum. The site also includes the rather abrupt ecological boundary between the sandstone rises and the surrounding black soil plains.

### 2.5 Surface water

The major watercourses, lakes, dams and wetlands within the project area were identified using <u>NR Maps</u> and aerial imagery. The <u>Directory of Important Wetlands in Australia</u> was queried to identify wetlands within the project area.

EP144 predominantly lies within the Victoria River-Wiso catchment, except for the north-eastern corner of the EP which is within the Nicholson-Leichardt River catchment, and the south-eastern corner which is within the Diamantina-Georgina Rivers catchments (Figure 2-2). The project area is crossed by two watercourses: Playford River (stream order 5) and one of its tributaries Buchanan Creek (stream order 3) (Figure 2-2). Mittiebah Creek is the other order 5 watercourse in the area, turning into Brunette Creek after encountering the Fish Hole Creek. All of these watercourses are ephemeral, flowing only after major rain events, however, they do support some permanent freshwater pools (e.g. Mitchiebo Waterhole, in the source of Playford River).



Path: 2:101 EcOz\_Documents104 EcOz Vantage GISIE210.101 + Hanoock + EMP EP14401 Project Files/Report maps/Figure 2.2. Map of hydrological boundaries and sites of botanical significance within and surrounding EP 144.msd

Figure 2 2. Map of river basins, waterways and sites of botanical significance within and surrounding EP144



# 2.6 Land systems

Christian and Stewart (1968) define a land system as 'an area or group of areas throughout which there is a recurring pattern of topography, soils and vegetation'. These have been mapped across the NT by different surveys and are at a significantly smaller scale than a bioregion (i.e. bioregions constitute many different land systems). Within each land system, a set of component land units is defined. In some areas of the NT, mapping has been undertaken to the level of detail of land units. Land unit mapping was undertaken at a scale of 1:100,000 in the NT Portions 651 – Alroy Downs Station, 962 – Mittibah Station, and 1483 – Brunette Downs Station, and at a scale of 1:25,000 in the NT Portion 561 – Connells Lagoon Conservation Reserve. However, there is no land unit mapping for the NT Portion 1 – Alexandria Station, where most of the project footprint is located so, for simplicity, land systems are used to characterise EP144 and the project footprint.

Land system mapping of the region was undertaken by Christian et al. (1954) at a scale of 1:250,000. This mapping shows that EP144 intersects 21 land systems that are described in Appendix A and shown in Figure 2-3. EP144 is dominated by clay plains (1,078,652 ha), sandstone plains and rises (201,382 ha), lateritic plains and rises (175,433 ha), sandstone hills (21,749 ha), rugged quartz sandstone plateaux and hills (12,667 ha), basalt hills (4,360 ha) and alluvial flood plains (5,398 ha) associated with Lake Sylvester, Lake de Burgh, the Playford River and its tributaries. The project footprint intersects four of these land systems: clay plains (Barkly 1, 2 and 3) and sandstone plains and rises (Yelvertoft) (Table 2-1 and Appendix A).

Land System	Landform	Soil	Vegetation
Clay plain	s		
Barkly 1	Level to gently undulating clay plains (black soil plains); cracking clay soils. Up to 20% contains gravelly rises	7	Astrebla tussock grassland
Barkly 2	Level to gently undulating clay plains (black soil plains); cracking clay soils. Up to 20-60% contains gravelly or stony rises	Vertosols	
Barkly 3	Level to gently undulating clay plains (black soil plains); cracking clay soils. Over 60% contains gravelly or stony rises		Mixed species tussock grassland
Sandston	e plains and rises		
Yelvertoft	Undulating terrain	Skeletal soils and truncated gravelly lateritic red earths	Dominated by <i>Eucalyptus</i> brevifolia or <i>E.</i> dichromophloia woodlands

#### Table 2-1. Summary of the land systems relevant to the project footprint



Patr: 2:101 EcOz\_Documents/04 EcOz Vantage GISIE211181 - Hanoock - EMP EP144/01 Project Files/Report maps/Rigure 2.3. Map of land systems within and surrounding EP 144.mxd

Figure 2-3. Map of land systems within and surrounding EP144



# 3 FIELD ASSESSMENT

This section outlines the methodology used and the environmental values identified within the project footprint.

# 3.1 Methodology

Field assessments were conducted by Nicole Clarke and José Francisco (Ecologists, EcOz) from 13-16 July 2021. The field assessment aimed to collect data across the project footprint to:

- Provide an overview of the vegetation communities through the assessment of analogue sites.
- Assess the proposed location of waterway crossing for their current condition, values and potential impacts.
- Assess the likelihood of occurrence for threatened species and significant vegetation communities.
- Document the existing threatening processes including, pastoralism, fire, drought, erosion, feral animals? and weeds.
- Undertake a weed survey.

Data was collected through walk and drive transects. Specific methodologies undertaken in the field are described below.

#### 3.1.1 Analogue Vegetation sites

Prior to the field survey, aerial imagery and available land resource datasets were reviewed to identify the preliminary location of analogue vegetation sites, a spatially representative set of survey sites adjacent to the construction footprint and within similar vegetation communities. The aim of assessment at these sites was to collect baseline data that could be used for future reference to assess rehabilitation of impact areas.

A total of six analogue sites were selected based on their proximity to the construction footprint and location within various land systems (Figure 3-1). Data collection within these sites included a description of the vegetation community, dominant flora species, soil types and any threatening processes (see Section 3.1.3).

The location of analogue vegetation sites are shown in Figure 3-1and described in Appendix B.

#### 3.1.2 Waterway crossings.

Prior to field work, all waterways within the project footprint were identified during the desktop assessment using NR Maps layers at a scale of 1:250,000. Waterways that crossed Ranken Road and other access tracks were surveyed by a walkover inspection 200 m on each side of the crossing. The following data was collected at each waterway crossing site: vegetation type, dominant flora species and threatening processes (Section 3.1.3). The survey team recorded the location of riparian and drainage line vegetation on a handheld GPS when encountered along the survey transect. Photographs of the drainage channel were taken and any vegetation present.

The location of waterway crossing sites are shown in Figure 3-1 and described in Appendix C.

#### 3.1.3 Threatening processes

The following threatening processes were recorded at each survey site:

- Impacts from pastoral activities and/or feral animals. This was based on the following categories: low (no / very little impact; medium (some grazing and cattle trampling); high (surface soils and vegetation are highly disturbed, and erosion and weeds are present).
- General observations to determine level of impacts from fire and drought.
- Weeds (see below).



#### Weeds

A weed survey was undertaken within the project footprint targeting priority species as outlined within the *Tennant Creek Regional Weeds Strategy 2021-*2026 (DEPWS 2021). Walk and drive transects were undertaken to determine the presence of priority weed infestations. The following locations were surveyed for weed occurrences:

- Two Drill Pads (1 and 2): walkover transects were performed in a 1 ha area proposed for each drill pad. Four transects spaced at 100 m apart were oriented in a North-South direction.
- Campsite: walkover transects were performed across an area of 2 ha (i.e. proposed 1 ha camp area and buffer). Four transects, spaced at 200 m apart were oriented in a North-South direction.
- Ranken Road and other access tracks were surveyed for weeds via a vehicle. Average speed when surveying was 60 km/h along Ranken Road, and 20 km/h along the proposed access tracks.
- Waterway crossings.
- Analogue vegetation sites.

Locations of weed survey sites are shown in Figure 3-1 and Figure 5-4.

The following data was collected for each survey site in accordance with the *NT Weed Data Collection Manual* (WMB 2015); species, seeding status, photographs and infestation level based on the size (diameter) and density. Density was recorded according to the following categories:

- 1 = Absent, no weeds of this species.
- 2 = < 1%, Very few, not many weeds e.g. single plant, perhaps with seedlings.
- 3 = 1 10%, More than one or two isolated plants but not a lot e.g. a few small plants.
- 4 = 11-50%, A lot, up to half the area covered e.g. a tree, dense patches of weeds.
- 5 = > 50%, Dominant cover is weed, more than half covered e.g. thickets, monocultures.



Path: 2:101 EcOz\_Documents104 EcOz Vantage GISIEZ19191 - Hanoock - EMP EP144101 Project Files/Report maps/Figure 3-1. Map showing survey effort within investigation area.mxd

#### Figure 3-1. Map showing survey effort within investigation area



# 3.2 Landform and vegetation communities

The project footprint is located mostly within cracking clay plains, corresponding to the land systems within the Mitchell Grass Downs bioregion. The transition to land systems in the Gulf Falls and Uplands bioregion is very clear and occurs in the northern section of the access tracks (Figure 2-3), where the landscape is dominated by red sandy loam plains with varying concentrations of gravel. Waterways and drainage depressions are scattered throughout the area. The following sections outline the different types of landforms within the project footprint. Appendix B provides a summary of the vegetation communities occurring within the six analogue sites assessed in each of these landforms.

#### 3.2.1 Clay plains

The clay plains are characterised by flat to gently undulating terrain supporting Mitchel Grass (*Astrebla* spp.) tussock grasslands growing over cracking clay, and small occurrences of sparse Whitewood (*Atalaya hemiglauca*) woodland over tussock grasslands. This landform is poorly drained, retaining surface water after heavy rain due to low permeability and runoff. Representative vegetation communities occurring in this landform are described in Vegetation Site 2 and 3, Appendix B. Clay plain areas are sensitive to impacts – particularly if traversed when wet with heavy machinery, vehicles, and equipment.

#### 3.2.2 Sandplains

The sandplains are characterised by flat to gently undulating terrain supporting hosting *Eucalyptus* spp. woodland over Spinifex (*Triodia pungens*) hummock grassland and prominent termite mounds growing in sandy soils with variable content of clay and gravel. Representative vegetation communities for this landform are described in Vegetation Site 5 and 6, Appendix B. This landform is subject to frequent fire (Section 5.4 and Figure 5-9). The impacts associated with grazing are less obvious than within the other landforms in the project footprint.

#### 3.2.3 Drainage lines and depressions

There are no permanent watercourses within or near the project footprint. Nevertheless, waterways are very distinct from the surrounding landscape given the well-marked banks populated by Coolibah trees (*E. microtheca*). (Representative vegetation for this landform is described in Vegetation Site 1 and 4, Appendix B.) The major waterways crossed by the project footprint are the Playford River (stream order 5) and Buchanan Creek (stream order 3). These areas are subject to weed infestations, including Parkinsonia (*Parkinsonia aculeata*) and sparse Noogoora Burr (*Xanthium strumarium*) (see Section 5.1). Watercourses within the project footprint are heavily impacted by cattle, with compacted soil and loss of groundcover vegetation resulting in an increased risk of erosion within this landform. The drainage lines intersecting the project footprint are not steep and easily trafficable, requiring very minor cuts (if any) for the transit of vehicles and machinery. Five waterway crossings were assessed during the field survey, with the data presented in Appendix C.

# 3.3 Significant vegetation

Significant vegetation communities are described in the *NT Land Clearing Guidelines* (DEPWS 2021). They are vegetation communities that are distinct and limited in extent or support important ecological values, and include rainforest, vine thicket, closed forest or riparian vegetation, mangroves, monsoon vine forest, sand-sheet heath, and vegetation containing large trees with hollows suitable for fauna. Groundwater-dependent ecosystems are also considered to be significant. Four significant vegetation types found within or adjacent to the project footprint are discussed below and shown in Figure 3-4.


#### 3.3.1 Riparian vegetation

Riparian vegetation is 'a distinct vegetation community occurring along the banks of rivers or streams that directly influences the adjacent water body' (DENR 2018). Riparian vegetation is considered a significant vegetation type as it supports a unique selection of habitat features that are relied upon by a range of flora and fauna species. It provides refuge habitat and habitat corridors; improves water quality by filtering terrestrial run-off; stabilises banks and reduces erosion; and supports terrestrial and aquatic habitats by maintaining natural light, temperature and oxygen levels within waterways (DENR 2018). The main threats to riparian vegetation are weed invasion, feral animals, fire, over-grazing, erosion, sedimentation and land clearing (DENR 2018).

In this report, two terms are used to describe vegetation along a watercourse:

- Riparian vegetation which differs to that in the surrounding landscape, and which serves the
  ecological functions described above, and should therefore be considered sensitive under the NT
  Land Clearing Guidelines (e.g. Figure 3-2 left).
- Drainage line vegetation which is similar to that in the surrounding landscape and whose only
  ecological function is bank stability (which can be replicated through erosion and sediment
  controls), and therefore is not sensitive riparian vegetation under the NT Land Clearing Guidelines
  (e.g. Figure 3-2 right).



Figure 3-2. Example of riparian vegetation (left) compared with drainage line vegetation (right).

Riparian vegetation occurs along the larger creeks and rivers, of which all are located within the Mitchell Grass Downs bioregion (i.e. black soil plains). The project footprint crosses riparian and drainage line vegetation in six locations (Figure 3-1, Figure 3-4), of which, five crossings were assessed during the field survey. Ranken Road is intersected by the Playford River and Buchanan Creek, while the access tracks intersect Playford River and two of its tributaries. There are two locations of riparian vegetation that are crossed by the main road and access track (D1 and D4). Additionally, the proposed location of Drill Hole 1 is located 50 m west of a drainage line (Figure 3-3 and Figure 3-1).

Typical riparian vegetation in the region consists of Coolibah (*Eucalyptus microtheca*) communities with a tussock grass understorey. Riparian vegetation within the project area was confined to the banks of the watercourse and did not extend far into the surrounding country (i.e. it was restricted to 50 m from the banks in the surveyed areas). The height of canopy trees within the riparian vegetation was between 10 and 15 metres.

The riparian vegetation and drainage line vegetation within the project area exhibited signs of impacts from cattle. Trampling of vegetation was evident on the banks and beds of all watercourses visited. The grassy understorey showed extensive grazing impacts; this exacerbates the erosion risk along the watercourse banks. Waterway crossing sites D1, D3 and D5 were found to have significant trampling and grazing impacts. Weeds were found at one site only (D1), with records of Parkinsonia and Noogoora Burr. A complete summary of the values and threats within each of the waterway crossings is provided in Appendix C.



As per the Land Clearing Guidelines (DEPWS 2021), appropriate vegetation buffers should be retained and protected to avoid and minimise impacts on sensitive vegetation / habitats, maintain water quality and hydrological flows. The minimum riparian buffer width recommended is dependent on the stream order as per Table 3-1.

Riparian Class	Stream Order	Minimum buffe width (m)	Applicable waterways in the project area
Drainage depression	NA	25	NA
Intermittent streams	First	25	
Intermittent streams	Second	50	Eastern Creek
Creek	Third and Fourth	100	Wild Cow Creek and Buchanan Creek
River	Fifth or higher	250	Playford River

Table 3-1. Recommended widths for ripa	rian buffers (DEPWS 2021)
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Figure 3-3. Photographs of typical riparian vegetation within the project area (a) Playford River (stream order 5), (b) Buchanan Creek (stream order 3), (c) Eastern Creek (stream order 2), and (d) a stream near Drill Hole 1.



#### 3.3.2 Large trees with hollows

Large old trees with hollows were observed within the riparian vegetation (e.g. Coolibah, *Eucalyptus microtheca*) (Figure 5-6, Vegetation Site 1 in Appendix D) and woodland communities (i.e. large Snappy Gums *Eucalyptus leucophloia* surrounding Drill Hole 1) (Figure 5-7, Vegetation Site 5 in Appendix B). Coolibahs are groundwater-dependent trees, while Snappy Gums grow in lateritic soils and stony rises. Hollows in large old trees provide critical shelter, nesting and roosting habitat for birds, mammals (including microbats) and reptiles.

#### 3.3.3 Wetlands

Wetlands are generally considered to be floodplains, lakes, claypans, billabongs and swamps, and can be permanently or intermittently wet (NRETAS 2010). They support distinct vegetation communities that rely on either permanent or seasonal surface water supply (Brock 1993). These areas often support a shallow water table. They are considered a sensitive vegetation type as they provide essential habitat for a diverse range of flora and fauna (including threatened and migratory species) and can be easily deteriorated by poor land management and planning.

There are no sensitive wetlands within the project footprint. Connells Lagoon is a sensitive wetland, 6 km northeast of the project footprint. Its corresponding Conservation Reserve is listed as a SoBS and crossed by Ranken Road on its south-western corner (Figure 2-2). The Lake Sylvester System is located 40 km southwest of the project area. It is a wetland of international significance and meets Ramsar criteria 1, 2, 4, 5 and 6 and for providing feeding and occasional breeding grounds for multiple tern species (*Gelochelidon nilotica, Hydroprogne caspia, Chlidonias hybrida* and *C. leucopterus*). Both Connells Lagoon and Lake Sylvester System are unlikely to be impacted by the proposed works given their distance from the project footprint.

#### 3.3.4 Groundwater-dependant ecosystems

Groundwater-dependent ecosystems (GDE's) refer to 'natural ecosystems that require access to groundwater to meet all or some of their water requirements on a permanent or intermittent basis, so as to maintain their communities of plants and animals, ecosystem processes and ecosystem services' (Richardson et al. 2011). Groundwater is especially important to ecosystems in arid and semi-arid parts of the country, and when there are extended dry periods during which evaporation markedly exceeds precipitation and surface water is scarce (Eamus et al. 2006). These areas provide essential habitat for a diverse range of flora and fauna, and can be easily impacted by poor land management and planning.

Based on definitions from Eamus et al. (2006), the <u>Atlas of Groundwater Dependent Ecosystems</u> maps three types of GDE – subterranean, aquatic (i.e. ecosystems dependant on surface expression of groundwater) and terrestrial (i.e. ecosystems dependent on the sub-surface presence of groundwater, often accessed when roots penetrate via the capillary fringe which lies above the saturated zone of the water table) (BOM 2021). The Atlas classes each mapped GDE according to the degree of certainty that it is, indeed, a GDE.

EP144 is dry for much of the year and largely includes sandplains with little relief and expansive black soil plains intersected by rivers and creeks. The Atlas identifies most of the rivers and creeks within EP144 as low potential aquatic GDE's, except for Xmas and Fish-Hole Creeks, which are classified as moderate and high potential, respectively. Xmas Creek is located outside of the project footprint, 9 km northeast of Ranken Road and c. 20 km west of Drill Hole 1. Xmas Creek flows into Connells Lagoon Conservation Reserve. Fish-Hole Creek is located in the northeast corner of EP144, approximately 60 km northeast of Drill Hole 2, flowing east into Nicholson River Basin. These GDE's are unlikely to be impacted by the proposed works given their distance from the project footprint.



