



Peak Helium

**EMP PKH2-3**

NT Exploration Permit (EP) 134

Appendices

**01 – 01.02**

# 1 Appendix 01 – Description of the Environment



Peak Helium Pty Ltd

**EMP PKH2-3**

NT Exploration Permit (EP) 134

## Appendix 01

### Description of the Environment

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**INGAUGE**  
Well Engineering & Project Management

# 1 Description of the Environment

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## 1.1 Climate

The location of the Project Area is northeast of Kulgera in the Northern Territory.

The Interest Holder has used Bureau of Meteorology (BOM) data from weather station 015603 (Kulgera) in its climate analysis [BOM, 2022A]. The Kulgera BOM station has 54 years of daily rainfall data (1968 to the present). The Kulgera weather station is approximately 55 km southwest of the Project Area.

The climate in the location of the Project area is characterised as arid to semi-arid. The area experiences hot, dry summers and cool, dry winters.

### 1.1.1 Temperature

The mean daily minimum temperatures for Kulgera range between 4.8 and 22.1°C, and the maximum mean daily temperatures range between 18.9 and 37.0°C.

**Table 1.1—1 Kulgera Average Monthly Temperatures**

Temperature (°C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Average Max	37.0	35.7	32.4	28.3	22.9	18.9	19.2	22.1	27.1	30.8	33.6	35.1	28.6
Average Min	22.1	21.3	18.0	13.9	9.0	5.2	4.8	6.6	11.3	15.3	18.4	20.3	13.9

### 1.1.2 Evaporation

Peak Helium has used SILO's Morton's Shallow Lake evaporation data to calculate evaporation in the Project Area [SILO, 2021, 2022]. Monthly evaporation depth totals have been listed in **Table 1.1—2** for the 10th, 50th and 90th percentiles (P10, P50 and P90). Percentiles are based on 52 years of SILO Morton's Shallow Lake evaporation data.

The average annual evaporation for Kulgera is approximately 1801.4mm, which exceeds the annual rainfall even in the wettest of years.

The highest rainfall months for the Project Area are December, January, and February. Peak Helium has used the sum of the P10 lake evaporation for December, January, and February, being 563mm. As such, Peak Helium will use 90-day evaporation of 500mm when calculating freeboard requirements to cater for 1 in 1,000-year rainfall events.

Table 1.1—2 Kulgera Average Monthly Evaporation

Evaporation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
P10 (mm)	200.5	165.3	152.3	109.8	73.3	56.7	67.6	94.7	124.9	162.0	183.0	197.4	1587.5
P50 (mm)	225.9	190.3	176.1	124.4	87.7	65.8	76.5	106.8	143.1	186.9	199.1	218.8	1801.4
P90 (mm)	242.7	206.5	186.2	133.0	94.6	71.2	84.0	115.1	153.5	196.3	211.7	237.1	1931.8

## 1.2 Rainfall

Peak Helium has evaluated average monthly rainfall, average daily rainfall, historically Significant Rainfall Events (SREs), and 1 in 1,000-year events when assessing rainfall risks for this EMP.

### 1.2.1 Average Monthly Rainfall

The Project Area experiences a semi-arid climate within Climate Zone 3, characterised by hot, dry summers, mild winters, and distinct wet and dry seasons [NATIONAL CONSTRUCTION CODE, 2015]. While the regulatory wet season runs between October and April, the local wet season is confined to November to March [DEPWS et al., 2019]. This seasonal variation has potential and significant implications for water resources; the wet season has the opportunity to bring considerable rainfall events. These rainfall events can cause local rivers to run and localised short-term flooding, determined by the rainfall's volume, duration, and spatial distribution. It is these flooding events that provide the recharge to the aquifers. In contrast, the dry season between April and November experiences little rain.

The average monthly rainfall for the Kulgera region is shown in **Table 1.2—1**.

**Table 1.2—1 Kulgera Average Monthly Rainfall**

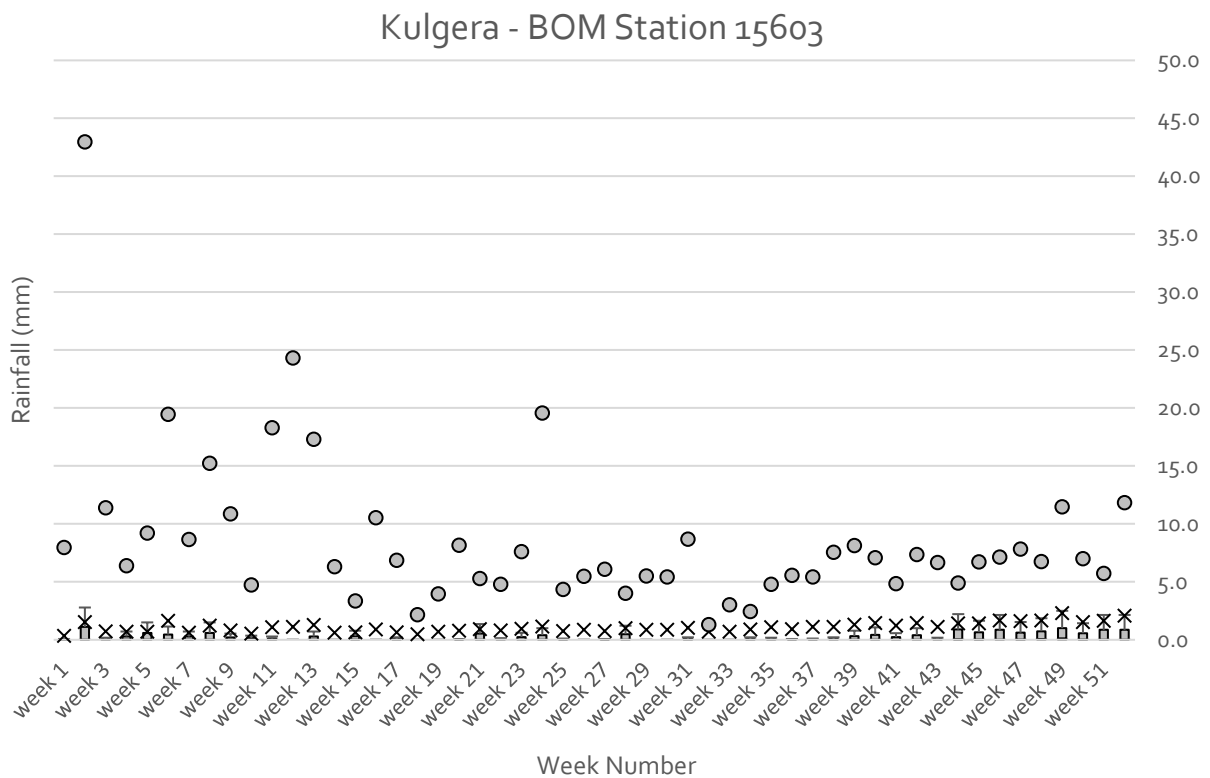
Rainfall	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Average Rain (mm)	28.9	32.5	29.1	13.3	12.3	15.8	11.6	8.5	14.8	19.4	25.2	32.8	249.9
Median Rain (mm)	14.4	9.0	10.7	2.6	3.8	4.4	4.6	1.2	4.4	5.0	16.7	22.6	219.3
Average Rain Days	2.5	2.4	2.0	1.7	1.6	1.7	1.6	1.2	1.7	2.1	3.1	3.2	24.8

Note: values coloured in red, and blue indicate yearly highs and lows, respectively.

### 1.2.2 Average Daily Rainfall

The average daily rainfall records for Kulgera show that both the expected amount of rainfall and uncertainty range is highest in November through April, inclusive. The average rainfall and uncertainty range for May through October is relatively low, with averages below 0.1mm per day. In December, the rainfall is still low, with an average of <0.2mm a day. In the event that it does rain, little runoff is anticipated, as the ground is expected to be relatively dry.

The daily recorded rainfall for Kulgera showing the minimum, lower quartile, median, upper quartile, maximum and outliers (1.5 times the maximum) are shown in **Figure 1.2—1**.



**Figure 1.2—1 Daily Rainfall Statistics**

### 1.2.3 Significant Rainfall Events

Peak Helium has defined a Significant Rainfall Event (SRE) in this **EMP** as an event with greater than 300mm total rainfall occurring over four days. This type of rain is consistent with rainfall from monsoonal troughs, tropical lows, or cyclones. There are no SREs for Kulgera, as shown in **Figure 1.2—2**, using Darwin Airport for comparison.

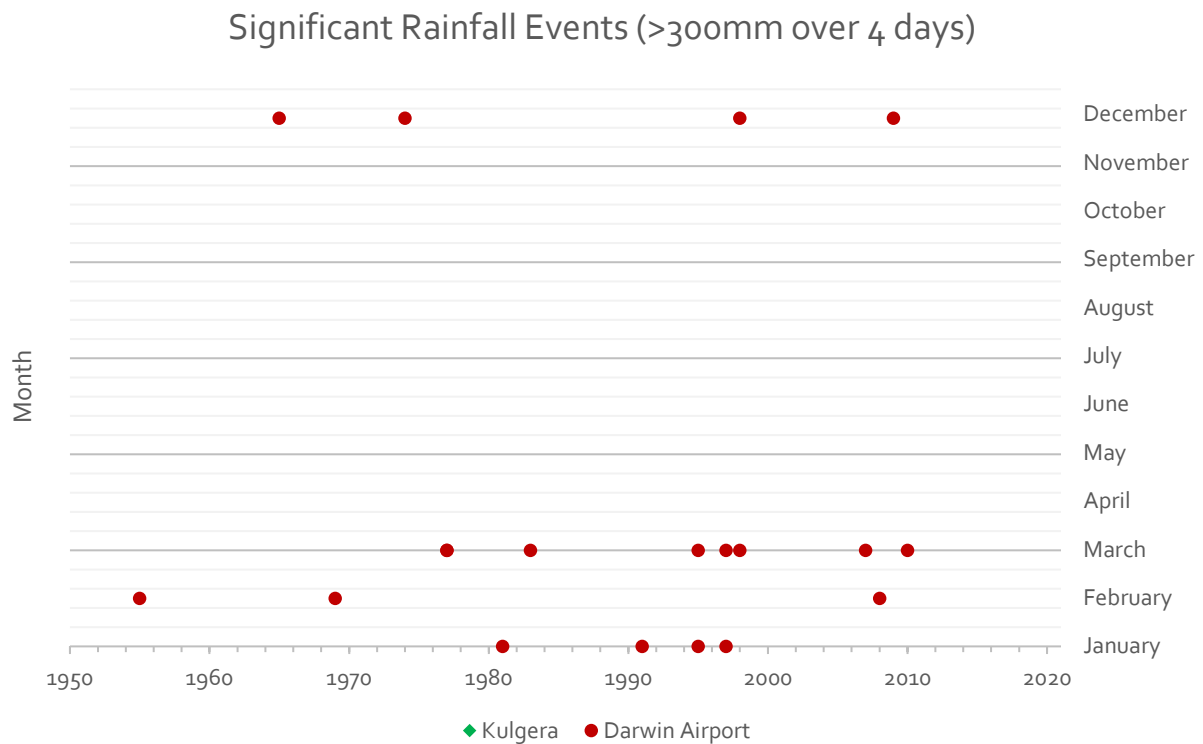


Figure 1.2—2 Significant Rainfall Events

#### 1.2.4 1 in 1,000-year events

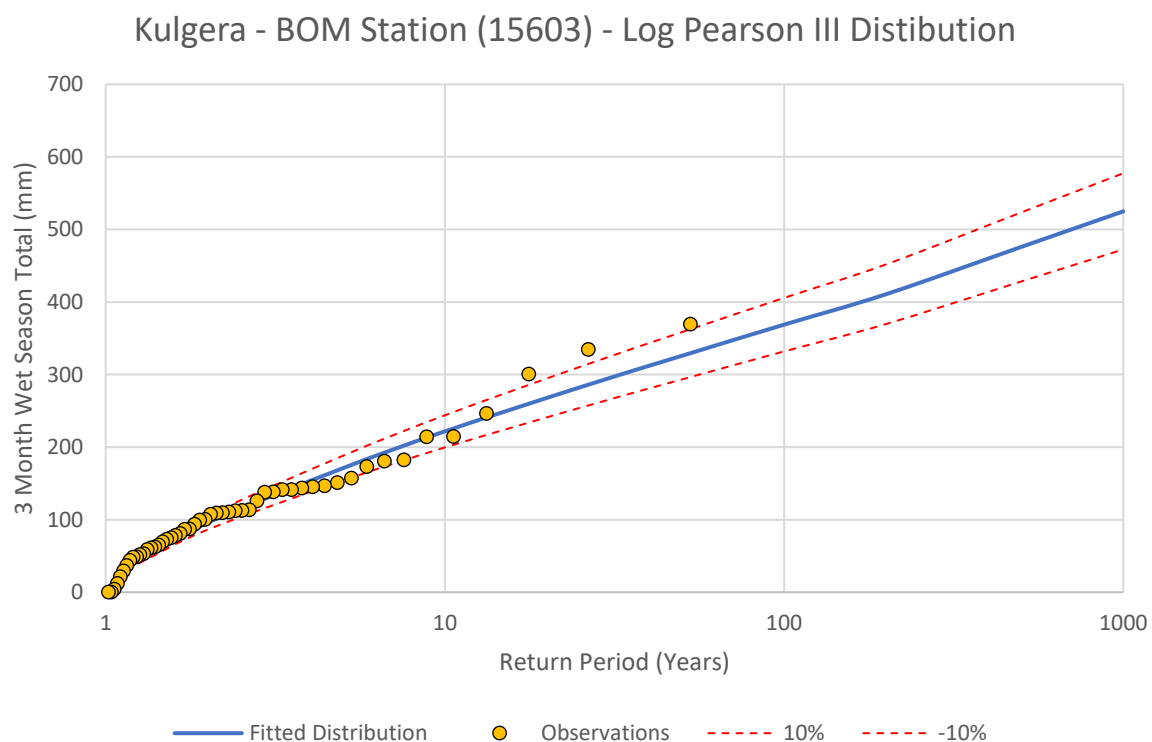
Consistent with industry-accepted methodology associated with practices such as dam risk assessments (which calculate the wet season based on your geographical location), three months was determined to be an applicable period of time to model a 1 in 1,000-year rainfall event.

The highest three-month rainfall periods for Kulgera were used, and a Log Pearson III distribution technique was fitted to the data. This analysis allowed us to extrapolate the 1,000-year, three-month duration wet season.

The median highest predicted 1 in 1,000-year total rainfall in three months, within the wet season, for Kulgera is 525mm. However, confidence bounds show that it could be up to 577mm. These calculations do not allow for any evaporation.

Based on the most conservative values and P10 evaporation of 450mm factored into the 90-day extreme rain event, a freeboard of 500mm will be applied to all open pits and unattended open-top tanks to minimise the risk of overtopping.

Figure 1.2—3 shows the Log Pearson III distribution plots for Kulgera, with 10% uncertainty bounds.



**Figure 1.2—3 1:1,000-year events**

### 1.3 Geology

The Amadeus Basin is a complex intracratonic downwarp initiated ~1000 Ma ago as a component of the Centralian Superbasin that formed between Archaean cratonic blocks to the south-west (Yilgarn), south-east (Gawler), and north-west (Kimberley). Towards the end of the Neoproterozoic and into the earliest Palaeozoic (~640 Ma to 530 Ma), the compressive Petermann Ranges Orogeny exhumed the Musgrave Block, dividing the Centralian Superbasin into the Amadeus Basin in the north and the Officer Basin in the south.