Path: Z101 EoOz\_Documents104 EoOz Vanlage GIS/EZ19191 + Hancook - EMP EP14401 Project Files/Report maps/Figure X-X map of important landforms and values mod

Figure 3-4. Map of important values within EP144



# 4 THREATENED SPECIES ASSESSMENT

This section outlines the procedure and results of the threatened species 'likelihood of occurrence' assessment conducted for this report. The assessment was undertaken using available desktop information – databases of existing records and potential species – and field survey data collected by EcOz staff in July 2021. The purpose of this assessment is to identify those species that may need to be included within the project's risk assessment, and those that can be reasonably excluded from further consideration because they are unlikely to occur within EP144. This process is <u>not</u> a risk assessment as it does not take into account project activities and their potential impacts.

# 4.1 Categories

The International Union for the Conservation of Nature (IUCN) nominates a set of criteria used to identify species at risk of extinction. These criteria are used to define categories of risk which are used by the Northern Territory Government to determine which threatened species are listed under the *TPWC Act*, and by the Commonwealth Government to determine which threatened species are listed under the *EPBC Act*. This report focusses on species that are listed as Vulnerable, Endangered or Critically Endangered under the *TPWC* Act, the *EPBC* Act or both.

### 4.2 Procedure

A 'likelihood of occurrence' assessment for threatened species was undertaken based on all the information available regarding the current state of the environment within EP144. The assessment considered the habitats present, historic regional records of threatened species, new threatening processes, any changes in the conservation status of species, and changes in surrounding habitat availability and quality. The following procedure was used to determine which threatened species have the <u>potential to occur in EP144</u>:

- Species records from the latest version of the <u>NT Atlas</u> were clipped to the Gulf Upland and Falls and Mitchell Grass Downs bioregions. Bioregions give a broad area with largely similar habitat characteristics and species assemblages. Clipping data to them ensures all potential species are captured in order to undertake a project-specific 'likelihood of occurrence' assessment.
- <u>EPBC Protected Matters Search Tool</u> (PMST) was used to generate a report using a 150 km buffer from EP144. This PMST is an online enquiry tool managed by the Commonwealth Department of Agriculture, Water and the Environment (DAWE) which interrogates a range of existing flora and fauna data, as well as predictive modelling to speculate on the presence of species within a search area. The PMST uses a grid system to determine which protected matters it encapsulates for a particular search. The PMST report (Appendix D) was generated on 8 September 2021.
- For each threatened species, the likelihood of it occurring <u>within EP144</u> was then assessed based on desktop information that relates to habitat requirements, distribution, number and dates of proximate records (obtained from NT Atlas), the ecological information described in Section 2, and the field survey results. Likelihood ratings are defined in Table 4-1.
- Threatened species that occur exclusively in marine environments were excluded.



#### Table 4-1. Ratings for the desktop threatened species likelihood of occurrence assessment

Likelihood	Definition
HIGH	It is expected that this species is present within EP144 because there is core habitat and recent proximate records.
MEDIUM	This species may occur within EP144 because there is suitable habitat; however, there is evidence that lowers its likelihood of occurrence (known range contraction of the species in the region, no recent records with the search area, substantial loss of habitat within EP144 since previous records, species is naturally rare or occurs at a low density etc.).
LOW	This species may occur as a vagrant within EP144; however, there is only marginally suitable habitat.
NONE	There is strong evidence that this species will not occur within EP144 (no suitable habitat and/or the species is considered likely to be regionally extinct).

### 4.3 Likelihood of occurrence assessment

The desktop assessment identified a list of 42 threatened species that were considered within the likelihood of occurrence assessment (Appendix E). Seven species are considered to have a high or medium likelihood of occurrence within EP144 (Table 4-2). These species require consideration within the EIS. All other species can be excluded from further assessment because they are unlikely to occur within EP144.

A meeting was held with the Flora and Fauna Division of the Department of Environment, Parks and Water Security (DEPWS) to ensure that these results aligned with the concerns of the Department. Only the four species considered to have a high likelihood of occurrence within EP144 are discussed below.



19.000.00	Common	Scientific	0	Status	5	Oran habitat
Likelinood	name	name	Class	EPBC	TPWC	Core nabitat
	Grey Falcon	Falco hypoleucos	Bird	VU	VU	Lightly timbered lowland plains
HIGH	Floodplain Monitor	Varanus panoptes	Reptile	Nominated for listing	VU	Various – incl. coastal beaches, floodplains, grasslands and woodlands
	Plains Death Adder	Acanthophis hawkei		VU	VU	Cracking clays
	Tobermorey Melon	Austrobryonia argillicola	Plant	1. <del>1</del> . 1.	VU	Along creeks and in areas with poor drainage
	Blue Grass	Dichanthium setosum		VU	3 <del>1</del>	Heavy black soils and/or stony red-brown loamy soils
MEDIUM	Gulf Snapping Turtle	Elseya lavarackorum	Dentile	EN	•	Calvert and Nicholson River systems
	Mertens' Water Monitor	Varanus mertensi	Reptile		VU	Coastal and inland waterways

Table 4-2. Threatened species 'likelihood of occurrence' assessment (medium and high likelihood species only)

VU - Vulnerable, EN - Endangered

#### 4.3.1 Grey Falcon (Falco hypoleucos)

Grey Falcons (listed as Vulnerable under *TPWC* Act and *EPBC* Act) live in lightly-timbered lowland plains, typically on inland drainage systems, where the average annual rainfall is less than 500 mm. They occur at low densities and are mostly seen as singles or pairs. Grey Falcons use nests built by other species, preferably in the tallest trees along watercourses. They are found through much of the arid and semi-arid areas of Australia and have been recorded in all Australian mainland states and territories. The majority of records from the Northern Territory are from the southern half, but records exist all the way north to Darwin (Ward, 2012).

The NT Fauna Atlas records nine undated observations of Grey Falcons within EP144, mostly in pairs. There were no sightings of this species or its nests during the July 2021 field survey. As individuals of this species are highly mobile, it is unlikely that it will be affected by the proposed works. However, habitat for this species should be protected through the avoidance of large old trees – in particular large Coolibah trees along the watercourses – and minimising the removal of riparian vegetation.

#### 4.3.2 Plains Death Adder (Acanthophis hawkei)

The Plains Death Adder (listed as Vulnerable under *TPWC* Act and *EPBC* Act) has a patchy distribution and is known to occur on the cracking soils on floodplains of the Adelaide, Mary and Alligator Rivers, the Barkly Tableland on the Northern Territory / Queensland border, and the Mitchell Grass Downs of western Queensland. Radio tracking data suggests they are nomadic and do not have definable home ranges. There is currently no data on the conservation status of the Barkly Tablelands populations although the species is known to occur in lower densities in the region, if compared to the coastal floodplains of the NT Top End (Phillips, 2012). One of the main threats to the Plains Death Adder is ingestion of toxic Cane Toads (*Rhinella marina*). The drier conditions of the Barkly Tablelands prevent the spread of Cane Toads; however, they have been sporadically observed in the region (Phillips et al., 2010)



No sightings of Plains Death Adders were made during the July 2021 field survey. There are three records of this species within EP144 in The NT Fauna Atlas, all within Alexandria Station. One of them from 1978 within riparian vegetation along the Playford River, 1.5 km away from the Ranken Road crossing. The other two records are not dated and are located greater than 5 km away from the project footprint. The Plains Death Adder is considered to have a high likelihood of occurrence within the project area based on the presence of suitable habitat (e.g. cracking clay soils), the low suitability of the environment to support Cane Toad populations, and the number of historic records. Ideally, the species occurrence should be investigated during the wet season, when it is known to be more mobile (Phillips, 2012). Where possible, project works should avoid impacts to cracking clay soils to minimise impacts to this species.

#### 4.3.3 Tobermorey Melon (Austrobryonia argillicola)

Tobermorey Melon (listed as Vulnerable under *TPWC* Act) occurs in inland northern Australia regions from the Barkly Tablelands of the Northern Territory to Central western Queensland. It is recorded from the Georgina, Diamantina and Thompson River catchments where it occurs along creeks and in poorly drained areas on cracking clay plains (Schaefer et al., 2008). It has been recorded from Bluebush swamps (dominated by *Chenopodium auricomum*), Gidgee (*Acacia georginae*) shrubland and riparian woodlands dominated by *Eucalyptus camaldulensis*. The species is rare in the NT and is currently known from only five locations in the central-east (Nano et al., 2012).

Threatening processes for this species are unknown but Nano et al. (2012) state that "the preferred habitat of this species is favoured by stock and feral animals: there is no information available about its tolerance of grazing. Pastoral and infrastructure (e.g. road and seismic lines) developments in Austrobryonia argiilicola habitat could have a major negative impact on this species." ().

Tobermorey Melon was not recorded in the project area during the field assessment. There are also no records of the species within EP144 in the NT Fauna Atlas. The nearest record is from near Lake Sylvester, approximately 50 km west of the project area.

Despite the lack of records for this species, suitable habitat is present, particularly along the waterways. As such, Tobermorey Melon is considered to have a high likelihood of occurrence within the project area.

#### 4.3.4 Floodplain Monitor (Varanus panoptes)

The Yellow-spotted or Floodplain Monitor (listed as Vulnerable under the TPWC Act) is a large terrestrial monitor that can grow up to 1.4m. It is a robust ground-dwelling monitor occupying a variety of habitats, including coastal beaches, floodplains, grasslands and woodlands. It feeds primarily on small terrestrial vertebrates and insects, and lays a clutch of eggs in a burrow, usually in the wet season (Ward et al. 2012).

The species once occupied a variety of habitats, including coastal beaches, floodplains, grasslands and woodlands, across the extent of northern Australia. However, its propensity to eat Cane Toads and die from the ingested toxins has caused a significant decline in the population (Ward et al. 2012). Persistence of the Floodplain Monitor is often correlated with areas that are generally unsuitable for Cane Toads. There are 10 records of Floodplain Monitor within 150 km of EP144. Four of these records are from Connells Lagoon Conservation Reserve, the most recent of which was recorded in 2016. Based on these recent records within the broader EP144 area, the Floodplain Monitor is considered to have a high likelihood of occurrence within the project area.



# 5 THREATENING PROCESSES

A number of threatening processes were identified within and surrounding the project area. These are discussed below.

## 5.1 Weeds

#### **Regional Context**

Some species of introduced flora are declared weeds under the NT *Weeds Management Act* because of the harm they can cause. Class A weeds must be eradicated by landowners and occupiers. Class B weeds must have their growth and spread controlled by landowners and occupiers. The remaining introduced flora species are referred to as *environmental weeds*. The Commonwealth Government has also categorised some species as Weeds of National Significance (WoNS).

Weed distribution is often related to environmental disturbances caused by the construction of roads and tracks, cattle grazing and feral animals. Weeds are most prevalent on land under pastoral lease, with infestations generally concentrated around infrastructure such as water points, fence lines, tracks, and also along the banks of watercourses where cattle and feral animals tend to congregate.

A review of the NT Weed Branch weed dataset shows that there are very few weed species recorded within EP144 and within a 100 km radius. This does not necessary mean that there are few weed infestations in the region; instead it may reflect remoteness of the area has prevented extensive surveys. By far the most frequently reported species in the area is Parkinsonia (*Parkinsonia aculeata*). This Class B weed grows in a wide range of climates and soil types.

EP144 lies within the *Tennant Creek Regional Weeds Strategy 2021-2026* (DEPWS 2021). That plan focusses on weeds that are most important to the region, categorising them as either:

- Category 1 Priority weeds (present in the region, widely considered feasible to eradicate from the Region, typically evaluated as very high risk and have isolated and restricted distributions).
- Category 2 Priority weeds or strategic control including the eradication of outliers (species warranting strategic control across the landscape due to the high impact they have on land managers and on broader economic and environmental values).
- Category 3 Weeds of concern (assessed by the weed risk management system as a medium to high risk, or have not been assessed, but have been identified by stakeholders as posing a threat to the values of the Region).
- Category 4 Hygiene and biosecurity weeds (it is important for landholders to implement weed hygiene and other biosecurity measures to prevent the spread of weeds into clean areas, and to control these species where the opportunity arises).
- Category 5 Alert weeds (have the potential to have a high level of impact to the region should it become established, the likelihood of the species naturalising and spreading in the region is perceived to be high).

Table 5-1 outlines the weeds listed in the Tennant Creek Regional Weeds Strategy. Buffel Grass (*Cenchrus ciliaris*) is described in the plan as a significant threat but, because of its value to pastoralists, is not a declared weed.



Common name	Botanical name	Class	WoNS	Status in the management plan
Bellyache Bush	Jatropha gossypiifolia	Α	Yes	Category 1
Mesquite	Prosopis spp.	Α	Yes	Category 1
Prickly Acacia	Acacia nilotica	Α	Yes	Category 1
Athel Pine	Tamarix aphylla	Α	Yes	Category 2
Parkinsonia	Parkinsonia aculeata	В	Yes	Category 2
Rubber Bush	Calotropis procera	В	No	Category 2
Burr – Noogoora	Xanthium strumarium	В	No	Category 3
Buffel Grass	Cenchrus ciliaris	65 <del>,</del> 61	No	Significant threat

Table 5-1.	Weed s	pecies re	levant to	<b>EP144</b>
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The NT Government Weed Management Branch was consulted on the survey approach and agreed that the lists covered all weeds for which surveys should be conducted. The agreed approach was to walk all disturbance areas to search for weeds.

#### Weeds within the project footprint

Weed species recorded during the field survey are listed and described in Table 5-2 and their occurrence is shown in Figure 5-4. Results indicate that weeds are mainly concentrated along the major drainage lines. No Category 1 species were recorded during the survey.

Parkinsonia (*Parkinsonia aculeata*) – a Category 2 weed – is widespread along the drainage lines, including within the project footprint. This species is also a declared WoNS and listed as a Class B weed in the NT. The field survey recorded multiple infestations in close proximity to the access tracks that represent high risk of spread. The location of identified weeds are presented in Figure 5-4 with a representative photograph in Figure 5-1.

Noogoora Burr (*Xanthium strumarium*) – a Category 3 weed – was recorded in a moderate infestation within the project footprint. It is also a declared Class B weed in the NT. The risk of spreading this weed is high due to the infestations location at the intersection between Ranken Road and Playford River (see photograph in Figure 5-2 and location of records within Figure 5-4).

Athel Pine (*Tamarix aphylla*) – a Category 2 weed – was observed at a single location outside the project footprint. It is a declared WoNS and a Class A species in the Barkly Region. Although this infestation was located outside of the project footprint adjacent to a turkey nest dam on Alexandria Station (photographs provided in Figure 5-3 and location in Figure 5-4), prompt control measures and hygiene protocols must be implemented to ensure that it is not spread further.

Species	Status	Occurrence	Comment
Parkinsonia (Parkinsonia aculeata)	Class B Category 2 (Very High Priority)	Six sites (two along the Playford River, one along Eastern creek, two along Buchanan Creek, and one in a minor drainage in Ranken Rd.)	This is a WoNS. It is widespread in the Playford River and Buchanan Creek banks within Alexandria Station (DEPWS 2021a).

#### Table 5-2. Weed species observed during field surveys, July 2021



Species	Status	Occurrence	Comment
Noogoora Burr (Xanthium strumarium)	Class B Category 3 (High Priority)	One site (along the Playford River crossing in Ranken Rd.)	There is no plan or strategy published for the management of this weed species. Seeding plants were widespread.
Athel Pine (Tamarix aphylla)*	Class A Category 2 (Very High Priority)	One site adjacent to a turkey nest dam	This species is a WoNS. The project footprint is located within the Athel Pine Weed Eradication Zone (Class A) (DEPWS 2021b).

\* Found outside of project footprint however, important to be avoided to prevent spread and further infestations.



Figure 5-1. Photograph of Parkinsonia (Parkinsonia aculeata) infestation along the Playford River with detail of its branches and leaves.





Figure 5-2. Photograph of Noogoora Burr (*Xanthium strumarium*) infestation along the Playford River with detail to a single plant and its dry fruits.





Figure 5-3. Photograph of the Athel Pine (*Tamarix aphylla*) infestation near a turkey nest dam in Alexandria Station.



Path: 2:101 EoOz\_Documents/04 EcOz Vantage GISIE219191 - Hancock - EMP EP144/01 Project Files/Report maps/Figure 5 4. Map of weed occurrences and drainage within, or adjacent to, the project footprint/mod

Figure 5-4. Map of weed occurrences within, or adjacent to, the project footprint on EP144



### 5.2 Pest animals

According to the NT Fauna Atlas, the introduced fauna species listed in Table 5-3 are widespread and abundant within the region, and hence likely to occur within EP144. Feral cats and pigs are both listed as a Key Threatening Process under the *EPBC Act*. Wild dogs refer to feral dogs (e.g. descended from domestic dogs) and not to the native Dingo (*Canis lupus dingo*).

Common name	Scientific name	Habitats	Impacts
Feral Cattle	Bos taurus	Various	
Feral Horse	Equus caballus	Grassland and shrubland	Erosion of soil and watercourses, weed spread, trampling and consumption of native flora, and sedimentation and increased nutrient levels in
Feral donkey	Equus asinus	Various	watercourses
Wild Dog	Canis lupus familiaris	Various	Prey on many species of native animals
Feral Cat	Felis catus	Various	
Feral Pig	Sus scrofa	Riparian areas and wetlands	Physical damage to wetlands
House Mouse	Mus domesticus	Various	Compete with native species. May impact upon native vegetation via seed predation
Black Rat	Rattus rattus	Various	May impact upon vegetation and outcompete native species
One-humped Camel	Camelus dromedarius	Various	Trampling, suppression of plant recruitment, damage to wetland and riparian areas, and competition with native animals for food and shelter
Rock Pigeon	Columba livia	Various	Compete with native species. May impact upon native vegetation via seed predation

Table 5-5. Test annuals that may occur within Er 144 (NT Faula Atlas)
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### 5.3 Pastoralism

The project area is located within several active pastoral properties:

- Adder Station
- Alexandria Station
- Alroy Downs
- Brunette Downs
- Mittiebah Station
- Rocklands Station
- Mount Drummond Station

Consequently, environmental impacts typically associated with pastoralism are expected to occur within EP144 (i.e. increased weeds, erosion, degradation of wetlands and riparian habitats, changes to soil surface structure/infiltration, water source degradation and altered fire regimes – DEWHA 2009). Cumulatively, these impacts can have a negative influence on biodiversity. Pastoralism is implicated in the decline of some vertebrate species and changes in plant species composition in the Australian rangelands (Fisher et al. 2002).