Up to 300 km of crustal shortening occurred during the Petermann Ranges Orogeny. Within the Mt Kitty area of the southern Amadeus Basin, northward thrusting of the basement and oldest Neoproterozoic sediments into a series of nappe structures shortened the crust by 20 to 30 km. The presence of interbedded evaporites enabled the overlying Bitter Springs Formation to act as a decollement layer within which this crustal shortening was compensated for by flexural flow folding. Coeval halokinetic flowage of an included thick salt layer produced the structural configuration of the post-Bitter Springs succession. Within the northern Amadeus Basin at this time, across an east-west line of flexure, deposition continued within an essentially half-graben setting.

Subsequent deposition during the Middle Cambrian through Devonian periods, although punctuated by periods of salt withdrawal and the creation of several shallow angle unconformities, was terminated by the multi-pulsed, compressive Alice Springs Orogeny. Being generated from the north, this orogeny created the dominant elongate fold pattern typical of the northern Amadeus Basin and, to the south of the central ridge, a southerly dipping monocline.

The nearest producing fields within the Amadeus Basin are located approximately 350km north-west and north from the Ramsay AA location, these are the Mereenie Field and the Palm Valley Field, which are found in Ordovician Sandstones.

Layer	Depth (m AMSL)	Depth (m MDGL)	Layer Uncertainty (+/- m)	Cumulative Uncertainty (+/- m)
Ground Level	-402	0	2	2
Petermann Unconformity	-24	378	76	78
Areyonga Unconformity	952	1354	195	273
Basal Loves Creek Fm	1345	1747	79	351
Basal Upper Gillen Fm	1638	2040	59	410
Base Gillen Evaporites	2637	3039	200	610
Top Basement	2903	3305	53	663

Figure 1.3—1 Prognosed Formation Tops for Ramsay Exploration Wells

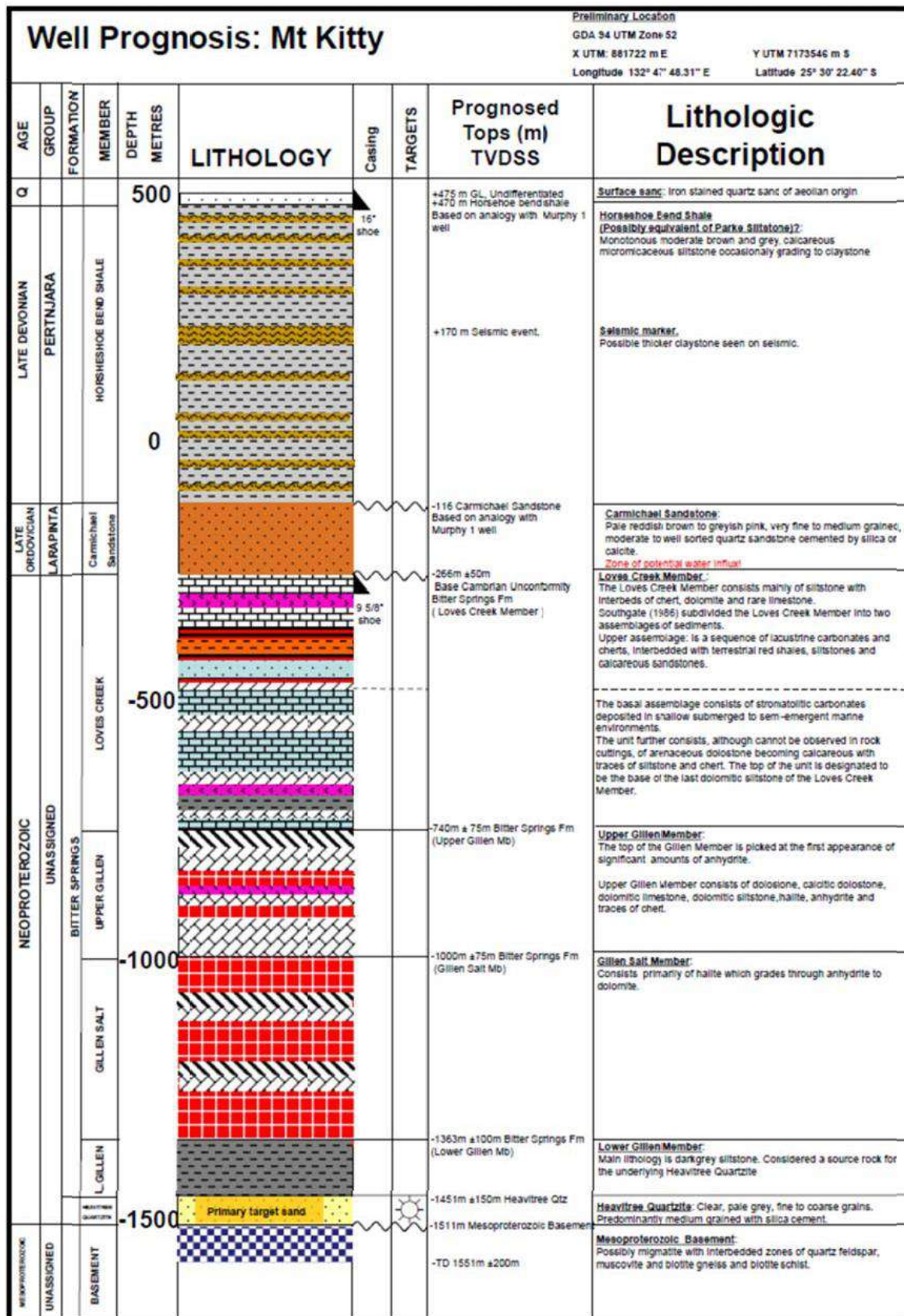


Figure 1.3—2 Well Prognosis: Mt Kitty

## 1.4 Topography

The Project Area is located at the Amadeus Basin and is described as a flat to gently undulating plain that is deeply weathered, covered by thick laterite, and associated soils, and predominantly supports savannah vegetation. The Project Area is mostly dune systems, which transition into plains, swales, and depressions. The Project Area lies within the Diamantina-Georgina Rivers catchment. The major watercourses in proximity to the Project Area are Karinga Creek in the west, and Nine Mile Creek in the northeast [K. J. DAY et al., 1985].

**Figure 1.6—1** shows 2m contour lines and slope over the Project Area.

## 1.5 Soils

The proposed activities are located in an area that predominantly comprises loamy depressions, clay pans, swales, and open and undulating plains. The Project Area has a high concentration of drainage lines and rocky rises; see **Figure 1.6—2**.

There is a large concentration of clay soils in the clay pans and seasonal swamps. These clays are scalded red-brown and heavy brown clay, respectively. The open plains also have a high level of clays to clay loams, with a high gravel content. There is a high volume of red sand to sandy red earth sands in the sandplains, and soft red aeolian sands in the dunes.

Understanding the implications for erosion and sedimentation due to the regulated activities is based on knowledge acquired through desktop research and soil mapping technology, readily available in the public domain [ECOZ, 2022].

Most well pads, camps, and gravel pits are located primarily within the Simpson land system. This land system consists of dunefields and the soil is predominantly red sands.

The southwestern well pad and camp exists within the Lindavale land system, and comprises plains, rises and plateaus on weathered and unweathered Cambrian limestone, dolomite, chalcedony, shale, sandstone and siltstone [TOPO, 2022].

## 1.6 Land Systems

Land systems are based on the ecosystem concept, in which several local land feature sequences are repetitive and integrated, e.g., climate, geological material, landform, soil and native vegetation.

**Figure 1.6—3** presents a description of the land systems of the Project Area [J. M. ALDRICK et al., 1992; R. A. PERRY et al., 1962].

**Table 1.6—1** shows the Land Systems of the Project Area.

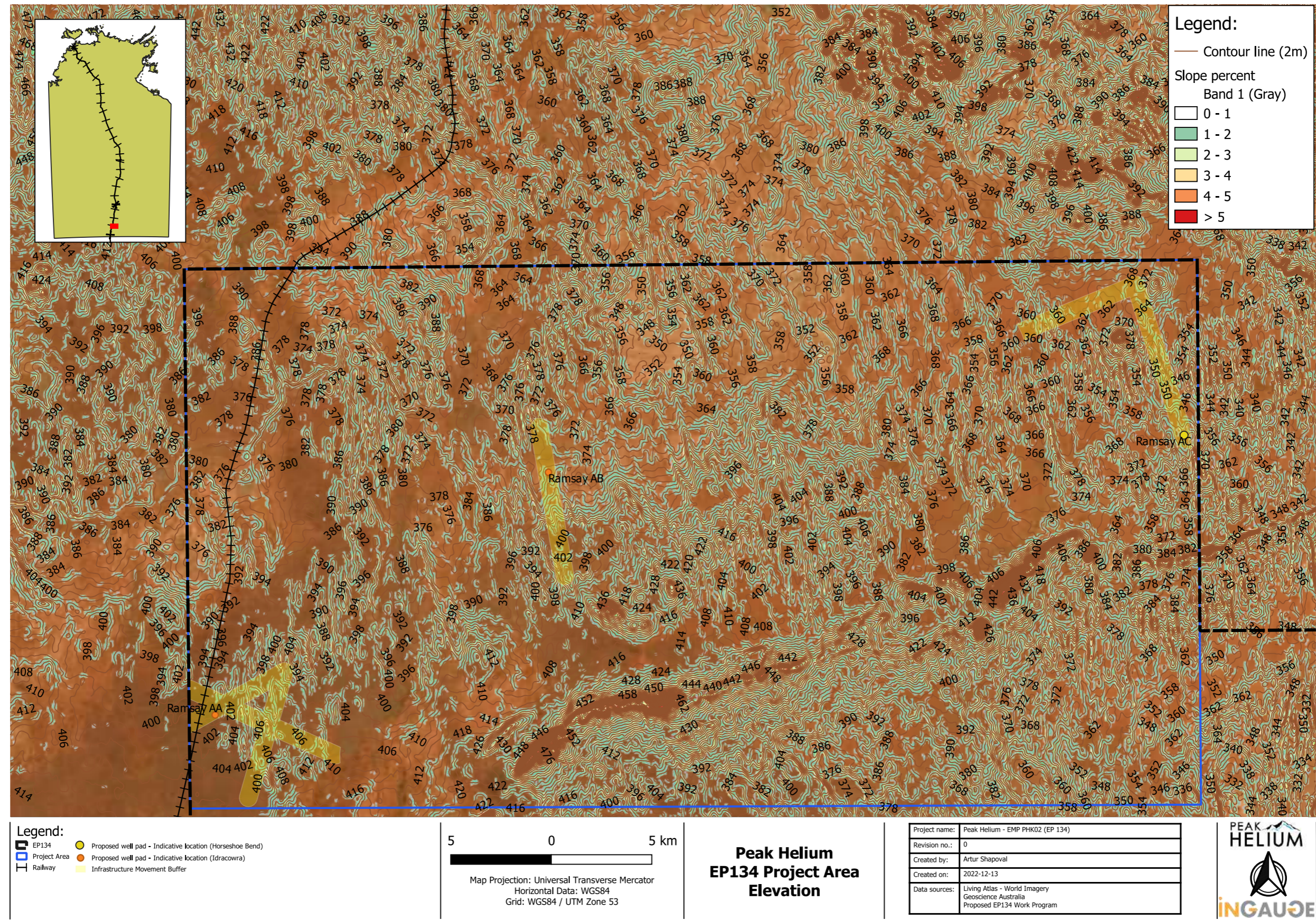


Figure 1.6—1 Contours (2m) of the Project Area

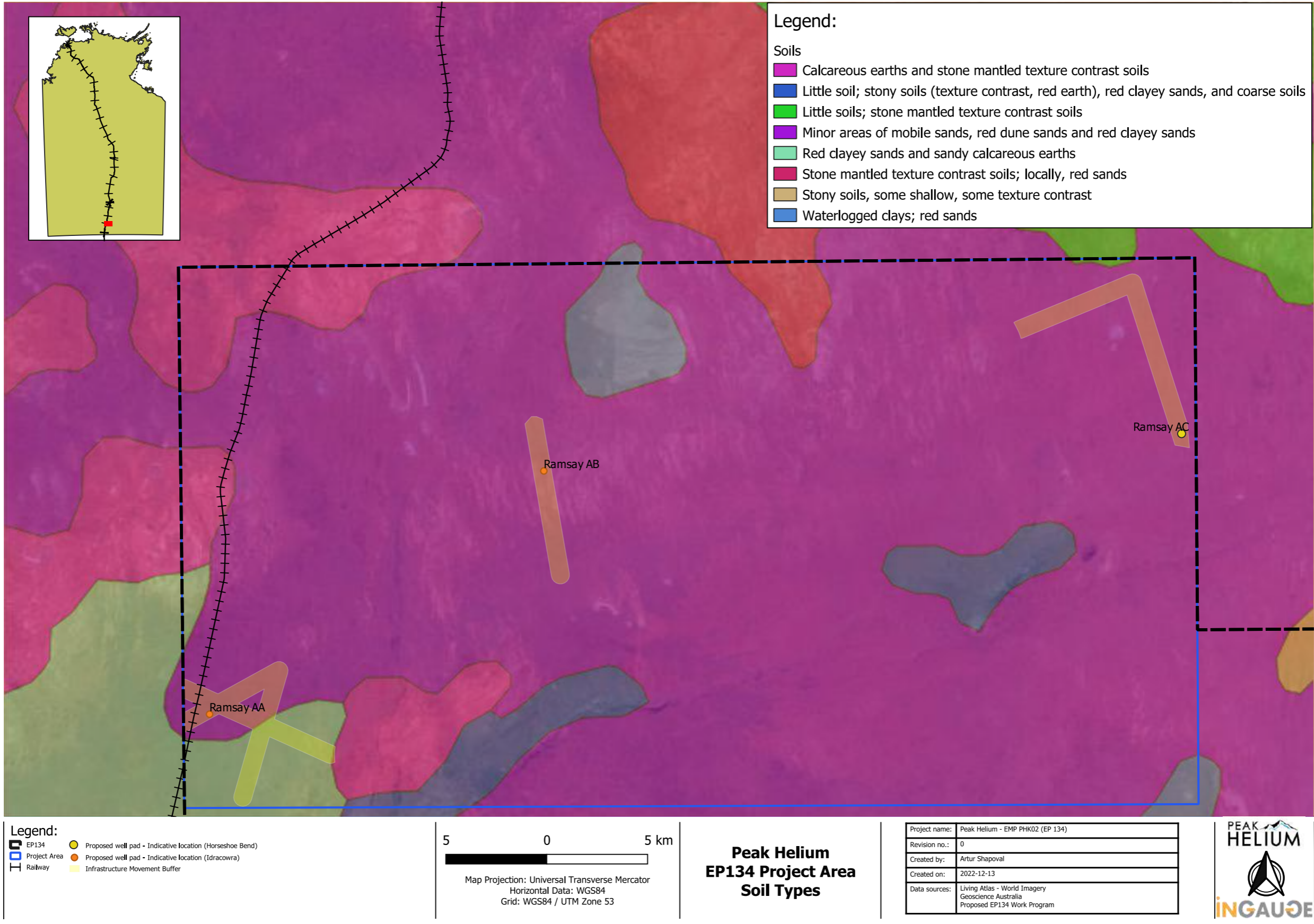


Figure 1.6—2 Soil Types of the Project Area

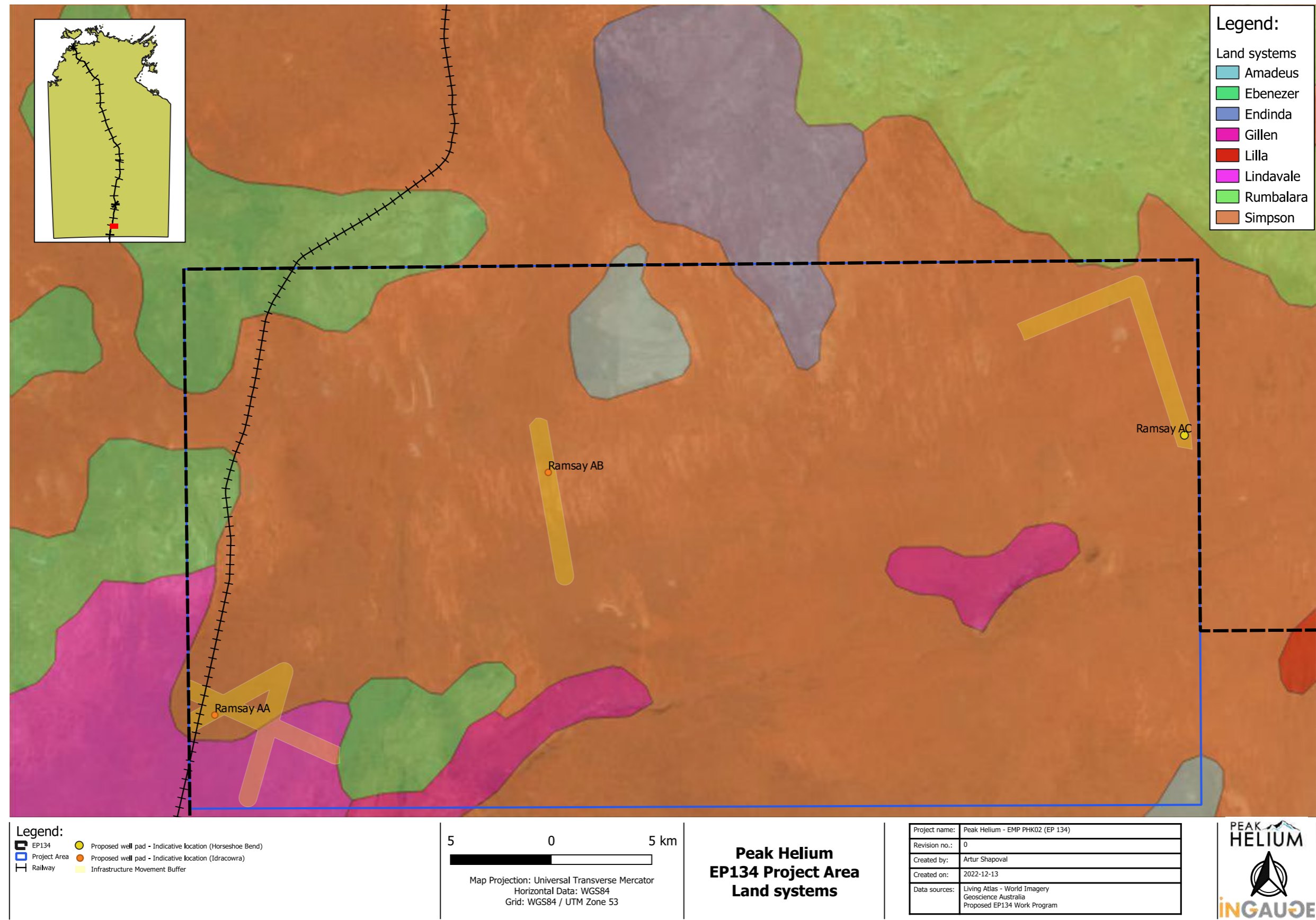


Figure 1.6—3 Land Systems of the Project Are

Table 1.6—1 Land Systems of the Project Area

Land System	Landscape Class	Landform	Soil Description	Vegetation Description	% Approx. of Area
<b>Simpson</b>	Desert dune fields	Dunefields with parallel linear dunes, reticulate dunes, and irregular or aligned short dunes.	Red sands	Typically, Desert Cane Grass ( <i>Zygochloa paradoxa</i> ) on dune crests, sparse shrubs, and low trees over spinifex on the flanks, and Mulga ( <i>Acacia aneura</i> ) and Coolibah ( <i>Eucalyptus microtheca</i> ) within the swales.	83.6
<b>Lindavale</b>	Limestone plains and rises	Plains, rises and plateaux on weathered and unweathered Cambrian limestone, dolomite, chalcedony, shale, sandstone, and siltstone with associated sand sheets.	Sandy and earth soils	Mulga, sparse shrubs and low trees, witchetty bush, bluebush and short grasses, and forbs.	2.7
<b>Ebenezer</b>	Sandstone plains and rises	Plains, rises and plateaux on mostly on sandstone, siltstone, claystone, shale, and some limestone.	Commonly shallow soils with surface stone and rock outcrop	Absent or sparse shrubs and low trees, witchetty bush, myall, bluebush, short grasses, and forbs, cottonbush and samphire with some small bare areas.	6.2
<b>Rumbalara</b>	Sandstone hills	Low hills, hills and stony plateaux on sandstone, siltstone, quartzite, and conglomerate (deeply weathered in places).	Outcrop with shallow stony soils	Absent, sparse shrubs and low trees, mulga, bluebush, saltbush, samphire, witchetty bush, short grasses, and forbs.	0.1
<b>Amadeus</b>	Salt pans	Salt pans with fringing dunes.	Waterlogged saline clays	Sparse, with a majority of bare ground in the pans and vegetation in the other areas including tea-tree,	2.3

Land System	Landscape Class	Landform	Soil Description	Vegetation Description	% Approx. of Area
				samphire, saltbush, bluebush, witchetty bush, desert oak and spinifex.	
<b>Endinda</b>	Lateritic plains and rises	Plains and rises associated with deeply weathered profiles (laterite), including sand sheets and other depositional products.	Sandy and earth soils	Sparse with very sparse shrubs and limited trees – only some Gidgee Trees ( <i>Acacia georginae</i> ) on valley floors – with saltbush and southern bluebush [ECOZ, 2022].	1.1
<b>Gillen</b>	Sandstone and Quartstone plains and rises	Quartzite and sandstone ranges and colluvial and alluvial fans and plains.	Red-brown sandy clay loams and deep red loamy sands	Absent or scattered mulga and witchetty bush over low shrubs, spinifex, and forbs. Ironwood, mulga, corkwood and witchetty over kerosene grass, mulga grass and other perennial grasses [K BASTIN SHAW, G, 1989].	4.1

## 1.7 Groundwater

The Project Area is located within the Neoproterozoic – Palaeozoic Amadeus basin, which has a 7-8km sedimentary thickness in some areas. The basin is shown in **Figure 1.7—3**. The north-central part of the basin contains extensive identifiable sandstone aquifers. These aquifers are namely the Hermannsburg, Mereenie and Pacoota sandstone aquifers. However, in the south-east of Amadeus Basin, where the Project Area is situated, there has been strong folding and faulting that has resulted in the development of fractured rock aquifers that are not easily identifiable [DENR, 2022; J. W. LLOYD et al., 1987] The Project Area longitude ranges from 133.5° to 134°. As evidenced in **Figure 1.7—1**, strong folding and faulting is evident within this area.

It is likely an aquifer within the Pertnara Group of the Amadeus Basin which are outlined in **Figure 1.7—2** below, will be the source of groundwater. This includes the Brewer Conglomerate, Hermannsburg Sandstone and the Parke Silstone fractured rock formations. However, there is the possibility that in parts of the Project Area the Mereenie Sandstone aquifer or one of the Larapinta Group formations is prevalent near surface due to folding. Based on depths and stratigraphy of nearby pastoral bores they are likely producing from the Hermannsburg Sandstone Aquifer [N.T.A WATER RESOURCES DEPARTMENT BRANCH, 1950, 1961; NORTHERN TERRITORY ADMINISTRATION - WATER RESOURCES BRANCH, 1993].

The area has a moderate to high level of groundwater salinity [G. A. YOUNG et al., 1987], which coincides with the presence of the Karinga Creek Paleodrainage System, a series of more than 100 saline lakes spanning from Horseshoe Bend and Curtin Springs pastoral stations [L. HARRISON et al., 2009].

The Project Area falls in the Georgina-Diamantina catchment, within the Lake Eyre drainage basin.

EP 134 is not within a water allocation plan area. Any guidelines published by the Northern Territory Government relating to groundwater monitoring parameters, methodologies, frequencies, reporting and data submission for petroleum operations will be followed. Current water bores can be seen in **Figure 1.7—4**.

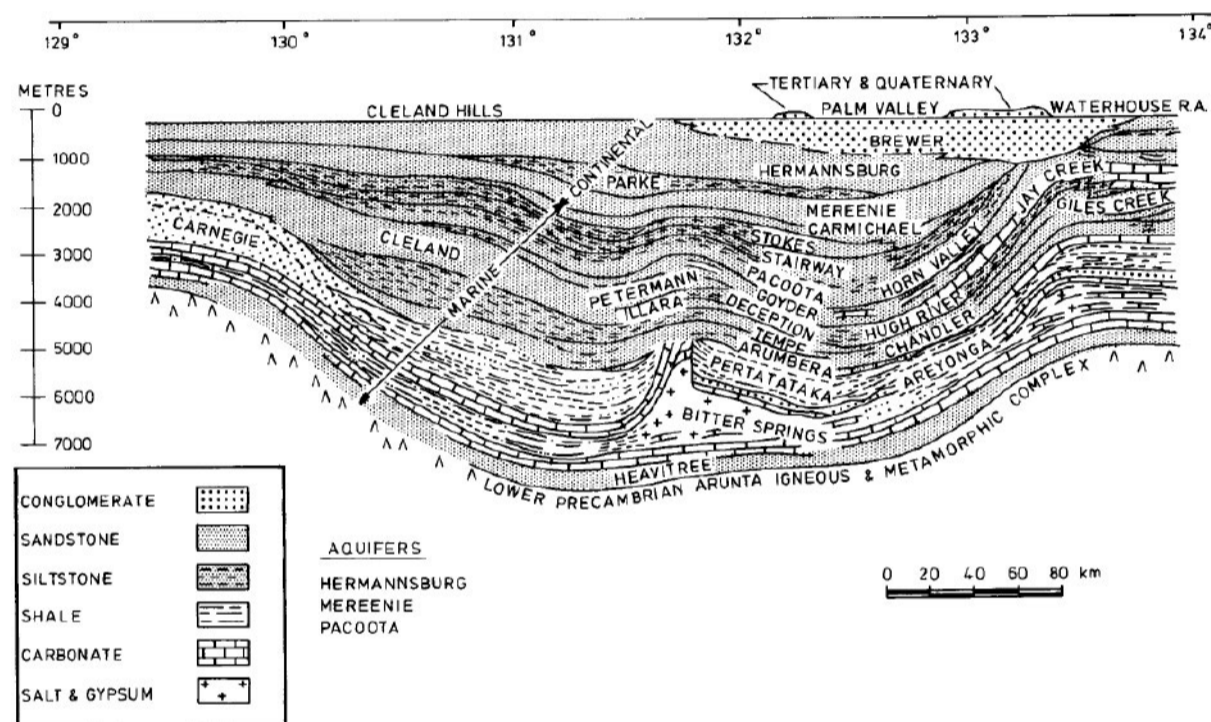
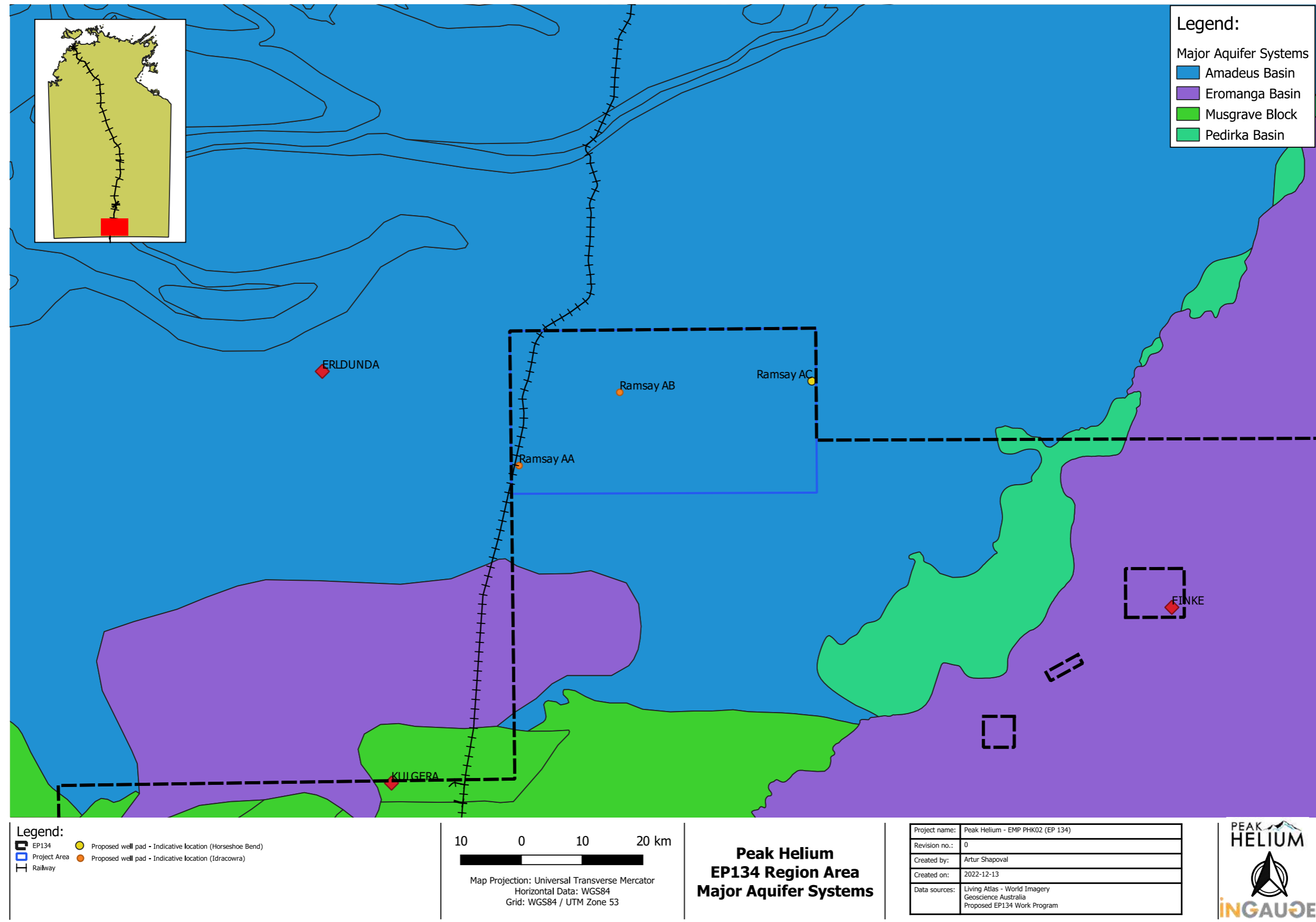


Figure 1.7—1 Geological Cross-Section of Amadeus Basin [J. W. LLOYD et al., 1987]

AGE	GROUP	FORMATION			OROGENIES
		WEST	CENTRAL	EAST	
TERTIARY RECENT		SURFICIAL DEPOSITS			ALICE SPRINGS
PERMIAN		BUCK	?	?	
CARBONIFEROUS - LATE DEVONIAN	PERTNJARA	BREWER HERMANNSBURG (AQUIFER) PARKE			
SILURO DEVONIAN		MEREENIE (AQUIFER)			PERTNJARA
? LATE ORDOVICIAN	LARAPINTA	GOSSE'S BLUFF CARMICHAEL STOKES STAIRWAY HORN VALLEY PACOOTA (AQUIFER) GOYDER  RODINGAN EROSION			RODINGAN
MIDDLE ORDOVICIAN					
EARLY ORDOVICIAN					