Pastoral impacts have particularly affected mammals – especially larger dasyurids, rodents, bandicoots and smaller macropods (Woinarski et al. 2001 – cited in DEWHA 2009).

Alexandria Station is highly impacted by pastoral activities. Vegetation composition and structure has been completely modified, with widespread areas of denuded ground layer, compacted soils and high erosion risk throughout the Station, including the drainage lines. Consequently, biodiversity values supported in areas of intensive grazing are very low. These poor conditions are reflected in the sections of the project footprint which cross the station, namely Ranken Road (Figure 5-5) and the proposed access tracks (Figure 5-6).

Mittiebah Station has been more successful in managing their pastoral activities, and cattle impact in this area is considered low. The proposed access tracks footprint crossing this Station overlaps existing and well-maintained roads (Figure 5-7). The current locations of the proposed drill holes and campsites are located in areas with low to no apparent cattle impact (Figure 5-7 and Figure 5-8).



Figure 5-5. Photograph of overgrazed grassland along Ranken Road adjacent to Alexandria Station. Detail shows the exposed and trampled soil.





Figure 5-6. Photograph of access track location within Alexandria Station showing severe grazing impacts within riparian vegetation along a minor drainage.



Figure 5-7. Photograph of good quality woodland with low to null pastoral impact between proposed Drill Hole 1 and the access tracks in Mittiebah Station.





Figure 5-8. Photograph of Mitchell grass Grassland with low to null pastoral impact in the area of proposed campsite and Drill Hole 2, Mittiebah Station.

### 5.4 Fire

Fires are a regular occurrence in the region. Regional fire history and fire scar mapping was obtained through the <u>Northern Australia and Rangelands Fire Information</u> website. Over the past ten years, most of EP144 has not burned. The only areas that have burnt are within the land systems associated with the Gulf Fall and Uplands bioregion, where fires have occurred one or two times in the last ten years (Figure 5-9).



Path: Z:101 EcOz\_Documents104 EcOz Vantage GIS/E219191 - Hanoock - EMP EP144/01 Project Files/Report maps/Figure 5 9. Fire history within and around EP 144.mxd

#### Figure 5-9. Fire history within and around EP144



### 5.5 Land Condition Assessment

Each survey site has been assigned a land condition category that is graded against the criteria outlined within Table 5-4. If a site aligned with two or more criteria within a row, it was assigned that condition category. Only analogue vegetation assessment sites, waterway crossing sites, and the proposed location of the two drill holes and the campsite have been included within this assessment, as the weed survey sites recorded weeds only and no other additional data, thus can't be assessed using this method. General comments on other areas have also been provided.

Condition	Vegetation	Erosion	Weeds	Cattle
GOOD	Vegetation structure intact, all expected layers present	No erosion	No weeds	Negligible impact
AVERAGE	Vegetation structure altered, basic vegetation structure present	Some erosion	Few weeds	Some impact
POOR	Vegetation structure severely impacted, some strata are absent	Significant erosion	Many weeds	Significant impact

Table 5-4. Categories of lan	d condition
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The land condition rating for each of the analogue vegetation sites and waterway crossing sites has been provided in Appendix B and Appendix C, respectively. Of the six analogue sites assessed, four are considered to be in good condition (Vegetation Sites 2, 3, 5 & 6) and two sites in average condition (Vegetation Sites 1 and 4). These latter two sites are considered in average condition due to the disturbance impacts from cattle and loss of vegetation structure. Of the five waterway crossing sites are considered to good condition (D2 & D4), one site in average condition (D1) and two sites are considered to have poor condition (D3 and D5). These latter two waterway crossing sites are subject to significant impacts from cattle, including trampling and removal of understorey vegetation.

The proposed drill holes and the campsite are located in areas deemed in good condition. The access tracks cross areas in poor condition, especially on Alexandria Station where the land is heavily affected by cattle and infested by weeds in the drainage lines. Ranken Road crosses areas of equally poor conditions, except for the Connells Lagoon Conservation Reserve that supports intact vegetation structure and no apparent weed infestations.



# 6 **RECOMMENDATIONS**

The drilling exploration program will include the removal of native vegetation and fauna habitat within the two proposed drill pads, the camp site and potentially along access tracks. These works will include areas supporting significant vegetation as per the NT Land Clearing Guidelines (DNRE 2020): riparian vegetation, and areas supporting large hollow bearing trees. Further, there is potential for the works to impact on threatened species. The potential impacts to significant vegetation and potential habitat for threatened species can largely be avoided and/or minimised if appropriate control measures are undertaken. The introduction and spread of weeds and erosion has been identified as a major risk to the ecological values of the project area. As such, the following recommendations are made:

- Travel between project area sites using existing tracks, roads, and trails only.
- During exploration activities, all vehicles, plant, and equipment should be certified weed-free prior to entry into the project area. Weed hygiene protocols must be implemented to ensure that weeds are not introduced or spread through the site.
- All vehicles, plant, and equipment should be certified weed-free prior to entry into the project area.
- Control existing weed infestations and avoid the spread of Parkinsonia, Noogoora Burr and Athel Pines. Weed control to focus on waterway crossing points where infestations are established, and any other area of disturbance.
- An erosion and sediment control plan must be developed as per the *NT Land Clearing Guidelines* (DEPWS 2021). This plan must outline measures to minimise impacts associated with waterway crossings and other erosion prone landforms.
- Where possible, avoid and minimise impacts to riparian vegetation. Apply buffers to waterways according to their stream order as per the NT Land Clearing Guidelines (DNRE 2020). This will also minimise impacts to potential habitat for TPWC Act-listed Tobermorey Melon.
- Avoid clearing all large old trees notably Coolibah trees along watercourses and large Snappy Gums near Drill Hole 1.
- Consider moving the location of the campsite from within the area supporting 'good' quality Mitchell grass Grassland to an area already degraded and denuded within Alexandria Station.
- Avoid or minimise impacts to cracking clay soils where possible that may provide habitat for the Plains Death Adder. Where excavation is occurring on cracking clay soils, a fauna spotter could be present to avoid impacts to this species.
- Produce a rehabilitation plan for all the disturbed areas, aiming to replicate the environmental conditions of the sites prior to the disturbances (i.e. refer to analogue sites).



# 7 SUMMARY OF EXPLORATION ACTIVITY SITES

This section provides a summary of the key findings within each of the proposed work areas. The summary includes the proposed work areas, ecological values, threatening processes, potential impacts and recommendations.

# 7.1 Ranken Road and other access tracks

- Ranken Road is located off the Tablelands Highway and runs from near the north-west corner of EP144 in a south-east direct towards the southern boundary of the EP. Over 100 km of Ranken Road is located within EP144.
- Additional clearing may be required to clear the access route to transport associated drilling equipment. It is proposed that the access track has a clearance area of 4 m width along it's length.
- Ranken Road intersects the following Landscape class (Land systems): clay plains (Barkly1, Barkly2, Barkly3), lateritic plains and rises (Wonorah) and sandstone plains and rises (Yelvertoft) see Table 2-1 and Section 3.2.
- Avoid clearing all large old trees notably Coolibah trees along watercourses and large Snappy Gums near Drill Hole 1.
- There are two waterway crossings sites along Ranken Road (D1 Playford River and D5 Buchanan Creek) and three waterway crossing sites along the station access track (D4 Playford River, D3 Eastern Creek and D2 unnamed drainage line). Waterways will be buffered according to Table 3-1.
- Parkinsonia\* was recorded along the Buchanan Creek at D5. Both Noogoora Burr\* and Parkinsonia\* were recorded at D1, and only Noogoora Burr\* at WC3- see Figure 5-4.
- All waterway crossing sites have a moderate erosion potential, except for D1 (Playford River) that is considered to have a low risk, and D3 (Eastern Creek) that is considered to have a high erosion risk.
- Avoid removal of large old hollow bearing trees along the waterways (e.g. Coolibah) or woodland environs.
- Potential habitat for Tobermorey Melon along the drainage lines. Avoid and minimise impacts to riparian and drainage line vegetation.
- Implement the erosion and sediment control plan to minimise impacts on waterways and other erosion prone landforms.

# 7.2 Drill Hole 1

- Drill hole 1 is located in the central north of EP144 and is accessed via Ranken Road and the station access track.
- The drill pad will occupy an area of approximately 1 ha (100 m x 100m) in size.
- Additional clearing may be required to clear the access route to transport associated drilling equipment.
- Drill hole 1 intersects the following Landscape class (Land systems): sandstone plains and rises (Yelvertoft) see Table 2-1 and Section 3.2.
- The proposed drill hole is located within good quality native vegetation, with no weeds and negligible impacts from pastoral activities (Figure 5 7 and Figure 5 8).
- Avoid clearing all large old trees notably the large Snappy Gums near Drill Hole 1.

# 7.3 Drill Hole 2

• Drill hole 1 is located in the north and accessed via Ranken Road and station access track.



- Additional clearing may be required to clear the access route to transport associated drilling equipment.
- The drill pad will occupy an area of approximately 1 ha (100 m x 100 m) in size, with a total clearance of native vegetation of 1.25 ha.
- Drill hole 1 intersects the following Landscape class (Land systems): clay plains (Barkly2) –see Table 2-1 and Section 3.2.
- Clay plains may support cracking clay soils that could provide potential habitat for the Plains Death Adder (listed as Vulnerable under TPWC Act and EPBC Act). Impacts to these areas should be avoided or minimised. Should impacts be proposed, further discussion with DEPWS will be required.
- The proposed drill hole is located within an area supporting good quality native vegetation, with low to no apparent cattle impact and no weeds (Figure 5 7 and Figure 5 8).

## 7.4 Campsite

- The camp will occupy an area approximately 1 ha (100 m x 100 m) in size.
- The campsite is located adjacent to Drill Hole 2 and accessed via the station access track.
- The camp site intersects the following Landscape class (Land systems): clay plains (Barkly2 and Barkly3) see Table 2-1 and Section 3.2.
- Clay plains may support cracking clay soils that could provide potential habitat for the Plains Death Adder (listed as Vulnerable under TPWC Act and EPBC Act). Impacts to these areas should be avoided or minimised. Should impacts be proposed, further discussion with DEPWS will be required.
- The proposed campsite is located in an area supporting good quality native vegetation, with low to no apparent cattle impact and no weeds (Figure 5 7 and Figure 5 8).
- It is recommended that the location of the campsite be moved from within the area supporting 'good' quality Mitchell grass Grassland to an area already degraded and denuded within Alexandria Station.



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# APPENDIX A LAND SYSTEMS OF EP144

Land system	Landform	Soil	Vegetation	Percentage within EP144
Alluvial floo	odplains			
Frog	Broad sandy floodplains, terraces and lower colluvial slopes	Deep siliceous and earthy sands, sandy yellow earths and sandy solodic soils	Mid-high open woodland of <i>E.</i> tectifica, <i>C.</i> terminalis, Erythrophleum chlorostachys, Brachychiton diversifolius, <i>C.</i> latifolia over Chrysopogon fallax, Sorghum plumosum, Sehima nervosum	0.005
McAuthur	Broad or narrow fluvial corridors conducting regional drainage across various land systems towards the coast. Grey and brown clays and siliceous sands. Mid-high open woodland of <i>E.</i> <i>terminalis</i> and <i>E. microtheca</i> with some <i>E. papuana</i> and <i>E.</i> <i>polycarpa</i> . Tall fringing riparian vegetation often includes <i>Melaleuca spp</i> .	Grey and brown clays, red and yellow earths and siliceous sands	Mid-high open woodland of C. terminalis, E. microtheca, Excoecaria parvifolia, Lysiphyllum cunninghamii, C. papuana over Chrysopogon spp., Eulalia fulva, Iseilema vaginiflorum	0.355
Basalt hills				
Cliffdale	Gently undulating to hilly terrains on basalt, dolerite, agglomerate and other volcanic and sometimes no- volcanic rocks. Lithosols with rock outcrop and red and black earths and red clays. Highly erodible, especially the sloping red soils. Mid- high open woodland of <i>E.</i> <i>tectifica</i> , <i>E. terminalis</i> and <i>Erythrophleum chlorostachys</i> .	Lithosols, euchrozems, red and black earths and red clays	Mid-high open woodland of E. pruinosa, E. tectifica, C. terminalis, Erythrophleum chlorostachys, Brachychiton diversifolius over Chrysopogon fallax, Sehima nervosum, Sorghum plumosum.	0.291
<b>Clay plains</b>		-		
Austral	Level to gently undulating clay plains Broad almost flat sand plains	Black soil plains, cracking clay soils Yellowish siliceous sands	Low open woodland of C. setosa, Melaleuca nervosa, Acacia spp., Petalostigma pubescens, Melaleuca symphyocarpa over Plectranchne pungens, Chrysopogon fallax, Sorghum spp.	5.393
Barkly1	Level to gently undulating clay plains (black soil plains); cracking clay soils. Up to 20% contains gravelly rises	Vertosols	Astrebla tussock grassland	19.490
Barkly2	Level to gently undulating clay plains (black soil plains); cracking clay soils. Up to 20- 60% contains gravelly or stony rises	Vertosols	Astrebla tussock grassland	18.755
Barkiy3	Level to gently undulating clay plains (black soil plains); cracking clay soils. Over 60% contains gravelly or stony rises	Vertosols	Mixed species tussock grassland	19.703



Land system	Landform	Soil	Vegetation	Percentage within EP144
Creswell	Erosionally-stable, gently undulating plains and rises on ferrugunised Lower Cretaceous sediments (laterite)	Ferruginous lithosols, lateritic podsolics, red and yellow earths, earthy sands and brown clays	Mid-high open woodland of C. dichromophloia, C. bleeseri, E. tetrodonta, Erythrophleum chlorostachys with isolated stands of A. shirleyi on crests over Chrysopogon fallax, Plectrachne pungens, Sorghum plumosum	1.434
Gallipoli	Broad, very gentle sloping to flat clay plains of the Barkly Tableland, formed on the Camooweal Dolomite. Grey and brown clays. Tall grassland of Astrebla spp. with Chrysopogon fallax and Eulalia fulva.	Grey and brown clays	Tall grassland of Astrebla spp., Chrysopogon fallax and Eulalia fulva	4.062
Joanundah	Several small areas on gently undulating black-soil plains. Alluvial floodplains, swamps, drainage depressions and alluvial fans; sandy, silty and clay soils on Quaternary alluvium	Northern Heavy Grey Pedocals or transition to Tertiary lateritic flat soils	Low open woodland of <i>E.</i> microtheca, <i>Excoecaria</i> parvifolia, <i>Bauhuna</i> cunninghamii, <i>Acacua</i> stenophylla over mixed tussock grasses	1.399
Sylvester	Level to gently undulating clay plains (black soil plains); cracking clay soils	Vertosols	Open shrubland Chenopodium auricomum, Muehlenbeckia florulenta, low woodland of E. microtheca, E. coolabah, Acacia stenophylla over tussock grasses	1.692
Lateritic plai	ins and rises	-		
Boomerang	Broad, almost flat colluvial plains around the margins of the Barkly Tableland clay plains. Red earths and minor earthy sands. Mid-high open woodland of <i>E. Pruinosa</i> with some <i>Lysiphyllum</i> <i>cunninghamii</i> .	Red earths and minor earthy sands.	Mid-high open woodland of <i>E.</i> pruinosa, Lysiphyllum cunninghamii over Eulalia fulva, Chrysopogon fallax, Aristida spp.	0.956
Elliot	Undulating rises to rolling rises on sedimentary rocks. Lateritic plains and rises. Plains and rises associated with deeply weathered profiles (laterite) including sand sheets and other depositional products; sandy and earth soils	Kandosols or Tenosols	Low-mid open woodland or tall sparse shrub land of <i>Corymbia</i> <i>spp., Acacia aneura, E.</i> <i>dichromophloia</i> over mixed tussock and hummock grassland.	4.588
Wonorah	Level to gently undulating clay plains; cracking black soils. Higher parts of plain: lightly- stripped, stony surfaces with outcrops of weathered rock and surface limestone; disorganised surface drainage. Lower parts of the plain: flat plains with no surface drainage.	Vertosols	Open tussock grassland of Astrebla pectinata	6.154



Land system	Landform	Soil	Vegetation	Percentage within EP144	
Bukalara	Rugged rocky plateaux and steep, linear ridges on massive sandstone such as the Bukalara Sandstone. Lithosols and shallow siliceious sands. Mid-high open woodland of <i>E.</i> <i>dichromophloia</i> with <i>E.</i> <i>miniata, E. tetrodonta</i> and <i>E.</i> <i>leucophloia.</i>	Lithosols and shallow siliceous sands	Mid-high open woodland of C. dichromophloia, E. miniata, E. tetrodonta, Erythrophleum chlorostachys over Plectrachne pungens, Chrysopogon fallax, Eriachne obtusa.	0.845	
Sandstone h	ills				
Mt Isa	Rugged, hilly country with north-south ridges; mostly outcrops or skeletal soils	Rock outcrops or skeletal soils on acidic rocks. Colluvial stony slopes some shallow yellow podzolic soils	<i>E. breviflora</i> woodland	1.450	
Sandstone p	lains and rises				
Downs	Gently undulating plains and rises on mainly fine-grained sandstones. Sandy yellow earths and siliceous sands. Mid-high woodland of <i>Melaleuca viridiflora</i> with <i>Pandanus spiralis</i> and <i>E.</i> <i>polycarpa</i> .	Sandy yellow earths and siliceous sands	Mid-high woodland of Melaleuca viridiflora, C. polycarpa, C. latifolia, Erythrophleum chlorostachys, Brachychiton diversifolius over Chrysopogon fallax, Sorghum plumosum, Themeda triandra.	0.020	
Emmerugga	Undulating to rolling low hills on mainly argillaceous sediments. Lithosols and shallow yellow earths. Mid- high open woodland of <i>E.</i> <i>leucophloia</i> with some <i>E.</i> <i>tectifica, E. terminalis</i> and <i>Erythrophleum chlorostachys.</i>	Lithosols and shallow yellow earths	Mid-high open woodland of C. latifolia, C. grandifolia, E. tectifica, C. confertiflora, Erythrophleum chlorostachys over Chrysopogon fallax, Themeda triandra, Sorghum plumosum	0.056	
Mitchiebo	Plains, rises and plateaux on mostly on sandstone, siltstone, claystone, shale and some limestone; commonly shallow soils with surface stone and rock outcrop	Slightly truncated lateritic red earths or lateritic podzolic soils. Skeletal soils on lateritic horizons or underlying rock. Podsolised desert alluvial soils	Woodland or shrub woodland vegetation	4.305	
October	Very rocky gentle undulating rises on massive sandstones. Lithosols. Mid-high open woodland of <i>E.</i> <i>dichromophloia</i> .	Lithosols	Mid-high open woodland of C. dichromophloia, E. phoenicea, Erythrophleum chlorostachys, C. ferruginea, E. tetrodonta over Plectrachne pungens, Chrysopogon fallax, Sorghum plumosum	0.115	
Seigal	Gently undulating to undulating rises with abundant, often linear rocky outcrops and shallow sandy soils. Lithosols, minor siliceous and earthy sands. Mid-high open woodland of <i>E. miniata, E. tetrodonta</i> and <i>E. ferruginea with E.</i> <i>Dichromophloia</i> and <i>E.</i> <i>leucophloia</i> .	Lithosols, minor siliceous and earthy sands	Mid-high open woodland of <i>E.</i> miniata, <i>E. tetrodonta</i> , <i>C.</i> ferruginea, <i>C. dichromophloia</i> , Callitris intratropica over Plectranche pungens, Sorghum plumosum.	0.292	