Figure 1.7—2 Geological Succession of the Amadeus Basin [J. W. LLOYD et al., 1987]



butts

Figure 1.7—3 Major Aquifer Systems of the Region

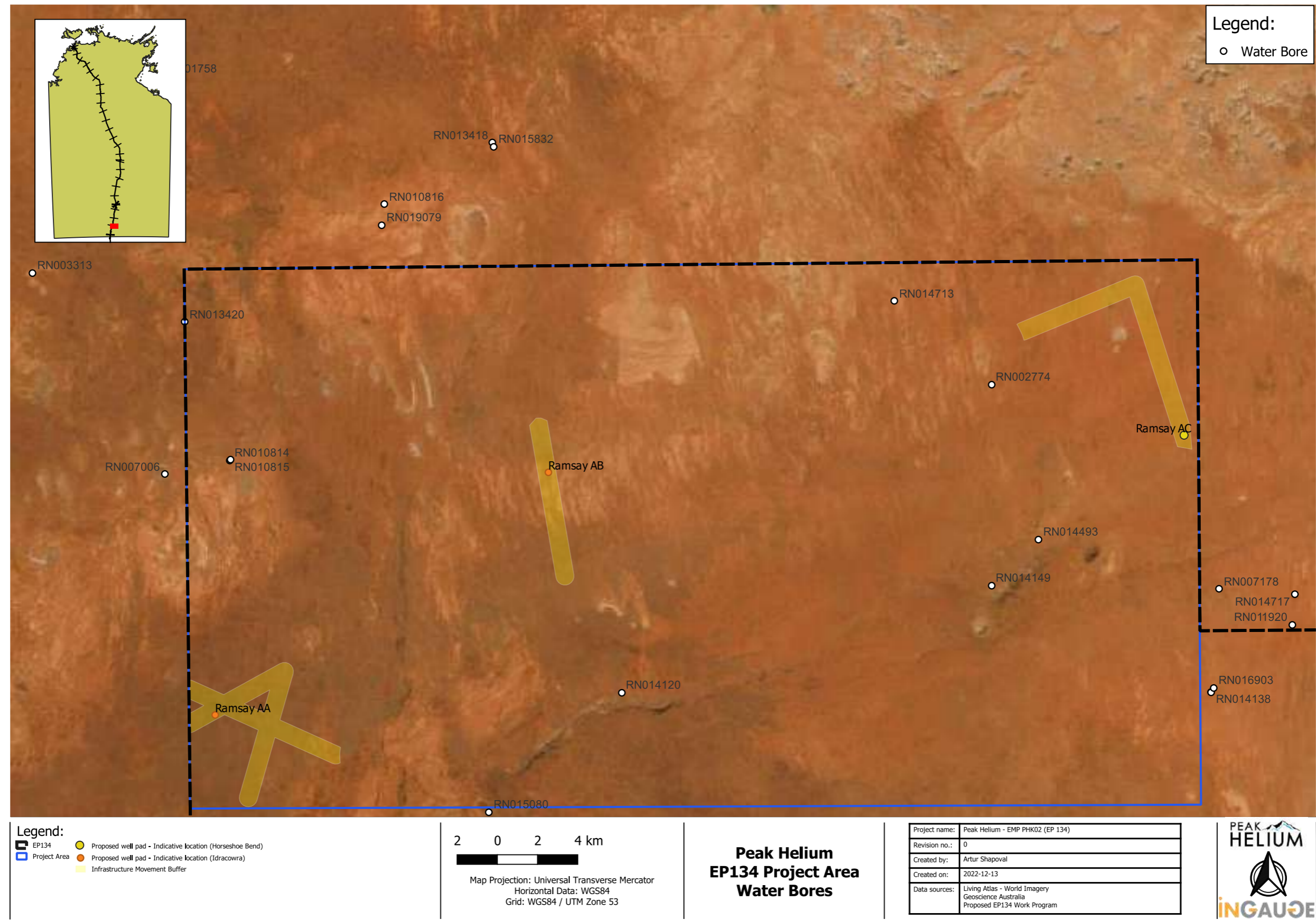


Figure 1.7—4 Water Bores in the Project Area

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## 1.8 Surface Water

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The Project Area is within the Diamantina-Georgina Rivers catchment. The main watercourses near the Project Area are Karinga Creek and Nine Mile Creek. There are several watercourses throughout the Project Area, including small drainages, tributaries, and drainage gullies. All water channels and tributaries only flow after heavy rainfall.

Stream Orders of the Project Area are shown in **Figure 1.8—1**.

### 1.8.1 Springs

Research of the springs spatial layer of the Natural Resource Maps [DENR, 2022] shows that there are no springs within the Location of the Regulated Activities.

**Figure 1.8—2** shows springs and GDEs in relation to the Project Area.

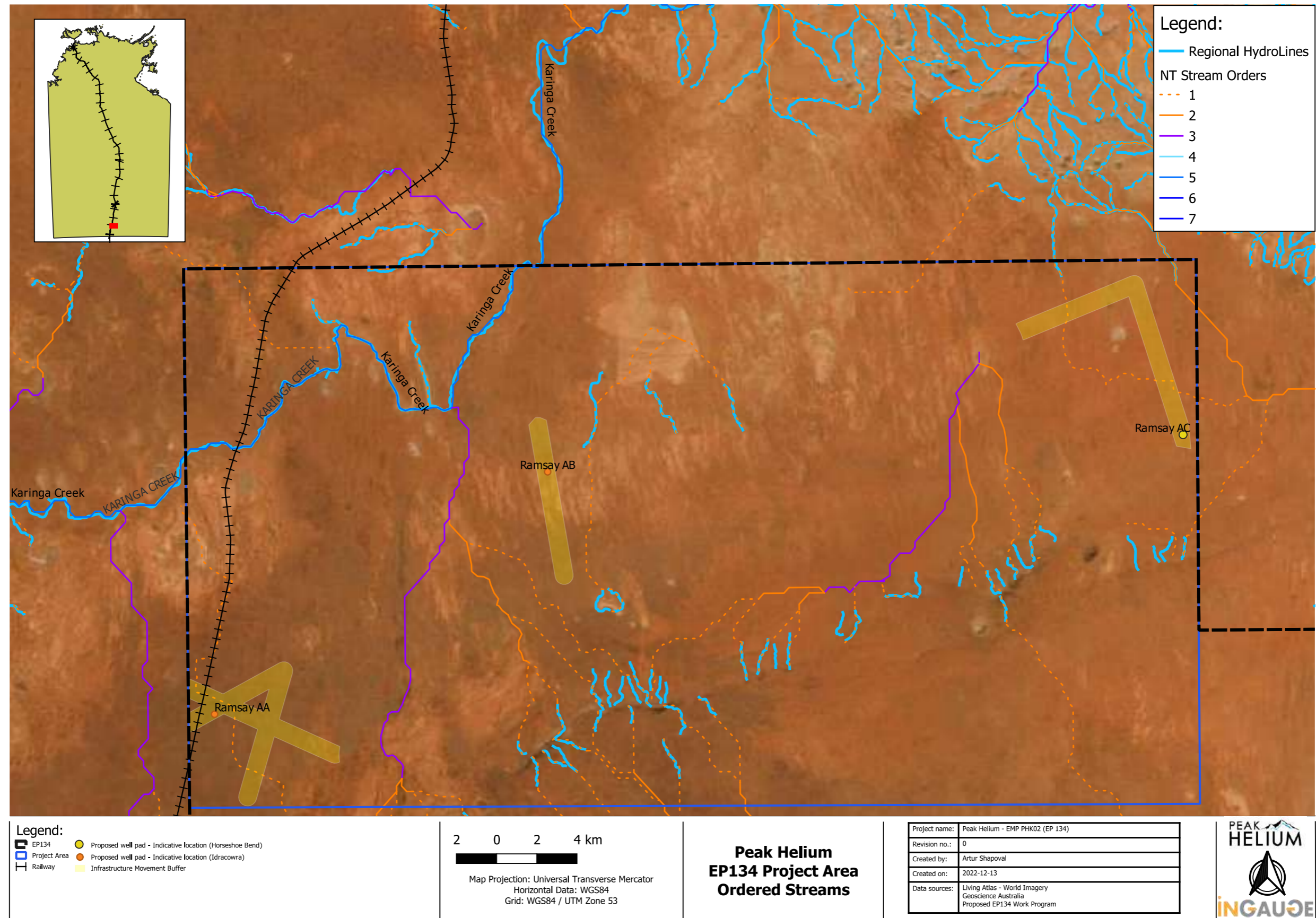


Figure 1.8—1 Ordered Streams of the Project Area (Realigned)

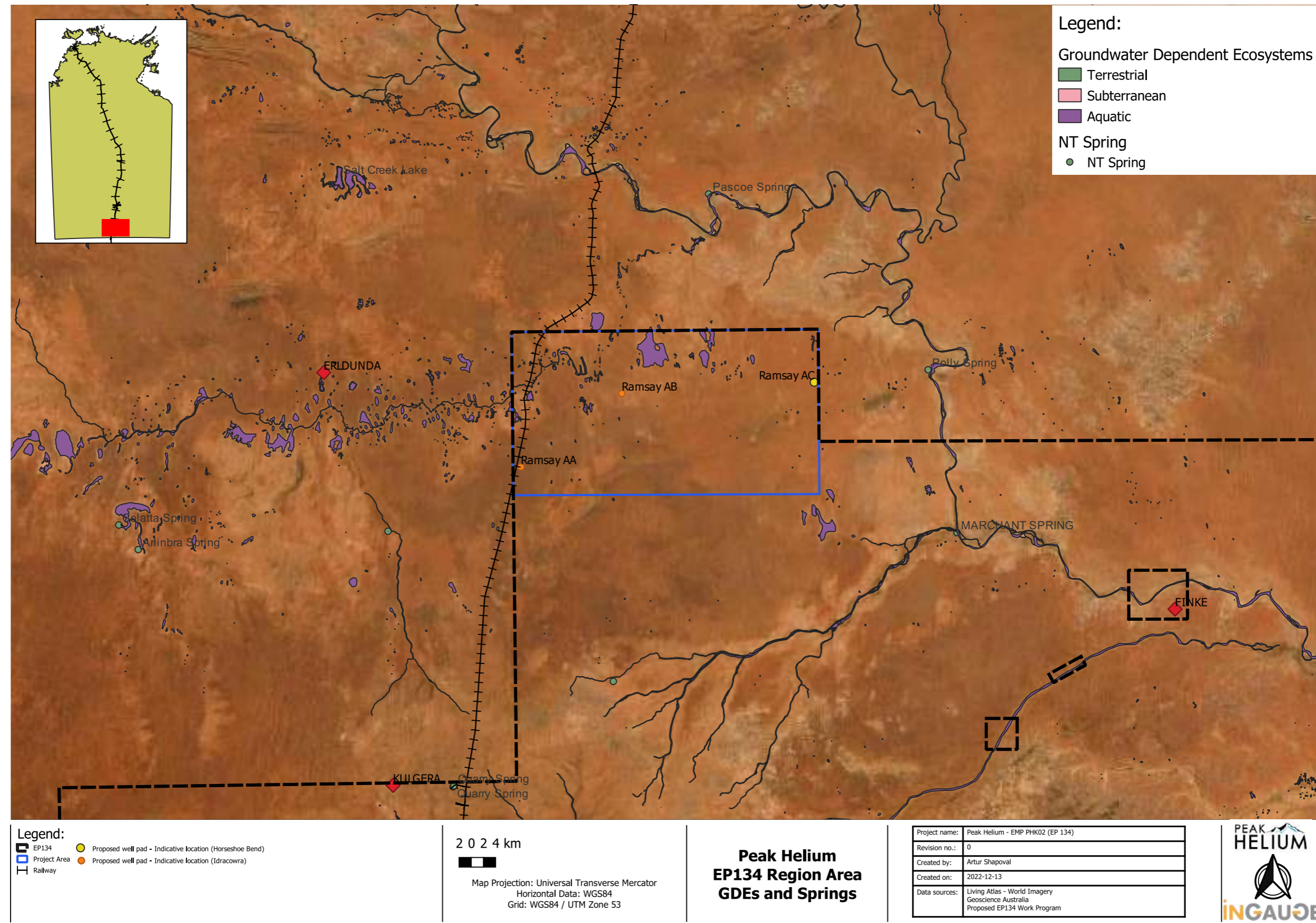


Figure 1.8—2 GDEs and Springs of the Project Area

## 1.9 Flooding

### 1.9.1 Location Characteristics

The Project Area is within the Diamantina-Georgina Rivers catchment. The main watercourses near the Project Area are Karinga Creek and Nine Mile Creek. Several watercourses throughout the Project Area include small drainages, tributaries, and drainage gullies. All water channels and tributaries only flow after heavy rainfall.

The hydrologically enforced SRTM (Shuttle Radar Topography Mission) digital elevation model, and the report, *Northern Territory Hydrology - The Alice Springs to Darwin Railway*, indicate that the land containing the proposed well pad locations can be primarily characterised as arid and flat with poorly defined catchment boundaries [W. D. WEEKS, 2006].

### 1.9.2 Flood Modelling

An Annual Exceedance Probability (AEP) is the probability of a flood event occurring in any year. It is denoted as either a percentage, such as a 1% or as a 1 in 100-year event.

Typically, a Regional Flood Frequency Estimation (RFFE) would be used in conjunction with the SRTM model to calculate peak stream discharge rates for a known flow path. However, it was determined that for flood modelling in the Project Area, this method is not adequately accurate due to the following points:

- The ephemeral nature of the nearby streams.
- The area of interest is located at the headwaters of two rivers.
- The nearest gauged watercourse (Finke River – Railway Bridge) is approximately 30km to the Project Area.

Therefore, a Log Pearson III distribution was used to calculate a 1 in 100-year rainfall event. A steady-state rainfall simulation was then developed over the catchment area using TUFLOW and the Shuttle Radar Topography Mission (SRTM) data to calculate peak flood depths and flow rates using the rainfall values from this event. The results are displayed in **Figure 1.9—1** below.

As evidenced in **Figure 1.9—1**, none of the indicative well pad locations will be affected by a flood, even during a 1 in 100-year rainfall event.

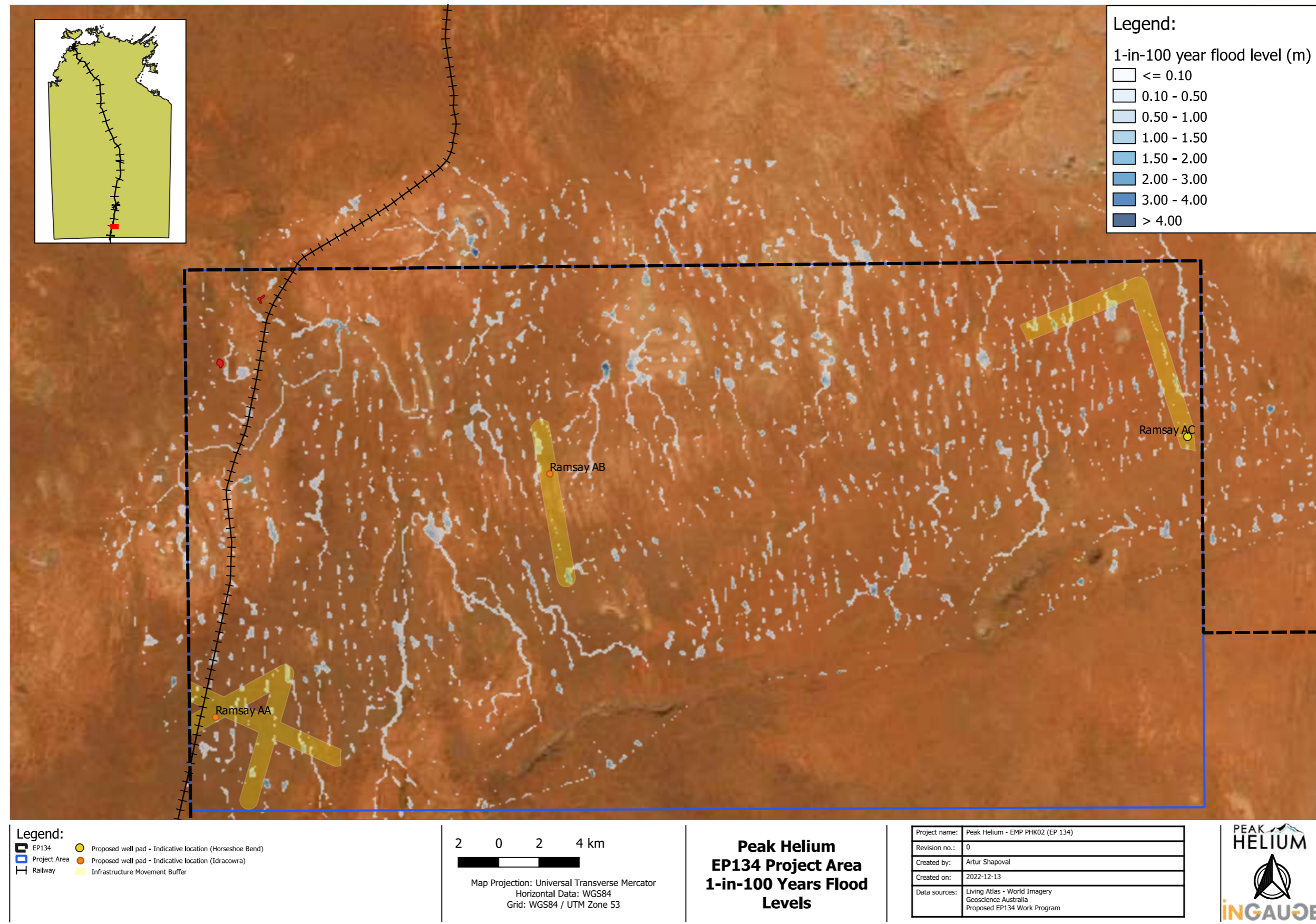


Figure 1.9—1 1 in 100-year Flooding Event Over the Project Area

## 1.10 Air Quality

A Methane Emissions Management Plan is available in **Appendix 10**. Peak Helium is committed to undertaking a 6-monthly leak detection test, at the well pad, until well abandonment as per Part D (5) of *the Code* [DEPWS et al., 2019].

## 1.11 Bioregions

Bioregions provide a consistent and robust framework for biodiversity assessment and planning. The classification is based on typical climate, geology, landform, native vegetation and species information. Based on version 7 of DAWE's *Interim Biogeographic Regionalisation of Australia* (IBRA) map, the Project Area is located across the Finke Bioregion.

**Figure 1.11—1** and **Figure 1.11—2** show the bioregions of both the region and the Project Area. These maps have been created using data from *Land Systems of the Southern part of the Northern Territory* database [C. S. CHRISTIAN et al., 1954; DEPWS, 2011] and indicate that the region comprises five bioregions: Tanami, Great Sandy Desert, Macdonnell Ranges, Finke, and to a smaller extent, Simpson Strzelecki Dunefields.

EP 134 occurs within the Finke interim biogeographical region – specifically the Tieyon subregion. The Finke IBRA comprises arid sand plains, with some dissected uplands and valleys and several major rivers (Finke, Hugh, and Palmer rivers) [DAWE, 2008A]. The Finke region is characterised by low sandstone ranges, weathered tablelands, and rounded metamorphic hills [B. BAKER et al., 2005]. Soils are a mix of predominantly shallow and deep sands, massive earths, and red duplex saline-affected soils. The most extensive vegetation is hummock grasslands, acacia shrublands dominated by mulga, senna, and saltbush/bluebush open shrublands.

Well pad Ramsay AA straddles both the Tanami and Great Sandy Desert Bioregions. The Great Sandy biogeographic region is located west of the Tanami Desert and stretches from the Pilbara Desert to the Finke and MacDonnell Ranges. The Great Sandy region comprises tree steppe, grading to shrub-steppe. Vegetation of the sub-bioregion is dominated by spinifex, shrubs (e.g., *Acacia* spp, *Grevillea wickhamii*, and *G. refracta*) and scattered trees (e.g., Bloodwoods and *Owenia reticulata*). Red sand dune fields overlying Jurassic and Cretaceous sandstone support vegetation [DCLM, 2001].

The Macdonnell Ranges biogeographic region is an arid area of high-relief ranges and foothills. Vegetation is dominated by spinifex and acacia. The bioregion has many semi-permanent natural waters, such as rock holes and springs [DAWE, 2008B]. The Simpson Strzelecki Dunefields biogeographic region comprises long parallel sand dunes, sand plains, dry water courses and saltpans. Like many of its neighbouring bioregions, its vegetation is dominated by spinifex hummock grassland and sparse shrubs (mulgara). Coolibah riverine woodlands support narrow river red gums. This region includes the lowest rainfall zone in Australia [DAWE, 2008C].

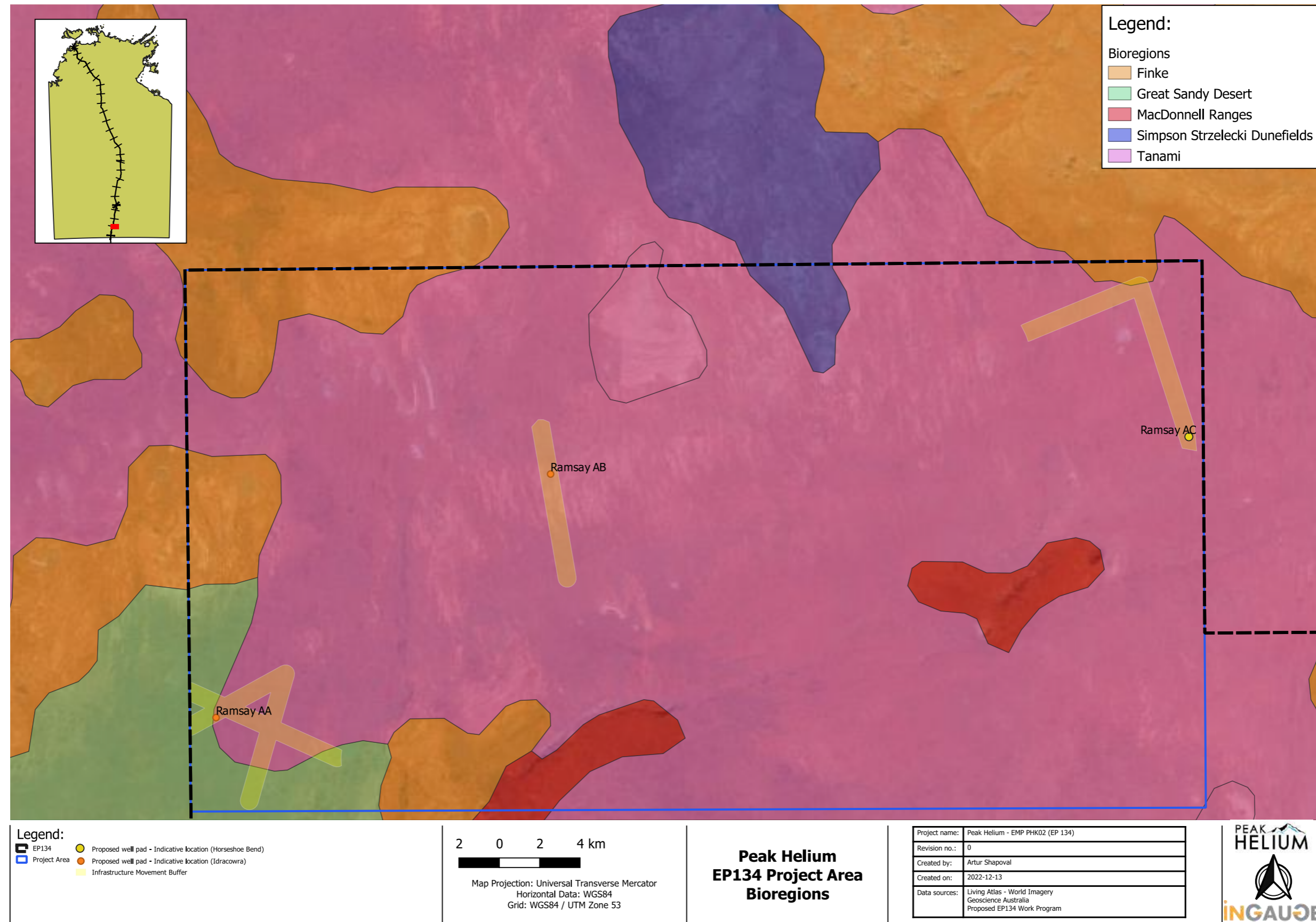


Figure 1.11—1 Bioregions of the Project Area

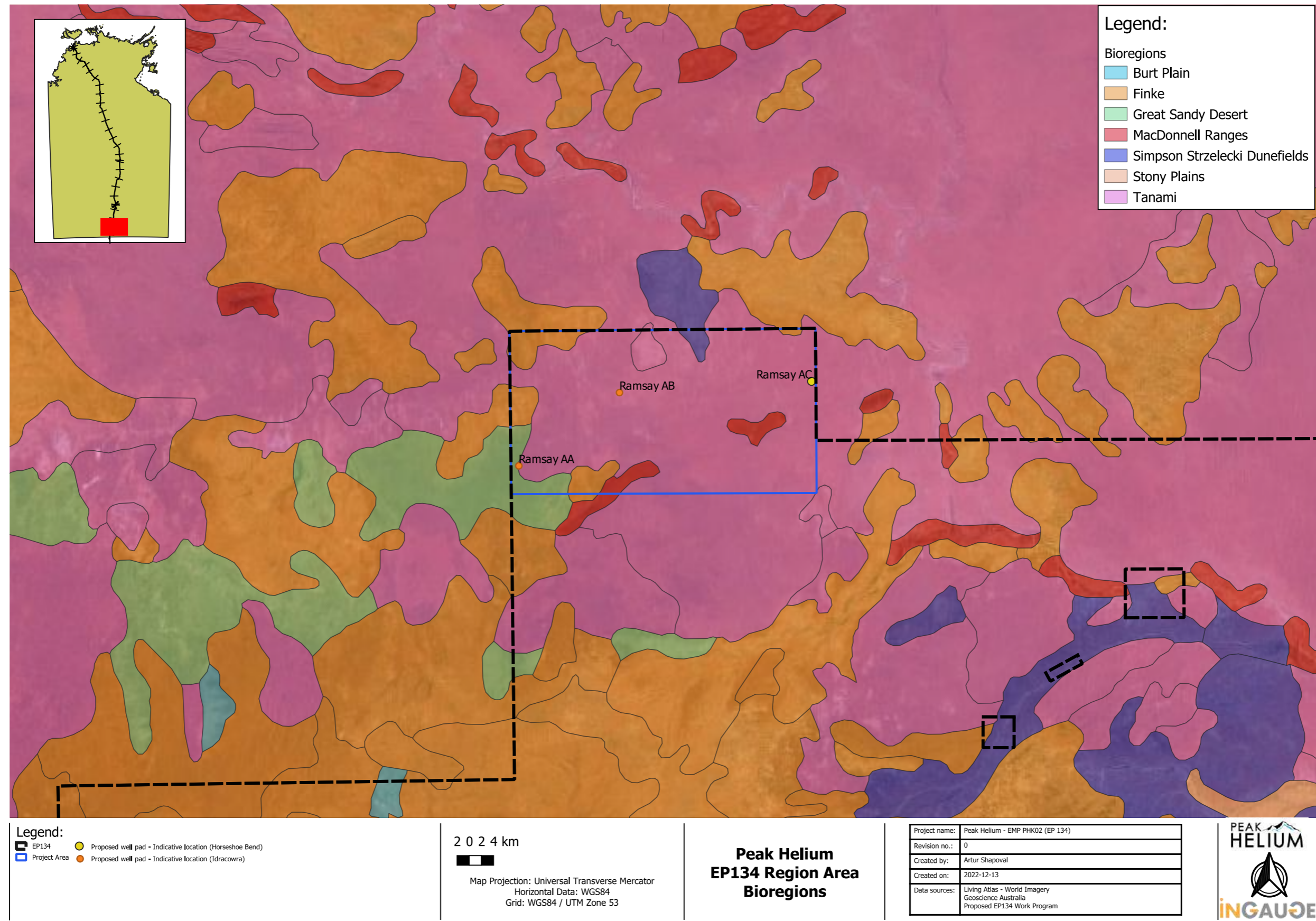


Figure 1.11—2 Bioregions of the Surrounding Region

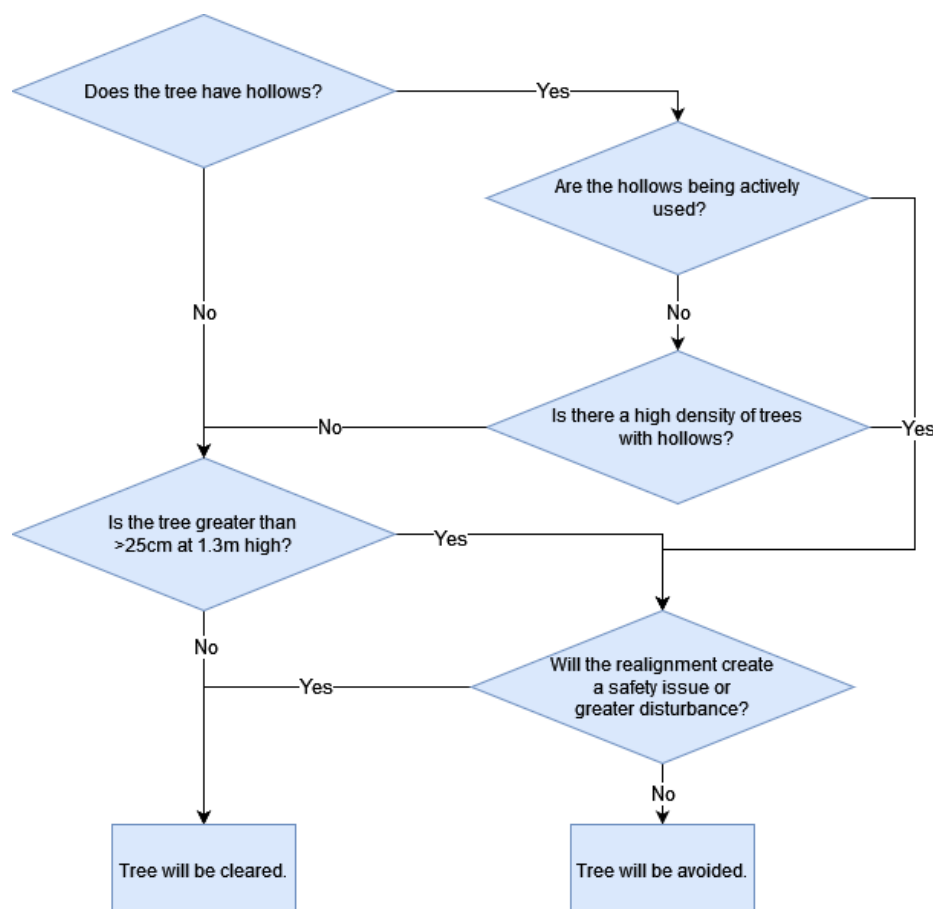
## 1.12 Vegetation

The EP134 is located within the Finke and Tanami bioregions and overlaps with Great Sandy Desert, Tanami, MacDonnell Ranges, and Simpson Strezlecki Dunefields bioregions. The Project Area landscape is a complex area characterised by arid sandplains and low sandstone ranges with dissected uplands and valleys.