Land system	Landform	Soil	Vegetation	Percentage within EP144
Yelvertoft	Undulating terrain	Skeletal soils and truncated gravelly lateritic red earths	Dominated by Eucalyptus brevifolia or E. dichromophloia woodlands	8.641

C. = Corymbia, E. = Eucalyptus



# APPENDIX B ANALOGUE VEGETATION SITES

Reference site	Veg Site 1	Date	13	3-7-2021		
Vegetation type	Eucalyptus m	icrotheca s	parse low	woodland.	2	
Ground cover (%)	Vegetation	Leaf litter	Bare s	oil Rock	Gravel	
	30	20	40	0	10	and in
Other site notes	Plain with less brown (light) S	than 1% Soil. Low	slope. Cra cattle distur	cking clay / yell bance.	owish	- AND
Vegetation	Upper stratu	ım N	lid stratum	Ground	d stratum	
% cover	<5		10	1	30	The second second second
Height range (m)	6 – 7		1.5 – 2.5		< 1	
Dominant species	Eucalyptus microtheca	Cai lan Ata her E. (juv	issa ceolata laya niglauca microtheca eniles)	Cynodon Aristida s Eragrostis	dactylon p. s sp.	WGS 84 136.8618, -19.8287
Land Condition	Average					

Reference site	Veg Site 2	Date	16-7-3	16-7-2021	
Vegetation type	Whitewood (At Mitchell grass changing to str community.	talaya hem tussock gra rictly Mitche	<i>iglauca</i> ) spars assland ( <i>Astre</i> ell grass tusso	se low wood sbla pectina ock grasslar	lland over <i>ta</i> ), าd
Ground cover (%)	Vegetation	Leaf litter	Bare soil	Rock	Gravel
	90	2	5	0	3
Other site notes	Plain poorly dr by grazing (cat	ained. Gre ttle)	y clay / loam	with gravel.	Disturbed
Vegetation	Upper stratu	m Mi	d stratum	Ground	stratum
% cover	15		0	1	00
Height range (m)	5 - 12				< 1
Dominant species	Atalaya hemiglauca	N/A		Aristida inaequiglu Astrebla p Abutilon andrewsia Unknown Amaranth Eulalia au	ımis bectinata anum aceae ırea
Land Condition	Good				



Reference site	Veg Site 3	Date	1	15-7-2021		
Vegetation type	Whitewood (A mixed tussock	talaya h grassla	e <i>miglau</i> ca) l and.	_ow open wood	land over	
Ground cover (%)	Vegetation	Lea	af Bares er	soil Rock	Gravel	N TARAN
	80	5	10	0	5	
Other site notes	Plain. Red sa	ndy loar	m with grave	I. Low grazing	by cattle.	
Vegetation	Upper stratu	oper stratum Mid strat		n Groun	d stratum	
% cover	100		100		98	25
Height range (m)	4 – 8		1 – 4		< 1	
Dominant species	Atalaya hemiglauca	G C Ia	Grewia sp. Carissa Anceolata	Eragrosti Aristida inaequigi Eriachne Aristida I Senna ai oligophyl Unknowr Neptunia	is sp. lumis sp. atifolia temisioides la Asteraceae	WGS 84 137.1529, -18.8240
Land Condition	Good			T is the same		

Reference site	Veg Site 4	Date		14-7-2021					
Vegetation type	Eucalyptus mi shrubland.	crothec	a woodland	over (	Carissa lan	ceolata			
Ground cover (%)	Vegetation	Lea	af Bare er	soil	Rock	Gravel	A CAL		
	40	10	) 4	0	0	10			
Other site notes	Minor claypan Disturbed by c	depresattle.	sion. Brown	nish de	eep crackin	g clay soil.			
Vegetation	Upper stratu	ım	Mid stratum		m Mid stratu		Ground	stratum	The State - States
% cover	30	11-	10			40			
Height range (m)	5 – 8		1 – 5		< 1				
Dominant species	Eucalyptus microtheca Grevillea stria	ta A h	Carissa anceolata Malaya nemiglauca		Astrebla pectinata Aristida latifolia Eulalia aurea Sporobolus australasicus Eragrostis sp.		WGS 84 137.0636, -18.7858		
Land Condition	Average								



Reference site	Veg Site 5	Date	15-7-	5-7-2021		
Vegetation type	Low open woo hummock gras	odland over ssland.	spinifex (Tric	odia pungen	s)	
Ground cover (%)	Vegetation	Leaf litter	Bare soil	Rock	Gravel	
	60	15	10	0	15	The second states and
Other site notes	(Flood) plain v gravel. Low d	vith gentle s isturbance	outhwards sl by cattle (gra	ope. Red s zing).	andy loam /	ALL LAND
Vegetation	Upper stratu	ım Mi	d stratum	Ground	l stratum	
% cover	25	- 11	10		60	
Height range (m)	8 – 10		1-3		< 1	and a second
Dominant species	Eucalyptus pruinosa Hakea arborescens	Mela Caris Iance	leuca sp. ssa eolata	Triodia pungens Eragrostis sp. Eulalia aurea		WGS 84 136.9511, -18.7971
Land Condition	Good			]		

Reference site	Veg Site 6	Date	15-7	15-7-2021		
Vegetation type	Low open Euc pungens) hum	<i>alyptus</i> sp. mock gras	Woodland slands	over spinifex	(Triodia	
Ground cover (%)	Vegetation	Leaf litter	Bare soil	Rock	Gravel	
	40	10	50	0	0	*
Other site notes	Foot slope of loam	arge crest.	Red sandy	/ kandosols,	red sandy	
Vegetation	Upper stratum Mid stratum Ground stratum					
% cover	10	10 2			35	- FAMPESTER STATE
Height range (m)	5 - 7		1 – 5	<1		
Dominant species	Eucalyptus microtheca	Eucalyptus pruinosa Ehretia saligna Capparis umbonata Atalaya hemiglauca		Triodia pu Aristida h Eragrostis	ngens olathera s sp.	WGS 84 136.8969, -18.7914
Land Condition	Good					

# APPENDIX C SUMMARY OF DATA FROM WATERWAY CROSSING SITES

Reference site	D1	Date	13-7-2021			
Stream Order	5 - Playford River					
Vegetation type	Low open <i>Eucalyptus microtheca</i> woodland over Mitchell grass ( <i>Astrebla</i> spp.) tussock grasslands.					
Weeds	Parkinsonia and Noogoora Burr					
Erosion potential	Low. Ranken Rd. cr covered with concre	Low. Ranken Rd. crossing at this drainage site is covered with concrete.				
Cattle Impact	Significant trampling and grazing					
Recommendations	Monitor the site for erosion development due to transit of heavy machinery					
Land Condition	Poor					

Reference site	D2	Date	15-7-2021	
Stream Order	4 - Wild Cow Creek			We have the second
Vegetation type	Low open Eucalyptu Mitchell grass (Astre	<i>is microtheca</i> woo bla spp.) tussock	and a start	
Weeds	None			
Erosion potential	Moderate. Shallow of	drainage depressio		
Cattle Impact	Low			
Recommendations	Access track should transversely. Monito due to transit of hea	cross the drainag or the site for erosic vy machinery		
	Contraction of the		137.1170, -18.8429	
Land Condition	Good			

Reference site	D3	Date	15-7-2021	
Stream Order	2 – Eastern Creek			
Vegetation type	Open <i>Eucalyptus mic</i> soil.	rotheca woodlan	ANNON	
Weeds	None			
Erosion potential	High. Wide open char	nnel, steep denud		
Cattle Impact	Significant trampling	and grazing		
Recommendations	Access track should o transversely. Monitor due to transit of heav	cross the drainag the site for erosic y machinery	WGS 84 137.0650, -18.9767	
Land Condition	Poor			

Reference site	D4	Date	15-7-2021	
Stream Order	5 – Playford River			
Vegetation type	Open Eucalyptus micro grass (Astrebla spp.) t	otheca woodlan ussock grasslan		
Weeds	None			
Erosion potential	Moderate. Wide channel, steep banks			and the second s
Cattle Impact	Low			
Recommendations	Access track should cr transversely. Monitor t due to transit of heavy	ross the drainag he site for erosio machinery	WGS 84 137.0482, -19.9857	
Land Condition	Good			

Reference site	D5	Date	15-7-2021		
Stream Order	3 – Buchanan Creek			199 A	
Vegetation type	Open Eucalyptus micro grass (Astrebla spp.) s	otheca woodlan parse tussock g			
Weeds	None				
Erosion potential	Moderate. Denuded banks				
Cattle Impact	Significant trampling and grazing				
Recommendations	Access track should cr transversely. Monitor to due to transit of heavy	ross the drainag he site for erosi machinery	WGS 84 137.8069, -19.1995		
Land Condition	Poor				

APPENDIX D Protected Matters Search Tool 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 <u>Environment Assessments</u> and the EPBC Act including significance guidelines, forms and application process details.

Report created: 08/09/21 10:35:33

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: 150.0Km


# 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 <u>Administrative Guidelines on Significance</u>.

World Heritage Properties:	1
National Heritage Places:	1
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	23
Listed Migratory Species:	18

### 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:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	23
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:	13
Regional Forest Agreements:	None
Invasive Species:	25
Nationally Important Wetlands:	11
Key Ecological Features (Marine)	None

# Details

## Matters of National Environmental Significance

World Heritage Properties		[Resource Information]
Name	State	Status
Australian Fossil Mammal Sites (Riversleigh)	QLD	Declared property
National Heritage Properties		[Resource Information]
Name	State	Status
Natural		
Australian Fossil Mammal Sites (Riversleigh)	QLD	Listed place

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Amytornis dorotheae Carpentarian Grasswren [558]	Endangered	Species or species habitat known to occur within area
<u>Calidris ferruginea</u> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat known to occur within area
Erythrura gouldiae Gouldian Finch [413]	Endangered	Species or species habitat known to occur within area
<u>Falco hypoleucos</u> Grey Falcon [929]	Vulnerable	Species or species habitat known to occur within area
<u>Grantiella picta</u> Painted Honeyeater [470]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica baueri Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Tyto novaehollandiae kimberli Masked Owl (northern) [26048]	Vulnerable	Species or species habitat likely to occur within area
Mammals		

Name	Status	Type of Presence
<u>Dasyurus hallucatus</u> Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat may occur within area
Macroderma gigas Ghost Bat [174]	Vulnerable	Breeding known to occur within area
Macrotis lagotis Greater Bilby [282]	Vulnerable	Species or species habitat may occur within area
Petrogale lateralis centralis Warru, Central Australian Rock-wallaby [90831]	Vulnerable	Species or species habitat may occur within area
Saccolaimus saccolaimus nudicluniatus Bare-rumped Sheath-tailed Bat, Bare-rumped Sheathtail Bat [66889]	Vulnerable	Species or species habitat may occur within area
Trichosurus vulpecula arnhemensis Northern Brushtail Possum [83091]	Vulnerable	Species or species habitat likely to occur within area
Zyzomys palatalis Carpentarian Rock-rat, Aywalirroomoo [25907]	Endangered	Species or species habitat known to occur within area
Zyzomys pedunculatus Central Rock-rat, Antina [68]	Critically Endangered	Species or species habitat may occur within area
Plants		
<u>Dichanthium setosum</u> bluegrass [14159]	Vulnerable	Species or species habitat
		known to occur within area
Reptiles		
Acanthophis hawkei Plains Death Adder [83821]	Vulnerable	Species or species habitat known to occur within area
Elseya lavarackorum Gulf Snapping Turtle [67197]	Endangered	Species or species habitat known to occur within area
Sharks		
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Listed Migratory Species * Species is listed under a different scientific name on t	he EPBC Act - Threatened	[Resource Information] Species list.
Name Migratory Marine Birds	Threatened	Type of Presence
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Marine Species		
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Migratory Terrestrial Species		
Cecropis daurica Red-rumped Swallow [80610]		Species or species habitat may occur within

Name	Threatened	Type of Presence
Cuculus optatus		area
Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundo rustica		
Barn Swallow [662]		Species or species habitat may occur within area
Motacilla 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
Rhipidura rufifrons		
Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Migratory Wetlands Species <u>Actitis hypoleucos</u>		
Migratory Wetlands Species <u>Actitis hypoleucos</u> Common Sandpiper [59309]		Species or species habitat known to occur within area
Migratory Wetlands Species Actitis hypoleucos Common Sandpiper [59309] Calidris acuminata		Species or species habitat known to occur within area
Migratory Wetlands Species Actitis hypoleucos Common Sandpiper [59309] Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area Species or species habitat known to occur within area
Migratory Wetlands Species Actitis hypoleucos Common Sandpiper [59309] Calidris acuminata Sharp-tailed Sandpiper [874] Calidris ferruginea		Species or species habitat known to occur within area Species or species habitat known to occur within area
Migratory Wetlands Species Actitis hypoleucos Common Sandpiper [59309] Calidris acuminata Sharp-tailed Sandpiper [874] Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area Species or species habitat known to occur within area Species or species habitat likely to occur within area
Migratory Wetlands Species Actitis hypoleucos Common Sandpiper [59309] Calidris acuminata Sharp-tailed Sandpiper [874] Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area Species or species habitat known to occur within area Species or species habitat likely to occur within area
Migratory Wetlands Species Actitis hypoleucos Common Sandpiper [59309] Calidris acuminata Sharp-tailed Sandpiper [874] Calidris ferruginea Curlew Sandpiper [856] Calidris melanotos Pectoral Sandpiper [858]	Critically Endangered	Species or species habitat known to occur within areaSpecies or species habitat known to occur within areaSpecies or species habitat likely to occur within areaSpecies or species habitat narea
Migratory Wetlands Species Actitis hypoleucos Common Sandpiper [59309] Calidris acuminata Sharp-tailed Sandpiper [874] Calidris ferruginea Curlew Sandpiper [856] Calidris melanotos Pectoral Sandpiper [858]	Critically Endangered	Species or species habitat known to occur within areaSpecies or species habitat known to occur within areaSpecies or species habitat likely to occur within areaSpecies or species habitat nay occur within area
Migratory Wetlands Species Actitis hypoleucos Common Sandpiper [59309] Calidris acuminata Sharp-tailed Sandpiper [874] Calidris ferruginea Curlew Sandpiper [856] Calidris melanotos Pectoral Sandpiper [858] Charadrius veredus Oriental Plover, Oriental Dotterel [882]	Critically Endangered	<ul> <li>Species or species habitat known to occur within area</li> <li>Species or species habitat known to occur within area</li> <li>Species or species habitat likely to occur within area</li> <li>Species or species habitat may occur within area</li> </ul>

Oriental Pratincole [840]

Species or species habitat may occur within area

Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]

Critically Endangered

Species or species habitat may occur within area

Breeding known to occur within area

Species or species habitat likely to occur within area

Pandion haliaetus Osprey [952]

Tringa nebularia Common Greenshank, Greenshank [832]

### Other Matters Protected by the EPBC Act

Commonwealth Land		[Resource Information]
The Commonwealth area listed below may inc the unreliability of the data source, all proposa Commonwealth area, before making a definiti department for further information.	dicate the presence of Commonwe als should be checked as to whethe ve decision. Contact the State or T	ealth land in this vicinity. Due to er it impacts on a Ferritory government land
Name		
Commonwealth Land -		
Listed Marine Species		[Resource Information]
* Species is listed under a different scientific r	name on the EPBC Act - Threatene	ed Species list.
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat known to occur within area
Anseranas semipalmata		
Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
<u>Charadrius veredus</u>		
Oriental Plover, Oriental Dotterel [882]		Species or species habitat

may occur within area

Chrysococcyx osculans Black-eared Cuckoo [705]

Glareola maldivarum Oriental Pratincole [840]

Haliaeetus leucogaster White-bellied Sea-Eagle [943]

<u>Hirundo daurica</u> Red-rumped Swallow [59480]

Hirundo rustica Barn Swallow [662]

Merops ornatus Rainbow Bee-eater [670] Species or species habitat known to occur within area

Species or species habitat may occur within area

Species or species habitat known to occur within area

Species or species habitat may occur within area

Species or species habitat may occur within area

Species or species habitat may occur within area

Name	Threatened	Type of Presence
Motacilla 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
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus		
Osprey [952]		Breeding known to occur within area
Rhipidura rufifrons		
Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato)		
Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area
Reptiles		
Crocodylus johnstoni		
Freshwater Crocodile, Johnston's Crocodile, Johnstone's Crocodile [1773]		Species or species habitat may occur within area
Crocodylus porosus		
Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area

## Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Boodjamulla (Lawn Hill)	QLD
Camooweal Caves	QLD
Connells Lagoon	NT
Ganalanga-Mindibirrina	NT
Lawn Hill (Arthur Creek)	QLD
Lawn Hill (Creek)	QLD
Lawn Hill (Gorge Mouth)	QLD
Lawn Hill (Gregory River Base)	QLD
Lawn Hill (Gregory)	QLD
Lawn Hill (Lilydale)	QLD
Lawn Hill (Littles Range)	QLD
Lawn Hill (Stockyard Creek)	QLD
Lawn Hill (Widdallion)	QLD