In the recent Environmental Assessment Report (EAR) conducted by EcoOz, it was determined that vegetation within the Project Area was dominated by Desert Cane Grass (*Zygochloa paradoxa*) on dune crests, sparse shrubs, and low trees over spinifex on the flanks, such as Southern Bluebush (*Dispyros lycioides*); Witchetty Bush (*Acacia kempeana*); and Mulga (*Acacia aneura*). Seasonal swamps provide regional biodiversity as they have a high cover of ephemeral forbs and support large tree species such as Coolabah Trees (*Eucalyptus coolabah*). Vegetation on swales is open, and slopes are flat. A few patches of Desert Oak (*Allocasuarina decaisneana*) provide valuable habitat for various flora and fauna. Low rocky rises have a very low relief. They are populated with open chenopod shrubland (*Maireana astrotricha* and *Sclerolaena spp.*) to low open shrubland of (*Senna artemisioides* subsp. *Alicia*) over forbs, chenopods, and short tussocks [EcoOz, 2022].

Some vegetation will require clearing for construction. The methodologies for clearing are outlined in **Appendix 02**. A decision tree for clearing is shown in **Figure 1.12—2** below.

**Figure 1.12—2** presents the vegetation communities over the Project Area.



**Figure 1.12—1 Tree Clearing Decision Tree**

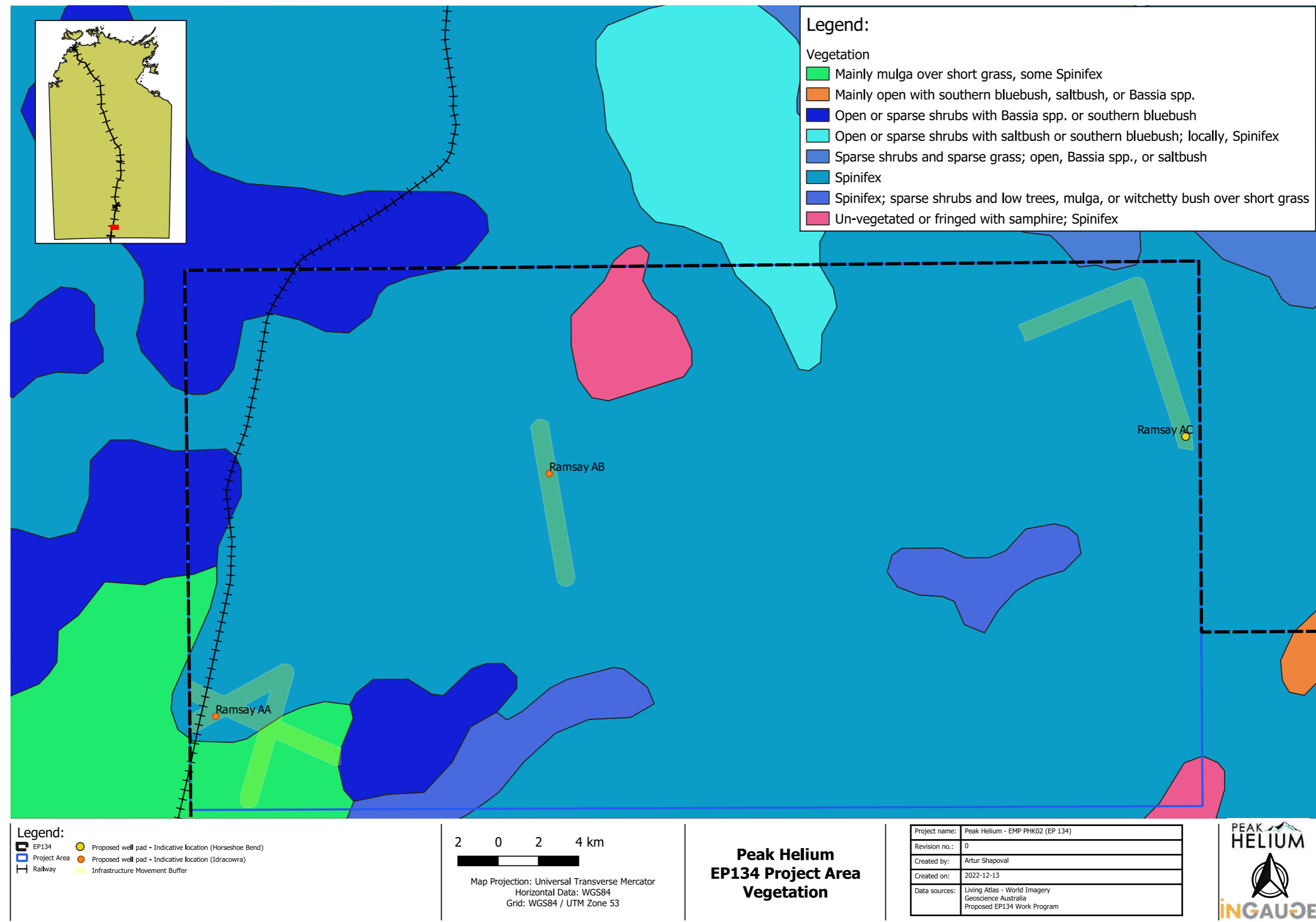


Figure 1.12—2 Vegetation of the Project Area

## 1.13 Listed Threatened Species

To assess which threatened species are likely to occur, a search of the NT Flora and Fauna Atlas was conducted in 2022. This data was paired with findings from the Protected Matters Search Tool (PSMT) [EPBC, 2021]. The search parameters on the PMST were set to the Project Area, with an additional buffer of 50km to determine the likelihood of species occurrence in this search area. This was done in addition to the desk-top and field base search conducted by EcOz (**Appendix 01.02**).

The PMST indicates that the EP is intersected by a Site of Conservation and Botanical Significance. The Karinga Creek Paleodrainage System (KCPS) comprises more than 100 linked saline lakes between Horseshoe Bend and Curtin Springs Pastoral Lake. After flooding, the KCPS provides important habitat for waterbirds and shorebirds, including the Banded Silt, Red-capped Plover, and Sharp-tailed Sandpiper.

Reviewing the proposed infrastructure in relation KCPS, it can be seen that the well pads, campsites, gravel pits, new access tracks and tracks that require widening are positioned outside the boundaries of the Site of Conservation Significance (SOCS) and the Sites of Botanical Significance (SOBS), and only existing access tracks will be used to traverse this area (with the exception of widening an existing pastoral track across a SOCS connecting corridor (see **Figure 1.16 – 1**)). See **Appendix 04** (Risk Assessment) for detail on the risk and controls associated with the use of these tracks.

The PMST indicates that there are 16 listed threatened species and nine listed migratory species considered to have a potential of occurring within the search area. Three threatened species and seven additional EPBC migratory waterbirds and waders are likely to occupy or use habitats within the Project Area (namely the KCPS) and a 50km radius (note: the Curlew Sandpiper appears in both tables but is only counted once). The remainder of the threatened species are considered to have a low likelihood or no likelihood of occurring within the Project Area.

In addition to the desktop data sets that Peak Helium utilised to examine potential threatened species in the area, the Interest Holder also engaged EcOz Environmental Consulting to conduct a baseline ecological survey which included searching for threatened fauna and flora species and their habitat (**Appendix 01.02**). The ecological survey included a site inspection via helicopter. The aerial survey found that there were no Marble Gums or waterways with River Red Gums visible that would indicate the presence of key threatened species (the Grey Falcon and the Princess Parrot). Had these environmental factors been present, EcOz would have conducted targeted surveys; however, in their absence, targeted surveys were not deemed necessary.

In general, not all of the threatened species indicated through desktop information are expected to occur within the study area due to the absence of suitable habitats for some species.

### 1.13.1 Mitigation Measures for Minimum Disturbance to Threatened Species

To minimise any disturbances to threatened fauna and flora and critical habitat, Peak Helium will utilise an ecologist to ground-truth for the following (pre-clearing activities):

- Known and potential ground habitat (spinifex bush, tussock grass, saltbush and dunes that have evidence of burrows or, in the case of the Great Desert Skink – animal latrines).
- Hollow-bearing trees (5 or more) that might provide habitat for the Princess Parrot).

- Large trees that may be used for nesting by the Grey Falcon.
- Known and potential habitats for threatened species within the EP will be avoided for the purpose of clearing and construction activities. These activities will be repositioned and/or re-routed within the infrastructure movement corridors where practicable. Clearing for access tracks, well pads, gravel pits and campsites will be situated to avoid large trees and potential habitat for listed threatened species (e.g., nesting habitat for the Grey Falcon). A decision tree for tree clearing is shown in **Figure 1.12—1**.

Further mitigation measures to prevent disturbance and impacts to threatened species within the EP include:

- An ecologist will be on-site during clearing activities.
- Peak Helium will conduct a pre-clearing survey for potential Grey Falcon habitat within 300m of proposed activities. If active nests are encountered, a 300m exclusion zone will be established until the nests are no longer active.
- In addition to the above, Peak Helium will avoid clearing or disturbing clusters of 5 or more hollow-bearing trees to maintain potential nesting habitat for the Princess Parrot, under the direction of an ecologist.
- Peak Helium will avoid swamps that may provide habitat in all clearing and construction activities.
- The Weed Management Plan (**Appendix 09**) will be implemented and carefully monitored to ensure that weed infestations are avoided or controlled. Specifically, the Interest Holder will ensure that Buffel Grass or Athel Pine is not spread within or without the Project Area. Buffel Grass is implicated in the diminishing populations of the Slater's Skink.
- Peak Helium will maintain and implement a Weed Management Plan (**Appendix 09**) to prevent noxious weed infestations and threatened fauna ingesting poisonous weeds.
- Peak Helium will maintain and implement a Waste and Wastewater Management Plan (**Appendix 06**) to prevent attracting pest species that may prey on threatened fauna and alter habitat through grazing.
- Vehicle speed limits of 40km/hr will be implemented when traversing SOCS and SOBS to prevent the chance of high-impact collisions.

Threatened Species Likelihood of Occurrence Assessment **Table 1.13—1** outlines the assessment criteria used to identify the likelihood of a species occurring in the Project Area [ECO, 2022].

Table 1.13—2 lists the threatened fauna and flora species present within a 50km radius of the proposed activities per the EPBC and the Baseline Ecological Assessment.

Table 1.13—1 Likelihood of Occurrence Criteria

Likelihood of Occurrence	Criteria
<b><u>HIGH</u></b>	<ul style="list-style-type: none"> <li>It is expected that this species occurs within the project footprint because there is core habitat and recent (post-2000) proximate records or knowledge that the species occurs in the local area.</li> </ul>
<b><u>MEDIUM</u></b>	<ul style="list-style-type: none"> <li>Species may occur within the project footprint 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 within or close to the project footprint, substantial loss of habitat within the project footprint since previous records, species is naturally rare or occurs at a low density etc.).</li> </ul>
<b><u>LOW</u></b>	<ul style="list-style-type: none"> <li>Species may occur, as a vagrant, within the project footprint; only marginally suitable habitat is expected.</li> </ul>
<b><u>NONE</u></b>	<ul style="list-style-type: none"> <li>There is strong evidence that this species will not occur within the project footprint (i.e., there is no suitable habitat and/or the species is considered regionally extinct).</li> </ul>

#### EPBC Act

Species listed under the Environment Protection and Biodiversity Conservation Act 1999 [EPBC Act], Australia:

- CE = Critically Endangered
- E = Endangered
- V = Vulnerable
- M = Migratory
- Ma = Marine

#### TPWC Act

Species listed under the Territory Parks and Wildlife Conservation Act 2000 [TPWC Act], NT:

- CE = Critically Endangered
- E = Endangered
- V = Vulnerable
- NT = Near Threatened
- DD = Data Deficient

Table 1.13—2 Threatened Fauna and Flora

Species Name	Common Name	Act Status		Likelihood of Occurrence	Records & Habitat
		EPBC	TPWC		
BIRDS					
<i>Amytornis modestus indulkana</i>	Thick-billed Grasswren (north-west subspecies)	V	CE	High	The Thick-Billed Grass Wren inhabits chenopod shrublands along drainage lines in inland Australia in areas dominated by <i>Atriplex</i> saltbush and <i>Maireana</i> bluebush. The species was formerly distributed West of Lake Eyre and Lake Torrens near the border of South Australia and the Northern Territory. The species is likely to occur within the Project Area and buffer zone. (NT) [DEPWS, 2012B].
<i>Calidris ferruginea</i>	Curlew Sandpiper	CE	V	High	The Curlew Sandpiper occurs around the coast of Australia and inland from Victoria River Downs and around Alice Springs. The species mainly occur in intertidal mudflats and coastal areas. There is suitable habitat for the Curlew Sandpiper within the KCPS. There are recent records of the species within the Project Area [D. HANSEN ET AL., 2016; ECOZ, 2022].
<i>Falco hypoleucos</i>	Grey Falcon	V	VU	High	Grey Falcons live in areas of lightly timbered lowland plains, typically on inland drainage systems, where the average annual rainfall is less than 500mm. They use nests built by other species and prefer nests in the tallest trees along watercourses. Most records of the instance of Grey Falcons from the Northern Territory (NT) are from the southern half, but there are records up to Darwin and Groote Eylandt. There are recent records of the species in the Project Area. In their report, EcoZ concluded that there is a low likelihood of the species within the Project Area. Nesting Grey Falcons are vulnerable to disturbance from vehicles and people within 300m of the nest. Therefore, before clearing, Peak Helium will conduct a pre-clearing survey to detect Grey Falcon nests within 300m of proposed clearing activities. Any active nests will retain a 300m buffer from any project activities. Proposed clearing areas will be situated to avoid large trees [DEPWS, 2021F; ECOZ, 2022].
<i>Leipoa ocellata</i>	Malleefowl	VU	CR	None	This megapode is a ground-dwelling bird occupying shrubland and woodland and favours areas with shrubby understory. The malleefowl has been recorded in the NT west of the Stuart Highway and south of the Tanami Desert, most recently in the 1960s. In 1977, they were recorded in the southwest corner of the NT. There is limited suitable habitat within the Project area. However, they are presumed to exist within the region [DEPWS, 2021L].
<i>Pedionomus torquatus</i>	Plains-wanderer	CE	CE	Medium	Inhabits sparse native grasslands on red-brown clay soils. The Plains-Wanderer has been recorded amongst cereal grasses, stubble, and chenopod scrub lands in south-eastern Australia. There are probable sightings of the species south of Alice Springs near Erlunda Station and Andado station. There is suitable habitat for these ground-dwelling birds in the Project Area [DAWE, 2015B].
<i>Pezoporus occidentalis</i>	Night Parrot	EN	CR	Medium	The Night Parrot is a nocturnal ground-dwelling parrot. It has a wide variety of habitats: flat spinifex grasslands in stony or sandy environments, samphire, chenopod shrublands, floodplains, claypans, and on the margins of creeks, salt lakes and other sources of water. The Night Parrot build nests in spinifex hammocks in unburnt Bull spinifex ( <i>Triodia longiceps</i> ), which does not occur within or adjacent to the Project Area. Breeding may occur at any time of the year and is stimulated by resource availability in the given area. They are sparsely distributed through the central arid regions of Australia. There are two historical records of the Night Parrot in the bioregion from 1929 and more recent sightings at the Alice Springs Telegraph Station, Horseshoe Bend Station, Idrawcowra Station, Henbury Station and Hermannsburg. In January 2017, Night Parrot vocalisations were collected in the southern Northern Territory [DAWE, 2018; ECOZ, 2022].
<i>Polytelis alexandrae</i>	Princess Parrot	VU	VU	High	The Princess Parrot is generally found in swales between desert sand dunes, within a shrub layer of scattered trees in arid and semi-arid sandplains. They can also be found to nest in tree hollows such as Red River Gums and Marble Gums. There is suitable habitat present within the bioregion, and the Princess Parrot is known to occur within the Project Area. The species is nomadic, and its movements are highly irregular; due to this, it is not possible to estimate the number of sites at which the species occurs. Princess Parrots nest in hollow-bearing trees, such as River Red Gums, Marble Gums and Desert Oaks. The biggest threat to Princess Parrot posed by the drilling program is the removal of these trees. Peak Helium will situate the proposed clearing to avoid large trees that might provide habitat. A decision tree for tree clearing is shown in Error! Reference source not found... There are Desert Oaks within the Project Area, and these will not be cleared. The nesting season for the Grey Falcon is typically between June to November. As such, minimal impacts on the species are expected [DAWE, 2020; ECOZ, 2022].
<i>Erythrotriorchis radiatus</i>	Red Goshawk	VU	VU	Low	The Red Goshawk’s preferred habitat is tall open eucalypt forests. It nests in large trees, usually within 1km of a permanent water source. Its territory is up to 200km² and tends to hunt for medium-sized birds. These hawks are solitary and are sparsely distributed across northern Australia, from Kimberley to south-east Queensland, however, there have been sightings in central Australia too [T. AUMANN et al., 1991; J. WOINARSKI, 2006].
<i>Rostratula</i>	Australian	EN	EN	Medium	The Australian Painted Snipe is a wading bird that has been recorded at wetlands in all states of Australia. This species may occur within the EP. This species predominantly inhabits terrestrial freshwater wetlands, lakes, swamps, claypans, and the outskirts of wetlands (both permanent and

Species Name	Common Name	Act Status		Likelihood of Occurrence	Records & Habitat
		EPBC	TPWC		
<i>australis</i>	Painted-snipe				temporary). The Australian Painted Snipe nests on the ground near swamps, canegrass swamps, inundated grasslands, and at the base of tussocks and saltbush. The species inhabits the outskirts of wetlands (both permanent and temporary), swamps and inundated grasslands. The Australian Painted-snipe may occasionally utilise ephemeral swamps within the search area when they contain water and suitable food sources. It is uncertain whether these swamps are suitable habitat for the species, further targeted work would be necessary for that assessment. The avoidance of swamps in all clearing and construction activities will suitably mitigate any potential risk to species’ habitat. The likelihood of the species occurring within the EP is medium [DEPWS, 2021G; DoEE, 2019; ECOZ, 2022; S. GARNETT et al., 2010].
<i>Calidris tenuirostris</i>	Great Knot	V	VU	Low	This collection of birds occupies coastal and estuarine locations with tidal mudflats. Most can also occur near coastal swamps and lakes (all accept the Great Knot). These species breed in the northern hemisphere in the summer and migrate to Australia for the summer. Some birds will remain in Australia for the winter (mostly juveniles). There are limited historical records of all species. The Asian Dowitcher is rare, while the Eastern Curlew is uncommon across Australia. Although there are limited suitable habitats within the project area, these species may use the KCPS as a stop-over site during migration, despite their preference for coastal habitats [M. BAMFORD et al., 2008; R CHATTO, 2003; DEE, 2017].
<i>Limosa lapponica</i>	Bar-tailed Godwit				
<i>Numenius madagascariensis</i>	Eastern Curlew				
<i>Limnodromus semipalmatus</i>	Asian Dowitcher				
<i>Charadrius leschenaultii</i>	Greater Sand Plover				
MAMMALS (TERRESTRIAL)					
<i>Dasycercus cristicauda</i>	Crest-tailed Mulgara	-	VU	Low	The Crest-tailed Mulgara inhabits sand dunes vegetated with cane grass and spinifex. As mentioned, there is taxonomic ambiguity between records of <i>D. blythi</i> and <i>D. Cristicauda</i> . Most records are from the southern Simpson Desert, specifically in Charlotte Waters and Crown Point in the NT. There are recorded sightings of both species in the search area and suitable habitat available. There is no evidence of burrows along seismic lines or indicative well pad locations (via aerial observation) If the species were to occur within the search area, they would inhabit the larger dunes.[DEPWS, 2021K].
<i>Macrotis lagotis</i>	Greater Bilby	VU	VU	Low	Greater Bilby was once widespread across Australia but is now confined to arid regions in WA, the Tanami Desert in the NT and south-western QLD. The species inhabits hummock grasslands on sandy soils. They prefer paleo-drainage lines. The Greater Bilby has a widespread range of foraging and will move home range if food is scarce. There are recent records of the species in the west of the bioregion, not in close proximity to the Project Area. Field surveys did not find any evidence of this species within the search area (burrows and diggings can be reliably identified via aerial observation). Key shrub species that provide food for the Greater Bilby is not present within the search area. However, it is important to note that the Greater Bibly is highly mobile and may occur if there are suitable conditions within the search area and ephemeral food resources become available [DAWE, 2017; ECOZ, 2022].
<i>Petrogale lateralis centralis</i>	Warru, Central Australian Rock Wallaby	V	NT	Low	The Warru is one of five subspecies of the Australian Rock Wallaby in Australia. The Warru favours steep-sloped upland rocky areas such as caves, outcrops, cliffs, and rock piles. In the Northern Territory, they occur mainly in the McDonnell ranges and through the arid southern end of the Northern Territory. There is suitable habitat for the Warru within the buffer zone [DEPWS, 2021I].
<i>Pseudomys australis</i>	Plains Mouse (NT)	V	E	High	The Plains Mouse inhabits open and rocky plains. They are primarily found in areas that are regularly flooded as they favour areas of cracking clay soil associated with drainage features. Formerly found across vast regions of arid to semi-arid Australia, they now only occur in northern SA and southern NT. Colony numbers rise dramatically following rainfall due to the high-resource yield that rain provides. The species live in burrows with a home range of 1.3 ha <sup>5</sup> in dry periods. The species is known to occur within the search area; however, primary habitat for the species (gibber plains and mid-slopes with boulders, small stones and gilgais) is not present within the Project Area. Therefore, a core population of the Plains Mouse is unlikely to occur. If present, it would only occur in times of bountiful resources when the species could spread into adjoining plains [DEPWS, 2021C; ECOZ, 2022].
<i>Rattus tunneyi</i>	Pale Field-Rat	-	VU	None	This species is primarily found in dense vegetation around creek systems. The Pale Field-Rat favours areas that are regularly irrigated. They are found in regions that experience higher levels of rainfall, from the Kimberly in the WA to south-eastern Queensland, including northern NT. There is suitable habitat for the Pale Field-Rat in the Project Area [DEPWS, 2021N].

Species Name	Common Name	Act Status		Likelihood of Occurrence	Records & Habitat
		EPBC	TPWC		
<i>Zyzomys pedunculatus</i>	Central Rock-Rat	CE	E	Low	The Central Rock-Rat inhabits a range of woodlands and grasslands in the MacDonnell Ranges. The species was historically widespread across the NT and WA and was rediscovered in 2012 in the MacDonnell Ranges. There is no suitable habitat for the Central Rock-Rat within the Project Area. The species or species' habitat may occur within the buffer zone [DEPWS, 2021J].
<i>Trichosurus vulpecula</i>	Common Brushtail Possum (Central Australian Subspecies)	-	EN	None	Found in central Australia in riverine habitats close to rocky outcrops. The Common Brushtail Possum occurs most commonly in southern NT and throughout the MacDonald Ranges. The species was once widely distributed through Australia; however, the species underwent a severe decline after European settlement. There is no suitable habitat for the species within the Project Area [DEPWS, 2021E].
<i>Sminthopsis psammophila</i>	Sandhill Dunnart	E	E	Medium	The Sandhill Dunnart occurs in semi-arid dune country covered by spinifex hummocks with swales consisting of Desert Oaks. The species has been recorded in Owl pellets in Uluru and Kata-Tjuta National Park, on the Eyre Peninsula in SA, and in the Great Victoria Desert (SA and WA). There have been no previous records of the Sandhill Dunnart in the region or in the NT for over 100 years. There is potentially suitable habitat for the species within the Project Area.
REPTILES (TERRESTRIAL)					
<i>Liopholis kintorei</i>	Great Desert Skink/Mulyamiji	V	V	Medium	The Mulyamiji occurs within tall, open shrubland, hummock grasslands, sand ridges and sand plains. There are currently seven known populations of the species, three from the Northern Territory (in the Tanami Desert, Uluru-Kata Tjuta National Park, and the Yulara lease lands). The Tanami Desert and Uluru populates are considered strongholds for the species. The Mulyamiji construct elaborate burrow systems with 5-10 entrances within a 10m radius. Up to ten individual Mulyamijis will share a burrow system. An ecologist will ground-truth the area for evidence of burrows prior to activities, and if any are found, clearing and construction will avoid these areas. Burrows can usually be identified through the occurrence of Mulyamiji latrines, where the species defecate over an area of 1-3m <sup>2</sup> near the burrow entrance. There is suitable habitat for the Mulyamiji within the EP but there is presently no evidence of ground burrows along seismic lines. The likelihood of the occurrence of the species within the EP has been determined to be medium, as the EP intersects the Tanami Desert bioregion, and there is suitable habitat for the species within the Project Area. [MCALPIN, 2011].
<i>Liopholis slateri (slateri)</i>	Slater's Skink	E	E	Medium	There is limited available information regarding the ecology of Slater's Skink. There are four known regions in which the Slater's Skink has occurred in the Finke and MacDonnell bioregions around Alice Springs. The Slater's Skink is a burrowing species, and digs complex burrow systems under small shrubs and tussock and hammock grass. At most sites, the Slater's Skink occurs in shrubland and open shrubland on alluvial plains. Recently identified populations also occur on minor drainage lines among stony hills. [DEPWS, 2012A].
FISH					
<i>Chlamydogobius japalpa</i>	Finke Goby	-	VU	None	There are records of the Finke Goby in the upper areas of the Finke River system. The species is found resting amongst detritus in shallow rock, sand, or gravel pools. No suitable habitat exists for the species present within the Project Area [DENR, 2020].
INVERTEBRATES					
<i>Semotrachia esau</i>	Land Snail	-	VU	None	There is no published information on the ecology of the Land Snail, apart from those specimens collected under figs or spinifex. There are only records of the species along the Finke River and Palm Creek in the Krichauff Ranges west of Alice Springs. There is no suitable habitat for the Land Snail within Project Area; they occur only in a restricted range that is remote from the project footprint.
<i>Sinumelon bednalli</i>	Bednall's Land Snail	EN	-	Low	Bednall's Land Snail is found around fig trees, specifically in loose litter under trees. This species is endemic to the NT. They occur in several sites in ranges of central Australia, from Wattarka National Park to Trepkina Gorge. There are likely other populations in southern NT to be discovered. Despite the lack of fig trees found in the footprint, there is limited suitable habitat within the Project Area. There is a low likelihood of species occurrence, mainly due to a lack of knowledge of species ecology and habitat requirements [DAWE, 2009; DEPWS, 2021H].
FLORA					
<i>Acacia latzii</i>	Latz's Wattle/Tjilpi Wattle	VU	VU	High	Latz's Wattle can be found on silcrete-capped mesas, low stony hills of shale, and siltstone. It is often found along minor creeks and on low hill slopes. The species has been recorded from southern NT to far northern SA. It is endemic to the Finke bioregion of the NT and restricted to two areas 200km apart. There is suitable habitat for the Latz's Wattle within the Project Area and the species is known to occur within the Project Area and buffer zone. [DEPWS, 2021D]. However, no species are found along seismic lines [ECOZ, 2022].

Species Name	Common Name	Act Status		Likelihood of Occurrence	Records & Habitat
		EPBC	TPWC		
<i>Eleocharis papillosa</i>	Dwarf Desert Spike-rush	VU	VU	Low	The Dwarf Desert Spike-Rush occurs in WA, SA, and the NT in ephemeral wetlands in freshwater and saline swamps. There are eight known populations across the NT, from the Tanami Desert to the Southern Finke Bioregion. The species has been recorded growing around Coolabah ( <i>Eucalyptus coolabah</i> ), Samphire ( <i>Halosarcia spp.</i> ), and Northern Bluebush ( <i>Chenopodium auricomum</i> ) and Swamp Cane grass ( <i>E. australasica</i> ). There is potential habitat for the Dwarf Desert Spike-Rush within the Project Area near Coolabah swamps [DAWS, 2021].
<i>Eremophila prostrata</i>	Rainbow Valley Fushia Bush	VU	NT	Low	The Rainbow Valley Fushia Bush is endemic to southern NT. The species occurs on sandplains and dune slopes that support hummock grasses and an array of shrubs and trees. There is limited suitable habitat in the Project Area. However, there are recent and historical records of the Rainbow Valley Fushia Bush within the bioregion to the north of the Project Area [DEPWS, 2021M].
<i>Santalum acuminatum</i>	Desert Quandong	-	VU	Low	The Desert Quandong is a shrub to small tree that can be found along creeks, in dune swales, on plains, low rises and occasionally on hills. In the NT, the species has been recorded west and southwest of Alice Springs. There are recent and historical records of the species within the Project Area, including recent photographic evidence obtained during an aerial inspection. Specifically, a species was sighted with similar characteristics (based on leaf shape and size) along seismic line 1, site 1a, and at site 1s. EcOz could not determine the sighted species unequivocally as the species was not flowering at the time of discovery [EcOz, 2022].
<i>Frankenia plicata</i>	Sea Heath	E	-	Low	The Sea Heath is predominantly found in South Australia but is also present along the Stuart Highway (NT). The species can grow in various habitats, including in the Simpson Desert, where it prefers swales of loamy sands and clay. The main threats to Sea Heath are trampling and habitat degradation caused indirectly by cattle [DEPWS, 2022; DEWHA, 2008; N. NEAGLE, 2002].

## 1.14 Listed Migratory Species

**Table 1.14—1** lists the migratory fauna species that are at least moderately likely to occur within a 10km radius of the proposed project site based on the likelihood of occurrence assessment. Where the 'Act Status' is left blank, insufficient data is available for status classification.

It is important to note that the Project Area has only a small potential to provide a stop-over area for migratory birds and does not provide long-term habitat/s or nesting locations.