#### **Invasive Species**

[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Columba livia		
Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus		
House Sparrow [405]		Species or species habitat likely to occur within area
Sturnus vulgaris		
Common Starling [389]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina		
Cane Toad [83218]		Species or species habitat known to occur within area
Mammals		
Bos taurus		
Domestic Cattle [16]		Species or species habitat likely to occur within area
Bubalus bubalis		
Water Buffalo, Swamp Buffalo [1]		Species or species habitat likely to occur within area
Camelus dromedarius		
Dromedary, Camel [7]		Species or species habitat likely to occur within area
Canis lupus familiaris		
Domestic Dog [82654]		Species or species habitat likely to occur within area
Equus asinus		

Equus caballus Horse [5]

Felis catus Cat, House Cat, Domestic Cat [19]

Mus musculus House Mouse [120]

Rattus rattus Black Rat, Ship Rat [84]

Sus scrofa Pig [6]

Vulpes vulpes Red Fox, Fox [18]

#### Plants

Acacia nilotica subsp. indica Prickly Acacia [6196] Species or species habitat likely to occur within area

likely to 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 likely to occur within area

Species or species habitat likely to occur within area

Species or species habitat likely to occur within area

Species or species

Name	Status	Type of Presence
		habitat may occur within area
Cenchrus ciliaris		
Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area
Cryptostegia grandiflora		
Rubber Vine, Rubbervine, India Rubber Vine, India Rubbervine, Palay Rubbervine, Purple Allamanda [18913] Jatropha gossynifolia		Species or species habitat likely to occur within area
Cotton-leaved Physic-Nut, Bellyache Bush, Cotton-leaf Physic Nut, Cotton-leaf Jatropha, Black Physic Nut [7507] Parkinsonia aculeata		Species or species habitat likely to occur within area
Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area
Parthenium hysterophorus Parthenium Weed, Bitter Weed, Carrot Grass, False Ragweed [19566]		Species or species habitat likely to occur within area
Prosopis spp.		
Mesquite, Algaroba [68407]		Species or species habitat likely to occur within area
Tamarix aphylla		
Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018] Vachellia nilotica		Species or species habitat likely to occur within area
Prickly Acacia, Blackthorn, Prickly Mimosa, Black Piquant, Babul [84351]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus		
Asian House Gecko [1708]		Species or species habitat likely to occur within area
Nationally Important Wetlands		[Resource Information]
Name		State
Bluebush Swamp		QLD
Corella Lake		NT
Eva Downs Swamp		NT

Gregory River	QLD
Lake Sylvester	NT
Lake de Burgh	NT
Lawn Hill Gorge	QLD
Marless Lagoon Aggregation	QLD
Musselbrook Creek Aggregation	QLD
Tarrabool Lake	NT
Thorntonia Aggregation	QLD

# 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, soils, 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

-18.49072 136.08279,-19.33516 136.08554,-19.33257 137.74997,-18.62091 137.74722,-18.6105 137.12375,-18.49854 137.12375,-18.49072 136.08279

# 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 Government National Environmental Scien

-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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#### APPENDIX E THREATENED SPECIES 'LIKELIHOOD OF OCCURRENCE' ASSESSMENT

a start	Status				
Name	Cth	NT	Summary	Likelinood of occurrence	
BIRDS					
Carpentarian Grasswren Amytornis dorotheae	EN	EN	<ul> <li>Habitat: NT population is restricted to dissected, topographically complex, sandstone and conglomerate hills and plateaux with infrequent fires (Lewis &amp; Woinarski 2006). The only recent observations were recorded in a site that had been burnt only twice in the preceding 12 years. All other historic sites with no recent observations had been burnt between three and eight times.</li> <li>Distribution: Gulf of Carpentaria hinterland – between Limmen River in the NT and Mount Isa in Qld. No records in the Borroloola area since 1986 despite several targeted surveys in the last decade (Martin &amp; McKean 1986; Garnett et al. 2011). Within the NT, now restricted to a tiny isolated population approximately 6 km to the west of Calvert Hills Station in the Wollogorang area (TSSC 2016).</li> </ul>	<ul> <li>Low</li> <li>Outside of extent of occurrence</li> <li>Closest historic record ~130 km north-east from EP</li> </ul>	
	<ul> <li>Garnett, S.T., Szabo, J.K. and Dutson, G. (2011). The Action Plan for Australian Birds 2010. CSIRO Publishing. Collingwood, Australia.</li> <li>Lewis, M. and Woinarski, J. (2006). Threatened Species of the Northern Territory - Carpentarian Grass-wren - Amytomis dorotheae. Northern Territory Department of Environment and Natural Resources. <u>https://nt.gov.au/data/assets/pdffile/0007/373543/carpentarian-grasswren.pdf</u> [Accessed 1 May 2018].</li> <li>Martin, K.C. and McKean, J.L. (1986). A study of the distribution and status of the endangered carpentarian grasswren Amytomis dorotheae. Report to the Conservation Commission of the Northern Territory, Palmerston, NT.</li> <li>Perry, J., Fisher, A. and Palmer, C. (2011). Status and habitat of the Caprentaria Grasswren (Amytonis dorotheae) in the Northern Territory. CSIRO Threatened Species Scientific Committee (2016). Conservation Advice – Amytornis dorotheae – Carpentarian Grasswren. Canberra: Department of the Environment. In effect under the EPBC Act from 05- Threatened Species Scientific Committee (2016). Conservation Advice – Amytornis dorotheae – Carpentarian Grasswren. Canberra: Department of the Environment. In effect under the EPBC Act from 05- Threatened Species Scientific Committee (2016). Conservation Advice – Amytornis dorotheae – Carpentarian Grasswren. Canberra: Department of the Environment. In effect under the EPBC Act from 05- Threatened Species Scientific Committee (2016). Conservation Advice – Amytornis dorotheae – Carpentarian Grasswren. Canberra: Department of the Environment. In effect under the EPBC Act from 05- Threatened Species Scientific Committee (2016). Conservation Advice – Amytornis dorotheae – Carpentarian Grasswren. Canberra: Department of the Environment. In effect under the EPBC Act from 05- Threatened Species Scientific Committee (2016).</li> </ul>				
White-throated Grasswren Amytornis woodwardi	VU	VU	<ul> <li>Habitat: Confined to hummock grasslands, sometimes with open shrubland or woodland overstorey, mixed among dense boulder fields or sandstone pavements (Schodde 1982; Noske 1992) and escarpment drainage lines.</li> <li>Distribution: NT only – patchily distributed from Nitmiluk National Park to western Arnhem Land (Noske 1992).</li> </ul>	<ul> <li>NONE</li> <li>Species distribution restricted to rugged sandstone massif of west Arnhem Land, Nitmuluk National Park and Mann River outside EP144</li> <li>No proximate records</li> </ul>	
	Noske Schod	, R. (19 de, R. (	92). The status and ecology of the white-throated grass-wren <i>Amytomis woodwardi. Emu</i> , Vol. 92, pp. 39-51. 1982). <i>The fairy-wrens</i> - <i>A monograph of the Maluridae</i> . Landsdowne Editions, Melbourne.		
Curlew Sandpiper Calidris ferruginea	CR	VU	<ul> <li>Habitat: Mostly coasts and estuaries, less frequently inland freshwater wetlands (Geering et al. 2007).</li> <li>Distribution: A summer migrant from the northern hemisphere; some birds remain in Australia during the winter. Mostly widespread around the northern Australian coast, less</li> </ul>	<ul> <li>Suitable wetland habitat associated with Lake Sylvester available within and west of EP144</li> <li>Outside expert distribution</li> </ul>	



Name	Sta	itus	Summary		
	Cth	NT		Likelihood of occurrence	
			common in the south, with few inland records (Garnett et al. 2011). Has declined due to habitat loss at migratory stop-over grounds along the flyway (Ward 2012).	<ul> <li>Historic record in 1985, ~50 km west of project area</li> </ul>	
	Geerir Garne Ward,	ng, A., Ag tt, S.T., S S. (201: https:	new, L. and Harding, S. (2007). Shorebirds of Australia. CSIRO Publishing, Collingwood, Australia. Szabo, J.K. and Dutson, G. (2011). The Action Plan for Australian Birds 2010. CSIRO Publishing, Collingwood, Australia. 2). Threatened Species of the Northern Territory – Curlew Sandpiper - Calidris ferruginea. Northern Territory Department ( //nt.gov.au/ data/assets/word doc/0009/373545/curlew-sandpiper.docx [Accessed 29 August 2018].	of Environment and Natural Resources.	
Greater Sand Plover Charadrius leschenaultii	VU	VU	<ul> <li>Habitat: Mostly coasts and estuaries with intertidal sand and mudflats – roosting on nearby beaches and rocky shores. Occasionally salt lakes, brackish swamps and shallow freshwater wetlands (DoE 2017).</li> <li>Distribution: A summer migrant from the northern hemisphere; some birds remain in Australia during the winter. Widespread around the Australian coast, less common in the south and inland. In the NT, recorded from most of the coastline (Garnett al. 2011).</li> </ul>	<ul> <li>NO suitable coastal habitat within EP.</li> </ul>	
	Depar	tment of Availa tt, S.T., S	the Environment (2017). Charadrius leschenaultii — Greater Sand Plover, Large Sand Plover. Species Profile and Threat ible at: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=877 [Accessed 1 May 2018]. Szabo, J.K. and Dutson, G. (2011). The Action Plan for Australian Birds 2010. CSIRO Publishing. Collingwood, Australia	s Database, Department of he Environment, Canberra. [online]	
Great Knot Calidris tenuirostris	CR	VU	Habitat: Coasts and estuaries with tidal mudflats – rarely away from coast. May roost during high tide on nearby beaches (Geering et al. 2007). Distribution: A summer migrant from the northern hemisphere; some birds remain in Australia during the winter. Mostly widespread around the northern Australian coast, less common in the south, with few inland records, centred around Alice Springs (Garnett et al. 2011).	<ul> <li>NONE</li> <li>No suitable coastal habitat within EP.</li> </ul>	
	Geering, A., Agnew, L. and Harding, S. (2007). Shorebirds of Australia. CSIRO Publishing, Collingwood, Australia. Garnett, S.T., Szabo, J.K. and Dutson, G. (2011). The Action Plan for Australian Birds 2010. CSIRO Publishing, Collingwood, Australia.				
Red Goshawk Erythrotriorchis radiatus	VU	VU	<ul> <li>Habitat: Prefers tall, open Eucalypt forest and riparian areas. Nests in large trees, frequently the tallest and most massive in a tall stand, nest trees are invariably within 1 km of permanent water (Debus &amp; Czechura 1988; Aumann &amp; Baker-Gabb 1991). Rarely breeds in areas with fragmented native vegetation (Aumann &amp; Baker-Gabb 1991; Czechura 2001). Home range of up to 200 km<sup>2</sup> (Czechura &amp; Hobson 2000).</li> <li>Distribution: Solitary and secretive hawk that is sparsely distributed across much of northern Australia, from the Kimberley in WA to south-eastern Qld. Within this range, generally confined to taller forests characteristic of higher rainfall coastal and sub-coastal areas (Debus 1998), but there are some isolated records of wandering birds from central Australia (Woinarski 2006).</li> </ul>	<ul> <li>No preferred tall open Eucalypt forest. However, riparian habitat located along significant waterways in EP may be suitable habitat</li> <li>The single record for the region has no date associated with it and is well outside the usual range of this species. The few records across arid Australia are almost certainly vagrant Closest records ~150 km from EP</li> <li>EP may be utilised for vagrant foraging only</li> </ul>	
	Aumar Czech Czech	nn, T. ar ura G.V. ura G.V.	nd Baker-Gabb, D. (1991). A Management Plan for the Red Goshawk. RAOU Report 75, Royal Australasian Ornithologist and Hobson R.G. (2000). The Red Goshawk Erythrotriorchis radiatus in northern Queensland: status and distribution. R (2001). The status and distribution of the Red Goshawk Erythrotriorchis radiatus on Cape York Peninsula, Queensland.	s Union, Melbourne. eport to Queensland Parks and Wildlife Service. Jnpublished report to Birds Australia.	



Manua	Sta	atus	Summary			
Name	Cth	NT		Likelihood of occurrence		
	Debus Debus Woina	s, S. and s, S. (199 Irski, J. ( https://	Czechura, G. (1988). Field iden ification of the Red Goshawk Erythrotriorchis radiatus. Australian Bird Watcher, Vol. 12, 98). The Birds of Prey of Australia. Oxford University Press, Melbourne. (2006). Threatened Species of the Northern Territory - Red Goshawk - Erythrotriorchis radiatus. Northern Territory Departu //nt.gov.au/ data/assets/pdf_file/0018/206352/red-goshawk.pdf_[Accessed 1 May 2018].	pp. 154-159. ment of Environment and Natural Resources. [online] Available at:		
Gouldian Finch Erythrura gouldiae	EN	VU	<ul> <li>Habitat: Prefers areas with an adequate supply of seed from annual and perennial grasses (especially <i>Sorghum</i>), a nearby source of surface water and – in the breeding season – unburnt, hollow-bearing Eucalyptus trees (especially <i>E. tintinnans, E. brevifolia</i> and <i>E. leucophloia</i>) (Tidemann 1996; O'Malley 2006).</li> <li>Distribution: Patchily distributed across northern Australia from the Kimberley to north-central Qld (Dostine 1998; Franklin et al. 1999; Barrett et al. 2003; Franklin et al. 2005). In the NT, most known breeding populations occur in the Top End. Non-breeding birds disperse widely (Garnett et al. 2011), greatly increasing the possible range of this species.</li> </ul>	<ul> <li>LOW</li> <li>Suitable grassland foraging and seasonal surface water</li> <li><i>E. leucophloia</i> community present in the project area</li> <li>No proximate records. Closest record ~ 130 km north of EP</li> </ul>		
	Dostin Frankl Frankl Garne O'Mal	t, G., Silt in, D.C., <i>Austra</i> in, D.C., <i>Resea</i> tt, S.T., S iey, C. (2 NT Ge ann, S.C.	<ul> <li>Burbidge, A., Barry, S., Curmingnann, K. and Pouner, R. (2003). The New Atlas of Australian Brids. Royal Australian Orhitro 298). Gouldian Finch Recovery Plan Erythrura gouldiae. Gouldian Finch Recovery Team and Parks &amp; Wildlife Commission Burbidge, A.H. and Dostine, P.L. (1999). The harvest of wild birds for aviculture: an historical perspective on finch trappir alian Zoologist, Vol. 31, pp. 92-109.</li> <li>Whitehead, P.J., Pardon, G., Matthews, J., McMahon, P. and McIntyre, D. (2005). Geographic patterns and correlates of arch, Vol. 32, pp. 399-408.</li> <li>Szabo, J.K. and Dutson, G. (2011). The Action Plan for Australian Birds 2010. CSIRO Publishing. Collingwood, Australia 2006). National Recovery Plan for the Gouldian Finch (Erythrura gouldiae). WWF-Australia, Sydney and Parks and Wildliff overmment, Palmerston.</li> <li>(1996). Causes of the decline of the Gouldian Finch Erythrura gouldiae. Biological Conservation International. Vol. 6, p.</li> </ul>	n NT, Darwin. Ing in the Kimberley with special emphasis on the Gouldian Finch. If the decline of granivorous birds in northern Australia. <i>Wildlife</i> A. In NT, Department of Natural Resources, Environment and the Arts, In . 49-61.		
Grey Falcon Falco hypoleucos	VU	VU	<ul> <li>Habitat: A generally solitary desert falcon that occurs in areas of lightly-timbered lowland plains, typically on inland drainage systems, where the average annual rainfall is less than 500 mm (Ward 2012).</li> <li>Distribution: Sparsely distributed through much of the arid and semi-arid regions of Australia but has been recorded from all mainland states and territories. In the NT, the majority of records are from the southern half, but there are records all the way up to Darwin (Ward 2012). A study of breeding records from 2003 to 2011 documented 38 breeding events – all within the hottest climate classes of Australia – with the northern-most record occurring south of Daly Waters (Schoenjahn 2013).</li> </ul>	<ul> <li>HIGH</li> <li>Suitable habitat available (foraging)</li> <li>Scattered regional records, including possibly in the eastern portion of EP144</li> <li>EP is too far north to be suitable for breeding.</li> </ul>		
	Schoenjahn, J. (2013), A hot environment and one type of prey: investigating why the Grey Falcon (Falco hypoleucos) is Australia's rarest falcon, <i>Emu</i> , Vol. 113, pp. 19-25. Ward, S. (2012). <i>Threatened Species of the Northern Territory - Grey Falcon - Falco hypoleucos</i> . Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/ data/assets/pdf_file/0020/206354/grey-falcon.pdf_[Accessed 1 May 2018].					
Crested Shrike-tit (northern subspecies)	VU	-	Habitat: Recorded in eight different woodland types in northern Australia, mainly those dominated by <i>Eucalyptus miniata, E. tetrodonta</i> or <i>E. bleeseri</i> (Robinson & Woinarski 1992). Nests have been found in the canopy of <i>E. tectifica, C. grandifolia</i> and <i>C. latifolia</i> at >12 m above the ground in open woodland habitat (Ward et al. 2009).	<ul> <li>Suitable Eucalyptus and Corymbia open woodland nesting and foraging habitat.</li> </ul>		



a factor	Sta	itus	Summary			
Name	Cth	NT		Likelinood of occurrence		
Falcunculus frontatus whitei			<b>Distribution:</b> North-western Australia from the Kimberley in WA, across the Top End of the NT to Borroloola (TSSC 2016). In the NT, recorded in very low densities in many isolated sub-populations (Garnett & Crowley 2000) between north-east Arnhem Land and semi-arid Victoria River District. Scarcity of records suggests that populations are at very low density (Woinarski 2004). Not known to have disappeared from any area where recorded historically (TSSC 2016).	<ul> <li>Closest record ~200 km north of EP144.</li> </ul>		
	Garne Robins Threat Ward, Woina	tt, S.T. a son, D. a ened Sp the El S.J., Be rski, J.C white/ of Infr	and Crowley, G.M. (2000). The Action Plan for Australian Birds 2000. Environment Australia and Birds Australia, Canbern and Woinarski, J.C.Z. (1992). 'A review of records of the Northern Shrike-tit Falcunculus frontatus whitei in north-western ecies Scientific Committee (2016). Approved Conservation Advice for Falcunculus frontatus whitei - crested shrike-tit (nor PBC Act from 02-May-2016. Available at: http://www.environment.gov.au/biodiversity/threatened/species/pubs/26013-com rghout, M. & Baker, B. (2009). Notes on the form and habitat of nests of the Northern Shrike-tit. Northern Territory Natur Z. (2004). National multi-species Recovery Plan for the Partridge Pigeon [eastern subspecies] Geophaps smithii smithii; masked owl [north Australian mainland subspecies] Tyto novaehollandiae kimberli; and masked owl [Tiwi Islands subspe- astructure Planning and Environment, Darwin.	ra, ACT. Australia'. South Australian Ornithologist, Vol. 31, pp. 111-117. thern). Canberra: Department of the Environment. In effect under servation-advice-05052016.pdf [Accessed 1 May 2018]. alist, Vol. 21, pp. 54-60. crested shrike-tit [northern (sub)-species] Falcunculus (frontatus) cies] Tyto novaehollandiae melvillensis, 2004-2008. NT Department		
Partridge Pigeon Geophaps smithii	VU	VU	<ul> <li>Habitat: Open forests and woodlands with an understorey of grasses (Woinarski 2006).</li> <li>Prefers woodland dominated by <i>Eucalyptus tetrodonta</i> and <i>E. miniata</i> (Braithwaite 1985; Garnett et al. 2011; Higgins &amp; Davies 1996). According to Fraser (2001), favour a structurally-patchy savanna understorey at a relatively intricate scale. In all seasons, prefer to feed in areas that have an open ground layer (e.g. following fire); however, more likely to nest where there is dense vegetation cover. Require the seeds of certain perennial grasses and sedges that are available early in the wet season when seed is otherwise scarce, particular the perennial grass species <i>Alloteropsis semialata</i> and <i>Chrysopogon</i>. The presence of these grasses may be crucial for survival at this time (Fraser 2001). Largely sedentary; however, can travel distances of 5 to 10 km in the wet season on search of food and water resources (Fraser 2001). Home ranges vary seasonally between 8 – 31 hectares Fraser (2001).</li> <li>Distribution: Historically, across the Top End (from Kununurra in WA to Borroloola in the NT). Since early 20<sup>th</sup> century a severe range contraction from the western, eastern and southern parts of the former distribution (Higgins &amp; Davies 1996; Woinarski et al. 2007).</li> <li>Currently, distribution is limited to sub-coastal NT from Yinberrie Hill in the south, Litchfield NP in the west and (western) Arnhem Land in the east (Garnett et al. 2011).</li> </ul>	<ul> <li>NONE</li> <li>Not recorded in MGD and GUF bioregions since 1924.</li> </ul>		
	<ul> <li>Braithwaite, R.W. (1985). The Kakadu fauna survey: an ecological survey of Kakadu National Park. Australian National Parks &amp; Wildlife Service, Canberra.</li> <li>Fraser, F. (2000). Species profile: Partridge Pigeon Geophaps smithii. Northern Territory Naturalist 16, 38-39.</li> <li>Fraser, F., Lawson V., Morrison S., Christophersen P., McGregor S. and Rawlinson M. (2003). Fire management experiment for the declining partridge pigeon, Kakadu Na ional Park. Ecological Management and Restoration 4, 94–102.</li> <li>Garnett, S.T., Szabo, J.K. and Dutson, G. (2011). The Action Plan for Australian Birds 2010. Birds Australia, CSIRO Publishing, Melbourne.</li> <li>Higgins, P.J. and Davies S.J.J.F. (eds) (1996). Handbook of Australian, New Zealand and Antarctic Birds. Volume Three: Snipe to Pigeons. Oxford University Press. Melbourne, Victoria.</li> </ul>					



Name	Status					
	Cth	NT	Summary	Likelinood of occurrence		
	<ul> <li>Woinarski, J.C.Z. (2006). Threatened Species of the Northern Territory - Partridge Pigeon (eastern subspecies) - Geophaps smithii. Northern Territory Department of Environment and Natural Resou [online] Available at: <a href="https://nt.gov.au/">https://nt.gov.au/</a> data/assets/pdf file/0003/206355/partridge-pigeon.pdf [Accessed 1 May 2018].</li> <li>Woinarski, J., Pavey, C., Kerrigan, R., Cowie, L. and Ward, S. (Eds) (2007). Lost from Our Landscape: Threatened Species of the Northern Territory. Northern Territory Government Darwin.</li> </ul>					
Painted Honeyeater Grantiella picta	VU	VU	<ul> <li>Habitat: Acacia and Eucalyptus-dominated woodlands and open forest, preferring habitats with more mature trees that host more mistletoe. Breeding times and seasonal movements (south to north) likely governed by the fruiting of mistletoe (Garnett et al. 2011).</li> <li>Distribution: Across eastern and northern parts of the country – but nowhere very numerous (Ward 2012). Many birds move after breeding to semi-arid regions such as north-eastern SA, central and western Qld, and central NT (TSSC 2015). Few NT records – most from the Barkly Tablelands – but no evidence of a breeding population in the NT, and the records are likely irregular visitors from south-eastern Australia (Ward 2012).</li> </ul>	<ul> <li>LOW</li> <li>Suitable habitat available</li> <li>Few regional records</li> <li>Irregular visitor to NT.</li> </ul>		
	Garne Threat Ward,	tt, S.T., S ened Sp at: <u>http</u> S. (2012 <u>https:/</u>	<ul> <li>Szabo, J.K. and Dutson, G. (2011). The Action Plan for Australian Birds 2010. CSIRO Publishing, Collingwood, Australia.</li> <li>ecies Scientific Committee (TSSC) (2015). Approved Conservation Advice for Grantiella picta (Painted Honeyeater). Cant b://www.environment.gov.au/biodiversity/threatened/species/pubs/470-conservation-advice.pdf [Accessed 1 May 2018].</li> <li>2). Threatened Species of the Northern Territory – Painted Honeyeater – Grantiella picta. Northern Territory Department of /nt.gov.au/ data/assets/pdf file/0009/373554/painted-honeyeater.pdf [Accessed 1 May 2018].</li> </ul>	perra: Department of the Environment. Available f Environment and Natural Resources. [online] Available at:		
Bar-tailed Godwit (Western Alaskan subspecies) Limosa lapponica baueri	VU	VU	Note: Using body measurements), Wilson et al. (2007) have shown that the two main Australian non-breeding regions belong to separate populations. Subspecies <i>menzbieri</i> is generally present in north-western Australia and breed in north-eastern Russia, and subspecies <i>baueri</i> is generally present in south-eastern Australia and breed in northern and western Alaska (Wilson et al. 2007). It is thought that both subspecies probably migrate to the NT. Due to the difficulties of distinguishing between the two, they are treated within the NT as <i>Limosa lapponica</i> and listed collectively as Vulnerable (Ward 2012).	<ul> <li>NONE</li> <li>No suitable coastal habitat within EP.</li> </ul>		
Bar-tailed Godwit (northern Siberian subspecies) Limosa lapponica menzbieri	CR	VU	<ul> <li>Habitat: Intertidal sand flats and mudflats. Also salt lakes and brackish wetlands near coasts, but rarely further inland (Geering et al. 2007). Roosts on sandy ocean beaches, rock platforms, and coral reef-flats (Marchant &amp; Higgins 1993).</li> <li>Distribution: Widespread around the Australian coast. In the NT, reported all along the coastline; one of the more frequently recorded and abundant species in shorebird surveys by Chatto (2003).</li> </ul>			
	Chatto, R. (2003). The distribution and status of shorebirds around the coast and coastal wetlands of the Northern Territory. Technical Report 73, Parks and Wildlife Commission of the Northern Territory, Darwin. https://dtc.nt.gov.au/ data/assets/pdf file/0008/279917/2003 shorebirds rp176.pdf [Accessed 1 May 2018]. Garnett, S.T., Szabo, J.K. and Dutson, G. (2011). The Action Plan for Australian Birds 2010. CSIRO Publishing. Collingwood, Australia. Geering, A., Agnew, L. and Harding, S. (2007). Shorebirds of Australia. CSIRO Publishing, Collingwood, Australia. Marchant, S. and Higgins, P. (eds.) (1993). Handbook of Australian, New Zealand and Antarctic Birds. Vol. 2 - Raptors to Lapwings. Oxford University Press, Melbourne, Victoria Wilson, J.R., Nebel, S. and Minton, C.D.T. (2007). Migration ecology and morphometrics of two Bar-tailed Godwit populations in Australia. <i>Emu</i> , Vol. 107, pp. 262–274. Ward, S. (2012). Threatened Species of the Northern Territory –Bar-tailed Godwit – Limosa lapponica. Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/ data/assets/pdf file/0008/373544/bar-tailed-godwit.pdf [Accessed 1 May 2018].					



	Status				
Name	Cth	NT	Summary	Likelihood of occurrence	
Purple-crowned Fairy Wren (western subspecies) Malurus coronatus coronatus	EN	VU	<ul> <li>Habitat: Riparian areas along the Victoria River, usually associated with areas of dense river grass – Chionachne cyathopoda (Rowley 1993; van Doorn &amp; Low Choy 2009). Also known from Pandanus aquaticus habitat (van Doorn &amp; Low Choy 2009). Generally confined to riparian habitats.</li> <li>Distribution: Occurs from the central Kimberly in WA to Victoria River in the NT. Within this range, almost entirely restricted to a narrow band around well-defined river channels. The extinction of the Ord River population in WA has isolated the Victoria River system populations from those in the Kimberley by 250 km, a distance which the subspecies would be unable to traverse (Skroblin et al. 2014).</li> </ul>	<ul> <li>NONE</li> <li>EP located outside the known distribution for this species.</li> </ul>	
	Rowle Skrobl van Do	y, I. (199 in, A., Co Vol. 6 porn, A. Vol. 2	33). The Purple-crowned Fairy-wren Malurus coronatus. I History, distribution and present status. Emu, Vol. 93, pp. 220 ockburn, A. and Legge, S. (2014). The popula ion genetics of the purple-crowned fairy-wren (Malurus coronatus coronatus); pp. 251-259. and Low Choy, J. (2009). A description of the primary habitat of the Purple-crowned Fairy-wren Malurus coronatus coronatus coronatus). I no. 24-33.	-234. is), a declining riparian passerine. Australian Journal of Zoology, atus in the Victoria River District, N.T. Northern Territory Naturalist,	
Eastern Curlew Numenius madagascariensis	CR	VU	<ul> <li>Habitat: Inter-tidal mudflats, salt lakes and brackish wetlands near coasts (Geering et al. 2007). May roost during high tide on nearby beaches.</li> <li>Distribution: A summer migrant from the northern hemisphere; some birds remain in Australia during the winter. Widespread in small numbers around the Australian coast (Garnett et al. 2011). Chatto (2003) considered the more important areas in the NT to be along the coast either side of Darwin, the Millingimbi to Buckingham Bay area, the Roper and Limmen Bight River mouths, and the Port McArthur area.</li> </ul>	NONE <ul> <li>No preferred coastal habitat.</li> </ul>	
	Chatto Game Geerin	, R. (200 Darwi tt, S.T., S ig, A., Ag	D3). The distribution and status of shorebirds around the coast and coastal wetlands of the Northern Territory. Technical F n. [online] Available at: <u>https://dtc.nt.gov.au/data/assets/pdffile/0008/279917/2003_shorebirds_rpt76.pdf</u> [Accessed 1] Szabo, J.K. and Dutson, G. (2011). The Action Plan for Australian Birds 2010. CSIRO Publishing. Collingwood, Australia new, L. and Harding, S. (2007). Shorebirds of Australia. CSIRO Publishing, Collingwood, Australia.	Report 73, Parks and Wildlife Commission of the Northern Territory, May 2018]. a.	
Night Parrot Pezoporus occidentalis	EN	CR	<ul> <li>Habitat: Flat spinifex (<i>Triodia</i> spp.) grasslands in stony or sandy environments; and samphire and chenopod shrublands – including genera such as <i>Atriplex, Bassia</i> and <i>Maireana</i> – on floodplains and claypans, and on the margins of salt lakes, creeks or other sources of water (from a variety of sources cited in DoE 2017).</li> <li>Distribution: Extremely sparsely distributed through central arid regions. In the NT sightings were made up to 1923 in the Alice Springs region (Whitlock 1924). Presumed extinct until recently rediscovered in western Qld and north-western WA.</li> </ul>	<ul> <li>No preferred flat spinifex habitat within EP</li> <li>No recorded sightings in the Northern Territory since 1934.</li> </ul>	
	Department of the Environment (2017). Pezoporus occidentalis. Species Profile and Threats Database. Department of the Environment, Canberra. [online] Available at: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=59350 [Accessed 1 May 2018].				
Princess Parrot	VU	VU	Habitat: Swales between desert sand dunes with a shrub layer and scattered trees (Pavey 2006).	<ul> <li>Preferred arid sand dune habitat within EP</li> </ul>	



Name	Status					
	Cth	NT	Summary	Likelihood of occurrence		
Polytelis alexandrae			<b>Distribution:</b> Confined to arid regions of WA, the NT and SA (Barrett et al. 2003; Blakers et al. 1984; Higgins 1999). There have been unconfirmed reports of the species from western Queensland (Britton 1992; Higgins 1999). Highly nomadic and, as noted in DoE (2016), 'is an irregular visitor (sometimes at intervals of more than 20 years) to most sites in its range and its movements are largely unknown. For these reasons, it is not possible or practical to provide an estimate of the number of locations at which the species occurs.'	<ul> <li>Species is nomadic and an irregular visitor.</li> </ul>		
	<ul> <li>Barrett, G. Silcocks, A. Barry, S. Cunningham, R. and Poulter, R. (2003). The New Atlas of Australian Birds, E. Blakers, M. Davies S.J.J.F. and Reilly P.N. (1984). The Atlas of Australian Birds. Melbourne, Victoria: Melbourne Britton, P.L. (1992). The Queensland Ornithological Society Bird Report, Sunbird, 22:51-83.</li> <li>Department of the Environment (2017). Polytelis alexandrae. Species Profile and Threats Database. Department <u>bin/sprat/public/publicspecies.pl?taxon_id=758</u> [Accessed 1 May 2018].</li> <li>Higgins, P.J. (ed.) (1999). Handbook of Australian, New Zealand and Antarctic Birds. Volume 4: Parrots to Dolla Pavey, C. (2006). Threatened Species of the Northern Territory - Princess Parrot - Polytelis alexandrae. Northern</li> </ul>		<ul> <li>Cocks, A. Barry, S. Cunningham, R. and Poulter, R. (2003). The New Atlas of Australian Birds, Birds Australia, Melbourn avies S.J.J.F. and Reilly P.N. (1984). The Atlas of Australian Birds. Melbourne, Victoria: Melbourne University Press.</li> <li>992). The Queensland Ornithological Society Bird Report, Sunbird, 22:51-83.</li> <li>the Environment (2017). Polytelis alexandrae. Species Profile and Threats Database. Department of the Environment, Carat/public/publicspecies.pl?taxon_id=758 [Accessed 1 May 2018].</li> <li>ed.) (1999). Handbook of Australian, New Zealand and Antarctic Birds. Volume 4: Parrots to Dollarbird, Oxford University D6). Threatened Species of the Northern Territory - Princess Parrot - Polytelis alexandrae. Northern Territory Department of [Accessed 1 May 2018].</li> </ul>	e, Victoria. anberra. [online] Available at: <u>http://www.environment.gov.au/cqi-</u> Press, Melbourne, Victoria. of Environment and Natural Resources. [online] Available at:		
Australian Painted-snipe Rostratula australis	EN	VU	<ul> <li>Habitat: Fringes of permanent and temporary wetlands, swamps and inundated grasslands (Taylor et al. 2013).</li> <li>Distribution: Nomadic and scattered across Australia with no predictable occurrence (Rogers 2001), but could occur at any wetland or inundated grassland across its distribution, including nearly all of the NT and Qld (Garnett et al. 2011).</li> </ul>	<ul> <li>Wetland habitat for the nomadic species west of EP144</li> <li>Breeding on the Barkley Tablelands recorded in 1993; however, only occurs as vagrant in the NT.</li> </ul>		
	Garnett, S.T., Szabo, J.K. and Dutson, G. (2011). The Action Plan for Australian Birds 2010. CSIRO Publishing. Collingwood, Australia. Rogers, D. (2001). Painted Snipe. Wingspan, Vol. 11 (No. 4), pp. 6-7. Taylor, R., Chatto, R. and Woinarski, J.C.Z. (2013). Threatened Species of the Northern Territory - Australian pained snipe - Rostratula australis. Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/ data/assets/pdf_file/0018/206361/australian-painted-snipe.pdf [Accessed 1 May 2018].					
Masked Owl (northern subspecies) Tyto novaehollandiae kimberli	VU	VU	Habitat: Mainly in <i>Eucalyptus</i> tall open forests (especially those dominated by <i>Eucalyptus miniata</i> and <i>E. tetrodonta</i> ), but also roosts in monsoon rainforests and forages in more open vegetation types, including grasslands (Woinarski & Ward 2012). Usually nests in tree hollows, within patches of closed forest (Garnett et al. 2011). Little else known about the subspecies, but the species in general is resident in pairs within a territory up to 3,000 hectares (Debus 1993). Nest in large hollows with an entrance more than 20 cm wide and that is greater than 10 m above the ground (Debus 1993). Breeding poorly known, but thought to occur between March and October (DEWHA 2010). Distribution: Poorly known, with few records from across a broad range in northern Australia. In the NT, records from the Top End, Kakadu, Coburg Peninsula (majority of records) and south-west Gulf country (Woinarski & Ward 2012).	<ul> <li>No tall Eucalyptus open forest habitat within EP144</li> <li>Within the expert distribution of the species; however, no nearby records. Closest record at Dead Dog waterhole ~185 km south of EP.</li> </ul>		
	Debus Depar	s, S.J.S. tment of from:	(1993). The mainland masked owl Tyoto novaehollandiae: a review. Australian Bird Watcher. Vol. 15. Pp. 168-191. the Environment, Water, Heritage and the Arts (DEWHA) (2010). Survey Guidelines for Australia's Threatened Birds. EPu http://www.environment.gov.au/epbc/publications/threatened-birds.html.	BC Act survey guidelines 6.2. Canberra, ACT: DEWHA. Available		



a land	Sta	tus	Summary	
Name	Cth	NT		Likelihood of occurrence
	Garnet Woina	t, S.T., S rski, J.C. of Env	zabo, J.K. and Dutson, G. (2011). The Action Plan for Australian Birds 2010. CSIRO Publishing. Collingwood, Australia Z. and Ward, S. (2012). Threatened Species of the Northern Territory - Masked Owl (north Australian mainland subspeci ironment and Natural Resources. [online] Available at: <u>https://nt.gov.au/data/assets/word_doc/0008/373553/masked-ow</u>	es) - Tyto novaehollandiae kimberli. Northern Territory Department I-mainland-top-end.docx [Accessed 1 May 2018].
MAMMALS				
Brush-tailed Rabbit-rat Conilurus penicillatus	VU	EN	<ul> <li>Habitat: Largely restricted to mixed <i>Eucalypt</i> open forest and woodland, or on dunes with <i>Casuarina</i> – seeming to prefer habitats that are not burnt annually, that have an understorey of predominantly perennial grasses and a sparse-to-moderate middle storey (Firth et al. 2006; Firth 2007; Kemper &amp; Firth 2008).</li> <li>Distribution: Formerly widespread across northern Australia, but has declined extensively from Qld and lower rainfall areas of the Kimberley in WA and the Top End in the NT. No recent records from much of the historically-recorded NT range between near the mouth of Victoria River (in the west) and Sir Edward Pellew island group (in east). Most recently known from Cobourg Peninsula, Tiwi Islands, Groote Eylandt and a small area within Kakadu National Park (Woinarski &amp; Hill 2012).</li> </ul>	<ul> <li>LOW</li> <li>Suitable habitat available</li> <li>No proximate records</li> <li>Few regional records</li> <li>Species has undergone significant range decline. Likely that species is extinct from applicable bioregions.</li> </ul>
	Firth, F Firth, F Kempe Woinar	LS.C. (2 Wildlife r, C.M. a ski, J.C. Natural I	007). Ecology and conservation status of the brush-tailed rabbit-rat Conilurus penicillatus. PhD thesis, Charles Darwin Un toinarski, J.C.Z. and Noske, R.A. (2006). Home range and den characteristics of the brush-tailed rabbit-rat Conilurus peni Research, Vol. 33, pp. 397-408. and Firth, R.S.C. (2008). Brush-tailed Rabbit-rat. In: Van Dyck, S. and Strahan, R. (eds). The Mammals of Australia. Re Z. and Hill, B. (2012). Threatened Species of the Northern Territory - Brush-tailed rabbit-rat, Brush-tailed tree-rat - Conilur Resources. [online] Available at: https://nt.gov.au/ data/assets/pdf_file/0016/205504/brush-tailed-rabbit-rat.pdf [Accesser	iversity, Darwin, Northem Territory. <i>icillatus</i> in the monsoonal tropics of the Nor hem Territory, Australia. eed New Holland, Chatswood, NSW. <i>rus penicillatus</i> . Northern Territory Department of Environment and d 1 May 2018].
Northern Quoll Dasyurus hallucatus	EN	CR	<ul> <li>Habitat: Wide range of habitats, but since the arrival of Cane Toads generally restricted to the most suitable habitats which are rocky upland areas with numerous crevices and rock piles (Van Dam et al. 2002). Prime habitat in the NT consists of rocky sandstone escarpments and outliers (Braithwaite &amp; Griffiths 1994). Home range varies from 35 to 100 ha (Oakwood 2002). Breeding occurs in May and June, with male die-off occurring shortly afterwards (Oakwood 2000).</li> <li>Distribution: Historically occurred in the NT from Borroloola in the south-east as far west as the NT/WA border (Woinarski et al. 2007), and extends into the Kimberley and Pilbara regions of WA. Dramatic range contraction and population crash associated with Cane Toad invasion. Now occurs across northern Australia in five regional populations – including the Top End in the NT.</li> </ul>	<ul> <li>NONE</li> <li>Species has undergone a marked decline since the arrival of Cane Toads.</li> <li>Distribution restricted to Top End</li> <li>Historic record (1902) within EP144.</li> </ul>
	Braithy Oakwo Oakwo Van Da Woinar	vaite, R.V. od, M. (; od, M. (; am, R.A., ski, J.C.; posed b	V. and Griffiths, A.D. (1994). Demographic variation and range contraction in the Northern Quoll, Dasyurus hallucatus (M 2000). Reproduction and demography of the northern quoll, Dasyurus hallucatus, in the lowland savanna of northern Austr 2002). Spatial and social organization of a carnivorous marsupial, Dasyurus hallucatus. Journal of Zoology, London. 257: Walden, D.J. and Begg, G.W. (2002). A preliminary risk assessment of cane toads in Kakadu National Park. Supervisin Z., Rankmore, B.R., Fisher, A. and Milne, D. (2007). The natural occurrence of northern quolls Dasyurus hallucatus on isly cane toads Bufo marinus. Report to Natural Heritage Trust.	arsupialia: Dasyuridae). <i>Wildlife Research</i> , Vol. 21, pp. 203-218. alia. <i>Australian Journal of Zoology</i> . 48:519-539. 237-248. g Scientist Report 164, Darwin, Northern Territory. ands of the Northern Territory: assessment of refuges from the threat
Western Quoll			Habitat: In central Australia, occurred throughout a range of habitats (Pavey 2006).	NONE



Name	Sta	itus	Summary				
	Cth	NT		Likelihood of occurrence			
Dasyurus geoffroii	VU	EX	<b>Distribution:</b> Historically occurred throughout the arid interior of Australia including southern NT (), now restricted to the south-west of WA (Pavey 2006). Considered extinct in the NT since the 1960's.	<ul> <li>Presumed extinct in the NT.</li> </ul>			
	Pavey,	C. (200 https://n	6). Threatened Species of the Northern Territory - Western Quoll, Chuditch - Dasyurus geoffroii. Nor hem Territory Depar Loov.au/ data/assets/pdf_file/0018/205470/western-quoll.pdf [Accessed 1 May 2018].	tment of Environment and Natural Resources. [online] Available at:			
Golden Bandicoot Isoodon auratus	VU	EN	Habitat: Mainly in heathland and shrubland on sandstone sheets, avoiding vegetation with greater tree cover (Palmer et al. 2012; Southgate et al. 1996). Distribution: Formerly across most of northern, central and western Australia (across a broad range of habitats), but now only recorded population on mainland Australia is within the Kimberley. In the NT, confined to the offshore islands of Arnhem Land. The only records from mainland NT are from the north-east corner of Arnhem Land between 1950 and 1980 (Palmer et al. 2012). Now extinct on the mainland except in a few locations in the north-west Kimberley (TSSC 2015).	<ul> <li>Now restricted to the north-west Kimberley.</li> </ul>			
	Southg	<ul> <li>Paimer, C., Woinarski, J. and Hill, B. (2012). Inreatened Species of the Northern Territory – Golden Bandicoot - Isoodon auratus. Northern Territory Department of Environment and Natural Resources. [online] Available at: <a href="https://nt.gov.au/">https://nt.gov.au/</a> data/assets/odf file/0017/205505/golden-bandicoot.pdf [Accessed 1 May 2018].</li> <li>Southgate, R., Palmer, C., Adams, C., Masters, M., Triggs, B. and Woinarski, J. (1996). Population and habitat characteristics of the Golden Bandicoot (Isoodon auratus) on Marchinbar Island, Northern Territory. Wildlife Research, Vol. 23, pp. 647-664.</li> <li>Threatened Species Scientific Committee (TSSC) (2015). Approved Conservation Advice for Isoodon auratus auratus (golden bandicoot (mainland)). Canberra: Department of the Environment. [online]</li> </ul>					
Ghost Bat Macroderma gigas	VU	-	<ul> <li>Habitat: Ranging from the arid Pilbara of WA to tropical savanna woodlands and north Qld. rainforests (TSSC 2016). Permanent roost sites are generally deep natural caves or disused mines (TSSC 2016).</li> <li>Move between a number of caves seasonally or as dictated by weather conditions, and require a range of cave sites (Hutson et al. 2001). Most breeding sites are caves with multiple entrances (TSSC 2016).</li> <li>Distribution: Geographically-disjunct colonies occur in the Pilbara and Kimberley in WA, NT north of approximately 17° latitude (including Elcho Island and Groote Eylandt), the Gulf of Carpentaria, eastern Qld from Cape York to near Rockhampton, and western Qld (including Riversleigh and Camooweal districts) (TSSC 2016). Distribution likely influenced by the availability of suitable caves and mines for roost sites (Ward &amp; Milne 2016). Only 14 breeding sites known (Worthington Wilmer 2012). Disperse widely when not breeding (TSSC 2016). In arid Australia, including southern NT until the early 1960's (Ward &amp; Milne 2016).</li> </ul>	<ul> <li>Potential cave/abandoned mine habitat for permanent roost sites within EP144</li> <li>Woodland is potential foraging habitat; however, is a long distance from known roost sites.</li> <li>No records for this species in the MGD bioregion. Two records for the species in with in the GUF bioregion ~200 km north of EP144.</li> </ul>			
	<ul> <li>Hutson, A. M., Mickleburgh, S. P. &amp; Racey, P. A. (2001) Microchiropteran Bats - Global Status Survey and Conservation Action Plan. IUCN/SSC Chiroptera Specialist Group, Gland, Switzerland and Cambridge, U.K.</li> <li>Milne, D. and Ward, S. (2016). Threatened Species of the Northern Territory – Ghost Bat - Macroderma gigas. Northern Territory Department of Environment and Natural Resource. [online] Available at: https://nt.gov.au/data/assets/odf_file/0010/376138/ahost-bat.pdf [Accessed 1 May 2018]</li> </ul>						
	Threat	ened Sp at: <u>http</u>	ecies Scientific Committee (2016). Approved Conservation Advice for Macroderma gigas (ghost bat). Canberra: Departme ://www.environment.gov.au/biodiversity/threatened/species/pubs/174-conservation-advice-05052016.pdf [Accessed 1 May	ent of the Environment. Available / 2018].			



Nama	Status				
Name	Cth	NT	Summary	Likelihood of occurrence	
	Worth	ington W	ilmer, J. (2012). Ghost Bat Macroderma gigas. In: Cur is et al. (eds.). Queensland's Threatened Animals. CSIRO, Can	berra: pp. 382-383.	
Greater Bilby Macrotis lagotis	VU	VU	<ul> <li>Habitat: In the NT, occurs in hummock grasslands on sandy soils with a preference for palaeo-drainage lines (Southgate 1990). Has large foraging area and will move home range in search for food (Johnson 2008).</li> <li>Distribution: Historically widespread in arid Australia. Currently confined to arid WA, the Tanami Desert in the NT and south-western Qld (Woinarski et al. 2014).</li> </ul>	<ul> <li>Low</li> <li>Large area of EP144 contains suitable hummock grassland habitat</li> <li>Within expert distribution of the species</li> <li>Historic records 50 km south-west of EP (1959). However, the range of the species has contracted considerably since the last proximate records.</li> </ul>	
	Johns South Woina	on, K.A. 193. gate, R. ırski, J., F	(2008). Bilby Macrotis lagotis. In: Van Dyck, S. and Strahan, R. (eds.). Mammals of Australia. Third Edition. Reed Nev (1990). Habitat and diet of the greater bilby Macrotis lagotis Reid (Marsupalia: Peramelidae). In: Seebeck et al. (eds.). E Burbidge, A. and Harrison, P. (2014). The Action Plan for Australian Mammals 2012. CSIRO Publishing: pp. 203-205.	v Holland, Queensland Government, Queensland Museum: pp. 191- Bandicoots and Bilbies. Surrey Beatty & Sons, Sydney, NSW.	
Golden-backed Tree-rat Mesembriomys macrurus		CR	<ul> <li>Habitat: In the NT, little known of the ecology apart that all three records were from riverine vegetation. In the Kimberley, known to occur in open Eucalypt forests with tussock grass understorey, rainforest patches, sandstone screes, beaches, and black soil plains (Woinarski et al. 2012).</li> <li>Distribution: Historically, known to have occurred in three localities in the NT (Parker 1973) with no new records in the last 30 years. In 1993, reportedly spotted in Kakadu National Park; however, further surveys of suitable habitats in the NT failed to locate the species (Lee 1995). Now only known to occur in some areas of the north-western Kimberley and associated offshore islands (Palmer et al. 2003).</li> </ul>	• Presumed extinct in the NT.	
	Lee, A Palme Parke Woina	K. (199 r, C., Tay of Infr r, S.A. (1 rski, J.C. Natur	<ol> <li>The Action Plan for Australian Rodents. Australian Nature Conservation Agency, Endangered Species Program, Canl ylor, R. and Burbidge, A. (2003). Recovery plan for the Golden Bandicoot Isoodon auratus and golden-backed tree-rat M astructure Planning and Environment, Darwin.</li> <li>(973). An annotated checklist of the native land mammals of the Northern Territory. Records of the South Australian Music Z., Palmer, C. and Hill, B. (2012). Threatened Species of the Northern Territory – Golden-backed tree-rat – Mesembriorny al Resources. [online] Available at: <u>https://nt.gov.au/data/assets/pdf_file/0006/205476/golden-backed-tree-rat.pdf</u> [Acce</li> </ol>	berra. esembriomys macrurus 2004-2009. Nor hem Territory Department eum, Vol. 16, pp. 1-57. /s macrurus. Northern Territory Department of Environment and essed 1 May 2018].	
Black-footed Rock-wallaby (McDonnell Ranges race) Petrogale lateralis	VU	•	<ul> <li>Habitat: Upland rocky areas with associated steep slopes (Pavey 2006). Heavily weathered outcrops, caves, cliffs and rock piles provide suitable habitat as daytime shelter (Woinarski et.al. 2014).</li> <li>Distribution: In the NT, mostly found in the MacDonnell Ranges, but also occurs throughout the arid southern end of the NT (Pavey 2006) and may be found in the Davenport and Murchison Ranges.</li> </ul>	• Presumed extinct in the NT.	
	Pavey Woina	, C. (200 at: <u>httr</u> Irski, J., E	16). Threatened Species of the Northern Territory - Black-footed Rock-Wallaby - Petrogale lateralis. Northern Territory De hs://nt.gov.au/data/assets/pdf_file/0003/376122/black-footed-rock-wallaby.pdf_[Accessed 1 May 2018]. Burbidge, A. and Harrison, P. (2014). The Action Plan for Australian Mammals 2012. CSIRO Publishing: pp. 403-405.	partment of Environment and Natural Resources. [online] Available	



	Sta	atus	Summary			
Name	Cth	NT		Likelihood of occurrence		
Pale Field-rat Rattus tunneyi	÷	vu	<ul> <li>Habitat: Historically occurred in a wide range of habitats, but now primarily in dense vegetation along creeks (Aplin et al. 2008).</li> <li>Distribution: Higher rainfall areas of northern Australia, extending from Kimberley in WA to south-eastern Qld, including the Top End of the NT (Braithwaite &amp; Griffiths 1996).</li> </ul>	<ul> <li>LOW</li> <li>Suitable habitat available</li> <li>Historic records within EP144 1975 &amp; 1982</li> <li>Species has undergone significant range decline.</li> </ul>		
	Aplin, Braithy Cole, Woina	K., Braitl waite, R. J. and V rski, J.C	hwaite, R. and Baverstock, P. (2008). Pale Field-rat: <i>Rattus tunneyi</i> . In: Van Dyck, S. and Strahan, R. (eds.). <i>The Mam</i> and Griffiths, A. (1996). The paradox of <i>Rattus tunneyi</i> : endangerment of a na ive pest. <i>Wildlife Research</i> , Vol. 23, pp. Voinarksi, J. (2002). <i>Field Guide to the Rodents and Dasyurids of the Northern Territory</i> . Surrey Beatty & Sons, Chipping I .Z. (2000). The conserva ion status of rodents in the monsoonal tropics of the Northern Territory. <i>Wildlife Research</i> , Vol.	mals of Australia (3 <sup>rd</sup> Edition). Reed New Holland, Sydney, NSW. 1-21. Norton, NSW. 27, pp. 421-435.		
Bare-rumped Sheathtail Bat Saccolaimus saccolaimus nudicluniatus	VU		<ul> <li>Habitat: In the NT, specimens have been collected from Pandanus woodland fringing the sedgelands of the South Alligator River, and Eucalypt tall open forests (Friend &amp; Braithwaite 1986; Churchill 1998) with more recent records from Howard Springs (Milne et al 2009). Most records occur within near-coastal habitats with one recent exception (Jasper Gorge) 150 km inland (Woinarski et al. 2014).</li> <li>Distribution: Widely distributed from India through south-east Asia to the Solomon Islands including north-eastern Qld and the NT. The north-eastern Australian population is described as the subspecies <i>S. s. nudicluniatus</i>, although it is not clear whether this should be applied to NT populations (Milne &amp; Woinarski 2006).</li> </ul>	<ul> <li>NONE</li> <li>Suitable habitat does not occur</li> <li>NT records restricted to Kakadu lowlands</li> </ul>		
	<ul> <li>Churchill, S. (1998). Australian Bats. Reed New Holland, Sydney.</li> <li>Friend, G.R. and Braithwaite, R.W. (1986). Bat fauna of Kakadu National Park, Northern Territory. Australian Mammalogy, Vol. 9, pp. 43-52.</li> <li>Milne, D.J., Jackling, F.C., Sidhu, M., and Appleton, B.R. (2009). Shedding new light on old species identifications: morphological and genetic evidence suggest a need for conservation status review o critically endangered bat, Saccolaimus saccolaimus wildlife Research36: 496–508.</li> <li>Milne, D. and Woinarski, J. (2006). Threatened Species of the Northern Territory - Bare-rumped Sheathtail Bat - Saccolaimus. Northern Territory Department of Environment and Natural Resources. https://nt.gov.au/data/assets/pdf_file/0007/376117/bare-rumped-sheathtail-bat.pdf</li> <li>Woinarski, J. Burbidoe, A. and Harrison, P. (2014). The Action Plan for Australian Mammals 2012. CSIRO Publishing: pp. 511-514.</li> </ul>					
Northern Brushtail Possum Trichosurus vulpecula arnhemensis	VU	-	<ul> <li>Habitat: Upland rocky areas with associated steep slopes (Pavey 2006). Heavily weathered outcrops, caves, cliffs and rock piles provide suitable habitat as daytime shelter (Woinarski et.al. 2014).</li> <li>Distribution: In the NT, mostly found in the MacDonnell Ranges, but also occurs throughout the arid southern end of the NT (Pavey 2006) and may be found in the Davenport and Murchison Ranges.</li> </ul>	<ul> <li>NONE</li> <li>Suitable habitat does not occur – Monsoon and Eucalypt tall forests</li> <li>Brushtail Possums presumably extinct in the Barkly region</li> </ul>		
	Kerle, Pavey Woina	J., Foulk , C. and Reso rski, J.C <i>The b</i>	tes, J., Kimber, R. and Papenfus, D. (1992). The decline of the brushtail possum, <i>Trichosurus vulpecula</i> (Kerr 1798), in an Ward, S. (2012). <i>Threatened Species of the Northern Territory - Common Brushtail Possum - Trichosurus vulpecula vulp</i> urces. [online] Available at: <u>https://nt.gov.au/data/assets/pdf_file/0019/205525/common-brushtail-possum.pdf</u> [Accessed .Z. (2004). In a land with few possums, even the common are rare: ecology, conservation and management of possums in inology of Australian possums and gliding possums. Surrey Beatty & Sons, Sydney: pp.51-62.	nid Australia. <i>Rangelands Journal</i> , Vol. 14, pp. 107-127. ecula. Northern Territory Department of Environment and Natural 1 May 2018]. In the Northern Territory. In: Goldingay, R. and Jackson, S. (eds.).		



Name	Status				
	Cth	NT	Summary	Likelihood of occurrence	
Carpentarian Rock-rat Zyzomys palatalis	EN	CR	<ul> <li>Habitat: Restricted to sandstone gorges and escarpments containing a core of dry or wet rainforest vegetation, mixed with woodland, scree slopes and permanent water, surrounded by savanna woodlands (Puckey &amp; Woinarski 2006).</li> <li>Distribution: Restricted to the NT, where known only from five locations within a radius of 35 km (Puckey 2003) at Wollogorang Station in the Gulf of Carpentaria (Kitchener 1989).</li> </ul>	<ul> <li>NONE</li> <li>Outside distribution, which is highly restricted to 5 populations within 35 km of Wollogorang Station.</li> </ul>	
	Kitchener, D.J. (1989). Taxonomic appraisal of Zyzomys (Rodentia, Muridae) wi h descriptions of two new species from the Nor hern Territory, Australia. <i>Records of the Western Australian Museum</i> , Vol. 14, pp. 331-373. Puckey, H. (2003). Additional records of the Carpentarian rock-rat <i>Zyzomys palatalis</i> at Redbank, close to the type locality. <i>Northern Territory Naturalist</i> , Vol. 17, pp. 43-45. Puckey, H. and Woinarski, J. (2006). <i>Threatened Species of the Northern Territory - Carpentarian Rock-rat - Zyzomys palatalis</i> . Northern Territory Department of Environment and Natural Resources. Ionlinel Available at: https://nt.gov.au/dat/assets/odf_file/0008/205478/carpentarian-rock-rat.pdf_IAccessed 1 May 2018]				
Central Rock-rat Zyzomys pedunculatus	CR	EN	Habitat: Range of grasslands and woodlands in the MacDonnell Ranges (McDonald 2012). Distribution: Historically widespread in the arid regions of the NT and WA (Baynes & Johnson 1996). Rediscovered in the MacDonnell Ranges at a few sites (McDonald 2012).	<ul> <li>NONE</li> <li>No suitable habitat within or around the project areas.</li> <li>Presumably Extinct in the Barkly Region.</li> <li>Species' distribution has contracted to around the MacDonnell Ranges.</li> </ul>	
	<ul> <li>Baynes, A. and Johnson, K. (1996). The contributions of the Horn Expedition and cave deposits to knowledge of the original mammal fauna of central Australia. In: Morton, S.R. and Mulvaney, D.J. (eds.). Exploring Central Australia: Society, the Environment and the 1894 Horn Expedition. Surrey Beatty and Sons, Sydney: pp. 168-186.</li> <li>McDonald, P. (2012). Threatened Species of the Northern Territory - Central Rock Rat - Zyzomys pedunculatus. Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/ data/assets/pdf_file/0013/205510/central-rock-rat.pdf</li> </ul>				
REPTILES	-	1	Habitaty Eleverylains in the Tan End and excelsion soil plains inland (Mabb et al. 2002)	HICH	
Plains Death Adder Acanthophis hawkei	VU	VU	<b>Distribution</b> : Habitat mapping suggests the potential geographic range extends from western Qld, across the sub-coastal north of the NT to the north-eastern Kimberley of WA. Fragmented populations occur in the Mitchell Grass Downs of western Qld, the Barkly Tablelands on the NT/Qld border and east of Darwin (Fogg Dam) in the NT (TSSC 2012; Wuster et al. 2005). Susceptible to ingesting toxic Cane Toads (Phillips et al. 2009).	<ul> <li>Suitable cracking clay habitat within EP144</li> <li>Within expert distribution</li> <li>Nearby records (2017) of the species proximate to, and in similar habitat to that within, EP144.</li> </ul>	
	<ul> <li>Phillips, B.L., Greenlees, M.J., Brown, G.P. and Shine R (2010). Predator behaviour and morphology mediates the impact of an invasive species: cane toads and death adders in Australia. <i>Animal Conservation</i>, Vol. 13, pp. 53-59.</li> <li>Webb, J.K., Christian, K.A. and Fisher, P. (2002). Fast growth and early maturation in a viviparous sit-and-wait predator, the northern death adder (<i>Acanthophis praelongus</i>) from tropical Australia. <i>Journal of Herpetology</i>, Vol. 36, no. 3, pp. 505-509.</li> <li>Wuster, W., Dumbrell, A.J., Hay, C., Pook, C.E., Williams, D.J. and Fry, B.G. (2005). Snakes across the Strait: trans-Torresian phylogeographic relationships in three genera of Australasian snakes (Serpentes: Elapidae: <i>Acanthophis, Oxyuranus</i>, and <i>Pseudechis</i>). <i>Molecular Phylogenetics and Evolution</i>, Vol. 34. pp. 1-14.</li> <li>Threatened Species Scientific Committee (2015). <i>Approved Conservation Advice – Acanthophis hawkei – Plains Death Adder</i>. Canberra: Department of the Environment. [online] Available at: <a href="http://www.environment.gov.au/biodiversity/threatened/species/pubs/83821-conservation-advice.pdf">http://www.environment.gov.au/biodiversity/threatened/species/pubs/83821-conservation-advice.pdf</a> [Accessed 1 May 2018].</li> </ul>				
Gulf Snapping Turtle	EN		Habitat: Riverine environment occurs in deep water pools in the upper catchment of permanently spring fed spring fed rivers. Little is known about microhabitat. Threats	MEDIUM	



Name	Status					
	Cth	NT	Summary	Likelihood of occurrence		
Elseya lavarackorum			include feral animals; trampling and depredation of nesting sites by grazing cattle and pigs (Woinarski 2006). Distribution: Restricted to rivers draining into the Gulf of Queensland, in the Northern Territory this includes the Calvert to Nicolson River system. Highest densities recorded adjacent to riparian vegetation. Listed federally endangered due to presumed small range and presumed decline in population (Woinarski 2006).	<ul> <li>Nearby records of the species proximate to, and with similar habitat to that within, EP144</li> <li>Species restricted to the north-eastern region of EP144, Nicholson River and its tributaries</li> </ul>		
	Woinarski, J. (2006). Threatened Species of the Northern Territory –Eleseya lavarackorum. Northern Territory Department of Environment and Natural Resources. https://nt.gov.au/ data/assets/pdf_file/0008/376181/gulf-snapping-turile.pdf. [Accessed 24 September 2019].					
Mertens' Water Monitor Varanus mertensi	-	VU	<ul> <li>Habitat: Semi-aquatic, occupying edges of freshwater watercourses and lagoons, but seldom seen far from water (Christian 2004).</li> <li>Distribution: Across far northern Australia from the western Cape York Peninsula in Qld to the Kimberley in WA (Christian 2004). Widespread in the NT, occupying all of the Top End river systems (Ward et al. 2006). Susceptible to ingesting toxic Cane Toads resulting in reduced abundance (Griffiths &amp; McKay 2007).</li> </ul>	<ul> <li>MEDIUM</li> <li>Suitable habitat available within EP144.</li> <li>Nearby historic records of the species proximate to, and similar habitat to that within, EP144</li> </ul>		
	Christian, K. (2004). Varanus mertensi. In: Pianka et al. (eds.). Varanoid lizards of the world. Indiana University Press, Bloomington, Indianapolis. Griffiths, A.D. and McKay (2007). Cane toads reduce the abundance and site occupancy of Merten's water monitor (Varanus mertensi). Wildlife Research, Vol. 34, pp. 609-615. Ward, S., Woinarski, J., Griffiths, T. and McKay, L. (2006). Threatened Species of the Northern Territory - Mertens Water Monitor - Varanus mertensi. Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/ data/assets/pdf_file/0018/206460/mertens-water-monitor.pdf [Accessed 1 May 2018].					
Mitchell's Water Monitor Varanus mitchelli	-	VU	<ul> <li>Habitat: Semi-aquatic and arboreal, inhabiting margins of freshwater watercourses, swamps and lagoons (Ward 2012).</li> <li>Distribution: Top End of the NT and Kimberley in WA (Schultz &amp; Doody 2004). In the NT, recorded in most catchments flowing into the Timor Sea, Arafura Sea and the Gulf of Carpentaria (Ward 2012).</li> </ul>	LOW • Suitable habitat available • Historic (1967/1973) records proximate to EP144. • No recent records for the region		
	Doody, J.S., Green, B., Rhind, D., Castellano, C., Sims, R. and Robinson, T. (2009). Population-level declines in Australian predators caused by an invasive species. Animal Conservation, Vol. 12, pp. 46-53. River Schultz, T. and Doody, S. (2004). Varanus mitchelli. In: Pianka et al. (eds.). Varanoid lizards of the world. Indiana University Press, Bloomington, Indianapolis. Ward, S. (2012). Threatened Species of the Northern Territory - Mitchell's Water Monitor - Varanus mitchelli. Northern Territory Department of Environment and Natural Resources. [online] Available at:https://nt.gov.au/data/assets/pdf_file/0019/206461/mitchells-water-monitor.pdf [Accessed 30 May 2017].					
Floodplain Monitor Varanus panoptes	-	vu	<ul> <li>Habitat: Broad range of habitats from coastal beaches to savannah woodlands (Christian 2004). Also common throughout floodplains grasslands and a variety of native woodlands (Ward et al. 2012).</li> <li>Distribution: Across northern Australia from the Kimberley in WA to Cape York Peninsula, and southwards through most of Qld. In the NT, recorded across most of the Top End and the Gulf Region (Christian 2004). Highly susceptible to cane toad poisoning (Ujvari &amp; Madsen 2009), and has experienced significant declines (Doody et al. 2009).</li> </ul>	MEDIUM <ul> <li>Historic records from within Connells Lagoon Conservation Reserve and surrounds within the western region of EP144</li> <li>Preferred habitat within EP</li> <li>Within expert distribution.</li> </ul>		
	Christian, K. (2004). Varanus panoptes. In: Pianka et al. (eds). Varanoid lizards of the world. Indiana University Press, Bloomington, Indianapolis. Doody, J.S., Green, B., Rhind, D., Castellano, C., Sims, R. and Robinson, T. (2009). Population-level declines in Australian predators caused by an invasive species. Animal Conservation, Vol. 12, pp. 46-53.					



Name	Status		Carried Street S			
	Cth	NT	Summary	Likelihood of occurrence		
	Ujvari, B. & Madsen, T. (2009). Increased mortality of naïve varanid lizards after the invasion of non-native cane toads ( <i>Bufo marinus</i> ). Herpetological Conservation and Biology, Vol. 4, pp. 248-251. Ward, S., Woinarski, J., Griffiths, T. & McKay, L. (2012). Threatened Species of the Northern Territory - Yellow Spotted Monitor, Northern Sand Goanna, Floodplain Monitor - Varanus panoptes. Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/data/assets/pdf_file/0006/206466/filoodplain-monitor.pdf [Accessed 1 May 2018].					
FISH						
Freshwater or Largetooth Sawfish Pristis pristis	vu	VU	<ul> <li>Habitat: Tropical marine and estuarine habitats, entering estuarine or fresh waters to breed during the wet season and moving into marine waters following the wet season (Peverell 2005). Of the four <i>Pristis</i> species reported to occur in Australia, is the one most often associated with freshwater, and has been recorded several hundred kilometres upstream (Thorburn et al. 2003).</li> <li>Distribution: Circumtropical, with distinct populations in the eastern Atlantic, western Atlantic, eastern Pacific and Indo-West Pacific – including northern Australia (TSSC 2014). In the NT, reported in Adelaide, Victoria, Daly, East and South Alligator, Goomadeer, Roper, McArthur, Wearyan and Robinson Rivers (TSSC 2014). May potentially occur in all large rivers of northern Australia from the Fitzroy River, WA, to the western side of Cape York Peninsula, Qld (DoE 2018).</li> </ul>	<ul> <li>LOW</li> <li>Suitable breeding habitat in seasonal watercourses within EP.</li> <li>Reported in the Roper River; no other regional records.</li> </ul>		
	Department of the Environment (DoE) (2018). Pristis pristis in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: http://www environment.gov.au/sprat. [Accessed 1 May 2018]. Peverell, S.C. (2005). Distribution of sawfishes (Pristidae) in the Queensland Gulf of Carpentaria, Australia, with notes on their ecology. <i>Environmental Biology of Fish</i> —es, Vol. 73, pp. 391-402. Threatened Species Scientific Committee (2014). Approved Conservation Advice - Pristis pristis (largetooth sawfish). Canberra: Department of the Environment. In effect under the EPBC Act from 11-April- 2014. [online] Available at: http://www.environment.gov.au/biodiversity/threatened/species/pubs/60756-conservation-advice.pdf [Accessed 1 May 2018].					
INVERTEBRATES						
Victoria's Land Snail Trachiopsis victoriana	-	VU	<ul> <li>Habitat: Found in leaf litter at the base of large limestone boulders in a marshy sink. Also recorded buried in soil in open <i>Eucalyptus</i> woodlands (Solem 1985).</li> <li>Distribution: Reported in and around a limestone sinkhole adjacent to the Victoria Highway, 86km south west of Katherine (Solem 1985). Possibly naturally extremely restricted in range.</li> </ul>	<ul> <li>NONE</li> <li>EP is outside species' highly restricted range</li> </ul>		
	<ul> <li>Solem, A. (1985). Camaenid land snails from Western and central Australia (Mollusca: Pulmonata: Camaenidae) - V Remaining Kimberley genera and addenda to the Kimberley. Records of the Western Australian Museum Supplement 20, pp. 707-981.</li> <li>Wilson, C., Woinarski, J., Kessner, V. and Braby, M. (2006). Threatened Species of the Northern Territory - Victoria's Land Snail - Setobaudinia victoriana. Northern Territory Department of Environment and Natural Resources. [online] Available at: <a href="https://nt.gov.au/">https://nt.gov.au/</a> data/assets/odf file/0007/206539/setobaudinia-victoriana.pdf [Accessed 1 May 2018].</li> </ul>					
FLORA						
Tobermorey Melon Austrobryonia argillicola	1	VU	<ul> <li>Habitat: Along creeks and in areas with poor drainage, often on cracking clay plains. Recorded in bluebush swamps and riparian woodlands dominated by <i>Eucalyptus camaldulensis</i> (Nano et al. 2012).</li> <li>Distribution: In northern Australian, occurs inland from the Barkly Tablelands to central western Qld. In the NT, rare and only found in five locations in the central-eastern area (Nano et al. 2012). More records identified in that area in 2016 by EcOz.</li> </ul>	<ul> <li>HIGH</li> <li>Preferred poorly-drained cracking clay soil habitat present within EP</li> <li>Preferred community of bluebush swamps</li> <li>Closest historic record (1995) &lt;15 km west of project area.</li> </ul>		



Name	Status				
	Cth	NT	Summary	Likelinood of occurrence	
	Nano, C., Kerrigan, R. and Albrecht, D. (2012). Threatened Species of the Northern Territory - Austrobryonia argillicola - I. Telford (Cucurbitaceae). Northern Territory Department of Environment and Natural Resources. <a href="https://nt.gov.au/data/assets/pdf_file/0017/208412/austrobryonia-argillicola.pdf">https://nt.gov.au/data/assets/pdf_file/0017/208412/austrobryonia-argillicola.pdf</a> [Accessed 1 May 2018].				
Blue Grass Dichanthium setosum	VU	-	<ul> <li>Habitat: Heavy soils, predominantly cracking clays or alluvium, in woodland and/or open woodland dominated by Acacia and Eucalyptus species (Booth, 2012).</li> <li>Distribution: Occurs throughout QLD from Toowoomba (east) to the Lynd Junction (north) to Lawn Hill National Park near to the NT border (west) and south into NSW. In the NT species remains unsurveyed (Booth, 2012).</li> </ul>	<ul> <li>MEDIUM</li> <li>Preferred habitat within EP</li> <li>Known to Lawn Hill NP ~150 km east of EP144.</li> <li>Often found in areas of high pastoral disturbance.</li> <li>No surveys undertaken in the NT. Abundance and distribution for this species in the NT unknown.</li> </ul>	
	Booth, R. (2012). Species profile – Dichanthium setosum. Queensland Government Department of Environment and Science. <u>https://apps.des.gld.gov.au/species_search/details/?id=10401#.~:text=Dichanthium%20setosum%20occurs%20from%20Toowoomba.near%20the%20Northerm%20Territory%20border</u> . [Accessed 30 Dec 2020].				
A fern Macrothelypteris torresiana	-	EN	<ul> <li>Habitat: Sheltered sandstone gorges associated with springs and groundwater seepages (Cowie &amp; Westaway 2012).</li> <li>Distribution: Isolated populations in northern WA, eastern Qld, north-eastern NSW and the NT (two locations on Wollogorang Station in the Gulf region, adjacent to the Qld border) (Cowie &amp; Westaway 2012). There are substantial areas of potentially-suitable habitat in Western Arnhem Land that are poorly surveyed at the scale and intensity necessary to exclude the possibility that more subpopulations exist; however, the chance of finding additional subpopulations in that area appears relatively low (Cowie &amp; Westaway 2012).</li> </ul>	<ul> <li>NONE</li> <li>No preferred sheltered gorge habitat within EP</li> <li>Project area is outside the expert distribution and there are no nearby records.</li> </ul>	
	Cowie, I. and Westaway, J. (2012). Threatened Species of the Northern Territory - Macrothelypteris torresiana. Northern Territory Department of Environment and Natural Resources. https://nt.gov.au/ data/assets/pdf_file/0006/208473/macrothelypteris-torresiana.pdf [Accessed 1 May 2018].				

CR = Critically Endangered, EN = Endangered, DD = Data Deficient, NT = Near Threatened, VU = Vulnerable