**Table 1.14—1 Migratory Species Likely to Occur Within Proposed Area**

Species Name	Common Name	Act Status		Likelihood of Occurrence	Records & Habitat
		EPBC	TPWC		
Migratory Birds					
<i>Calidris tenuirostris</i>	Great Knot	Ma, CE	VU	Low	The Great Knot has been recorded all over the Australian coast, with few scattered records inland. The most significant occurrences of the species are in northern Australia, on the coasts of Pilbara and Kimberly to the NT border, and then through Arnhem land to the southeast Gulf of Carpentaria. In the NT, high numbers of the Great Knot have been recorded in the Rober River Area, Fog Bay, Boucat Bay, and Castlereagh Bay. The species favours estuarine and coastal habitats, nesting on flat to gently sloping ground of broken rocks. Nesting sites are often exposed, with dwarf shrubs providing the only shelter. Most of the species leave Australia from the north coast in March-April and arrive in breeding grounds in May. Limited suitable habitat is present within the Project Area [DAWE, 2016A]. The Great Knot prefers coastal or estuarine habitats but may use the KCPS as migratory stop-over grounds. There are limited historical records of the Great Knot within the Project Area [ECOZ, 2022].
<i>Limosa lapponica</i>	Bar-Tailed Godwit	Ma, VU	VU	Low	Bar-Tailed Godwit has been recorded in the coastal areas of all Australian states. It is widespread through the Torres Strait and along the coasts of QLD, NSW and VIC. Populations of the species have been recorded in the Top End, from Darwin to the Alligator River. There are two sites of international importance for the species in the NT, the Millingimbi Coast and Elcho Island [DAWE, 2016C]. Bar-Tailed Godwit prefers coastal or estuarine habitats but may use the KCPS as migratory stop-over grounds. There are limited historical records of the species within the Project Area [D. HANSEN ET AL., 2016; ECOZ, 2022].
<i>Numenius madagascariensis</i>	Eastern Curlew	Ma, CE	VU	Low	Eastern Curlew is one of 20 birds that the Australian Government prioritises resource allocation to restore the species’ habitats. The species has a primarily coastal distribution and can be found in all states of Australia [DAWE, 2015A]. The Eastern Curlew prefers coastal or estuarine habitats but may use the KCPS as migratory stop-over grounds. There are limited historical records of the species within the Project Area [D. HANSEN ET AL., 2016; ECOZ, 2022].
<i>Limnodromus semipalmatus</i>	Asian Dowitcher	Ma	VU	Low	Asian Dowitcher is currently under threatening listing assessment. The species most frequently occurs in the northwest of Australia, between Port Hedland and Broome. In the NT, the species is found in Arnhem Land and Darwin.  The Asian Dowitcher prefers coastal or estuarine habitats but may use the KCPS as migratory stop-over grounds. There are limited historical records of the species within the Project Area [D. HANSEN ET AL., 2016; ECOZ, 2022].
<i>Charadrius leschenaultii</i>	Greater Sand Plover	Ma	VU	Low	The Greater Sand Plover is distributed throughout coastal areas in all states, with the highest species occurrence in the NT. There are sparse records of the species between Roebuck Bay and Darwin, and many records in the Top End of the NT, including Groote Eylandt [DAWE, 2016B]. The Great Sand Plover roost on sand spits, banks, beaches, or tidal lagoons. The Greater Sand Plover prefers coastal or estuarine habitat but may use the KCPS as migratory stop-over grounds. There are limited recent records of the species within the Project Area [D. HANSEN ET AL., 2016; ECOZ, 2022].
<i>Calidris ferruginea</i>	Curlew Sandpiper	Ma, CE	VU	High	The Curlew Sandpiper occurs around the coast of Australia and inland from Victoria River Downs and around Alice Springs. The species mainly occur in intertidal mudflats and coastal areas. There is suitable habitat for the Curlew Sandpiper within the KCPS. There are recent records of the species within the Project Area [D. HANSEN ET AL., 2016; ECOZ, 2022].
<i>Tringa neblularia</i>	Common Greenshank	M	LC	Low	The Common Greenshank has the highest distribution in Australia of any shorebird. They are found both on coasts and inland, in estuaries, mudflats, swamps, lagoons and inundated land. In the Northern Territory, the have been recorded in the Tanami Desert, and from Birrindudu Waterhole to Lake Woods, Lake Sylvester and the Barkly Tableland. There is suitable habitat for the Common Greenshank in the Project Area and buffer zone, specifically within the KCPS. The species do not breed in Australia [AUSTRALIAN GOVERNMENT, 2022].

Species Name	Common Name	Act Status		Likelihood of Occurrence	Records & Habitat
		EPBC	TPWC		
<i>Actitis hypoleucos</i>	Common Sandpiper	M	LC	Low	The Common Sandpiper breeds in Europe and Asia. It also visits New Guinea, Australia and, less commonly, New Zealand. In Australia, the species is found in coastal and inland wetlands, in both saline and freshwater ecosystems. The Common Sandpiper is usually found solitary or in small groups but can form flocks up to 200 birds prior to migration. Areas of national importance for the species in the Northern Territory include Kakadu National Park and Darwin. The species forages in shallow water and soft mud at the edges of wetlands. There is suitable habitat for the species within the EP and buffer zone, specifically in the KCPS [AUSTRALIAN GOVERNMENT, 2016].
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	M	LC	Low	The Sharp-tailed Sandpiper spends its non-breeding season in Australia, and to a lesser extent, New Zealand. Most of the population migrates to Australia.
<i>Plegadis falcinellus</i>	Glossy Ibis	M	LC	Low	Within Australia, the largest contiguous areas of prime habitat is inland and northern floodplains. The Glossy Ibis is commonly in the largest numbers in drying Top End grass/sedge swamps and Channel Country grass/forb meadows [ Chatto 2000; Marchant & Higgins, 1990].
<i>Ardea alba</i>	Great Egret	M	LC	Low	Great Egrets prefer shallow water, particularly when flowing, but may be seen on any watered area, including damp grasslands. Great Egrets can be seen alone or in small flocks, often with other egret species, and roost at night in groups [Australian Museum, 2022].

EPBC Act

Species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), Aust.:

- M = Migratory
- Ma = Marine

TPWC Act

Species listed under the *Territory Parks and Wildlife Conservation Act 2019* (TPWC Act), NT:

- NT = Near Threatened
- LC = Least concern

## 1.15 Pest Species and Weeds

The NT classification for declared weeds is grouped into the following classes:

- **Class A:** are to be **eradicated** by landowners and occupiers.
- **Class B:** are to have their growth **controlled** by landowners and occupiers.
- **Class C:** are environmental weeds

All class A and class B weeds are also class C weeds.

A review of the NT Weed Management Branch dataset shows that part of the Project Area occurs within the Athel Pine (*Tamarix aphylla*), Bellyache Bush (*Jatropha gossypifolia*), Brazilian Pepper (*Schinus terebinthifolia*), Gamba Grass (*Andropogon gayanus*), and Mimosa Management Zones. Athel Pine was observed near the Project Area and is a declared Weed of National Significance.

The Project Area occurs within the *Alice Springs Regional Weeds Strategy 2021-2026*. This strategy concerns weeds that are most important to the region. These weeds are categorised in **Table 1.15—1** [DEPWS, 2021A].

As part of the 2021/2022 Seismic Program weed survey, EcOz collected data on landforms, vegetation, and ground-based sites. During on-ground surveys, two weed species were recorded within the Project Area and in close proximity to the Project Area – Buffel Grass (*Cenchrus ciliaris*) and Athel Pine (*Tamarix aphylla*). Although Buffel Grass is not declared a weed under the *Weed Management Act*, it is considered a Category 2 priority species in the *Alice Springs Regional Weed Strategy 2021-2026*. Athel Pine is subject to a Statutory Weed Management Plan. Peak Helium is committed to implementing the recommendations of this plan. These recommendations are presented in **Appendix 09** (Weed Management Plan), **Appendix 04** (Risk Assessment) and are summarised below.

Table 1.15—1 ASRWS Categorisation

Category	Priority Level	Defined As
1	Priority Weeds	They are present in the region, widely considered feasible to eradicate from the Region, typically evaluated as very high risk and have isolated and restricted distributions.
2	Priority Weeds or Strategic Control – Including Eradication of Outliers	Species warrant strategic control across the landscape due to their high impact on land managers and broader economic and environmental values.
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.
4	Hygiene and Biosecurity Weeds	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.
5	Alert weeds	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.

These weed species identified by the *Alice Springs Regional Weeds Strategy* [DEPWS, 2021B] relevant to the Project Area are listed in **Table 1.15—2**.

Table 1.15—2 Weed Species Relevant to Project Area

Scientific Name	Common Name	NT Class	WoNS†	Status in Management Plan
<i>Cylindropuntia</i> spp. including <i>C. imbricata</i> , <i>C. fulgida</i>	Rope Cactus	A	No	Category 1, very high
<i>Opuntia</i> spp. including <i>Opuntia stricta</i>	Prickly Pear	A	No	Category 1, very high
<i>Cenchrus Pedicellatus</i>	Athel Pine	A/B	Yes	Category 2, very high
<i>Parkinsonia aculeata</i>	Parkinsonia	B	No	Category 2, very high
<i>Cenchrus ciliaris</i>	Buffel Grass	Not Declared	No	Category 2, very high
<i>Eragrostis</i> spp. Including <i>E. cilianensis</i> , <i>E. barreleri</i> , <i>E. cylindriflora</i> , <i>E. minor</i>	African Lovegrasses	Not Declared	No	Category 3, *medium
<i>Argemone ochroleuca</i>	Mexican Poppy	B	No	Category 3, medium
<i>Aerva javanica</i>	Kapok	Not Declared	No	Category 3, N/A
<i>Rumex vesicarius</i> ; formerly <i>Acetosa vesicaria</i>	Ruby Dock	Not Declared	No	Category 3, N/A
<i>Carthamus lanatus</i>	Saffron Thistle	B	No	Category 3, Medium
<i>Cenchrus echinatus</i>	Mossman River Grass	B	No	Category 3, Medium
<i>Tribulus terrestris</i> *	Caltrop*	B	No	Category 4, low

†WoNS = Weeds of National Significance [WoNS, 2021].

Appendix 09 (Weed Management Plan) presents the full details of observed weed locations identified by EcOz during the 2022 survey and discusses weed monitoring, mitigative measures and reporting schedules. Appendix 04 (Risk Assessment) covers the risk and controls associated with weeds.

### 1.15.1 Weed Management Overview

Peak Helium's weed management strategy is comprised of the following:

- EcOz's survey and on-site ground-truthing.
- The site-specific Weed Management Plan (**Appendix 09**).
- Desktop data.
- Relevant weed management plans (e.g., *Weed Management Plan for Athel Pine 2017-2027*) [NORTHERN TERRITORY GOVERNMENT, 2021].

An overview of Peak Helium's weed management strategy to minimise any weed-related risks are presented in the below table (**Table 1.15—3**).

**Table 1.15—3 Weed Risk Mitigation**

Commitment		Implementation
1.	Comply with all applicable legislation, regulations, conditions, and regional weed management plans, and address specific weed management requirements of station owners.	<ul style="list-style-type: none"> <li>• Peak Helium, with EcOz, have created a site-specific Weed Management Plan (<b>Appendix 09</b>), which will be followed and overseen by a dedicated weed officer.</li> <li>• All tracks, campsite/s and well pads will be inspected and mapped prior to use.</li> <li>• Site environmental inductions will be implemented for all personnel and contractors (to include vehicle hygiene requirements) and recorded in a training register.</li> </ul>
2.	Minimise and/or eliminate (where possible) the spread of biosecurity risk materials (weeds) within the EP, and to and from the EP.	<ul style="list-style-type: none"> <li>• Peak Helium will ensure that all vehicles and machinery are free of weeds, weed seeds, and all vegetative material prior to any exploration or travel.</li> <li>• All vehicles/machinery/equipment entering the EP will have a valid weed hygiene declaration.</li> <li>• Any vehicles with evidence of weeds or weed material will be thoroughly washed before entering and exiting the EP.</li> </ul>
3.	Minimise and/or eliminate (where possible) the spread of weed infestations (including Athel Pine infestations).	<ul style="list-style-type: none"> <li>• Peak Helium is committed to implementing the recommendations of the <i>Weed Management Plan for Athel Pine 2017-2027</i>, which include: <ul style="list-style-type: none"> <li>○ Reporting relevant data or findings regarding the species in the EP using the <i>NT Weedmate App</i> or by emailing <b>weedinfo@nt.gov.au</b>.</li> <li>○ Reporting weed records in accordance with <i>The Field Guide for Collecting Weed Data for the Northern Territory</i>.</li> </ul> </li> <li>• Any weed infestations will be mapped prior to activities, they will be clearly demarcated and avoided where possible.</li> </ul>

Commitment		Implementation
4.	Monitor, report and respond to incidents in accordance with the site-specific Weed Management Plan ( <b>Appendix 09</b> ) and relevant legislation and weed management plans.	<ul style="list-style-type: none"> <li>Any weed infestations will be mapped, and all on-site personnel made aware.</li> <li>Weed monitoring will be ongoing as per <b>Section 6</b> (Annual Action Plan) of <b>Appendix 09</b>. Project sites to be monitored, including known weed locations, access tracks, well pads, campsites, gravel pits and the 50m buffer around stock watering points traversed by the access track.</li> <li>All weed monitoring and survey activities will be recorded and reported (where applicable) in accordance with the <i>NT Weed Data Collection Guidelines</i> [DENR; DLRM, 2015].</li> </ul>
5.	Nominate a dedicated weeds officer to oversee Peak Helium's weed management strategy and ongoing monitoring.	<ul style="list-style-type: none"> <li>Peak Helium has nominated a dedicated weed officer for EP 134 with relevant skills and experience to successfully manage weed-related issues for the duration of the project. The weed officer's contact details are presented in <b>Appendix 09</b>.</li> </ul>

## 1.16 Protected Areas

There are SOCS and SOBS within the Project Area. The KCPS is a chain of 100 saline lakes that flow after substantial rainfall. These lakes provide habitats for threatened waterbirds, migratory shorebirds, and vertebrate species [L. HARRISON et al., 2009].

The proposed Project Activities of EP134 will not affect SOBS or SOCS as well pads, gravel/borrow pits and campsites are located outside the SOCS and SOBS boundaries. Access to well pads, gravel pits, and campsites will only be on existing pastoral tracks. Existing pastoral tracks traverse the KCPS SOCS/SOBS.

The following controls are in place to prevent any disturbance/impact on SOCS/SOBS within the Project Area:

- There will be no clearing activities within the SOCS or SOBS.
- No new access tracks will be constructed within SOCS or SOBS.
- Only existing pastoral access tracks will be utilised to traverse SOCS and SOBS, and these will not be widened. (Note: a small section requires widening that appears to be within the SOCS, but the area being traversed is a connecting corridor, not a SOCS (see **Section 3.6.2** of the EMP).
- Where SOCS and SOBSs areas are traversed, they will be clearly identified so that the site team are made aware, and a speed limit of 40km/hr will be implemented.
- There will be no storage of chemicals or fuel in SOCS and SOBS areas.
- There will be spill kits available where SOCS and SOBS are being traversed.
- Transport of chemical or wastewater on unsealed roads during wet weather conditions is only to occur with an approved by the Site Supervisor when damage to roads is deemed negligible, risk of a spill unlikely and there are no forecasted significant rain events during the transport activity.
- In the event of a chemical or wastewater transport vehicle becoming bogged in a SOCS/SOBS, Emergency Response Plan (**Appendix 14**) is to be activated, so extraction activities are conducted safely and prevent loss of contents.

Additional controls that will be implemented outside of SOCS/SOBS areas to minimise impact to threatened species (include but are not limited to):

- Peak Helium will utilise an ecologist to ground-truth for the following (pre-clearing activities):
  - Known and potential ground habitat (spinifex bush, tussock grass, saltbush and dunes that have evidence of burrows or, in the case of the Great Desert Skink – animal latrines).

- Large, or hollow-bearing trees that might provide habitat or nesting locations for threatened fauna (such as the Grey Falcon and the Princess Parrot. A decision tree for clearing is shown in Error! Reference source not found..
- Peak Helium will conduct a pre-clearing survey for potential Grey Falcon habitat within 300m of proposed activities. If active nests are encountered, a 300m exclusion zone will be established until the nests are no longer active.
- Clearing Desert Oak trees as they have been known to be used by the Princess Parrot for nesting will be avoided.
- In addition to the above, Peak Helium will avoid clearing or disturbing clusters of 5 or more hollow-bearing trees to maintain potential nesting habitat for the Princess Parrot.
- Peak Helium will avoid swamps that may provide habitat in all clearing and construction activities.
- To aid in the avoidance of potential habitat, indicative infrastructure movement corridors have been cleared and will be utilised to re-align new tracks, well pads and campsites, if required.
- The Weed Management Plan (**Appendix 09**) will be implemented and carefully monitored to ensure that weed infestations are avoided or controlled. Specifically, the Interest Holder will ensure that Buffel Grass is not spread within or without the Project Area. Buffel Grass is implicated in the diminishing populations of the Slater's Skink.
- Peak Helium will maintain and implement a Weed Management Plan (**Appendix 09**) to prevent noxious weed infestations and threatened fauna ingesting poisonous weeds.
- Peak Helium will maintain and implement a Waste and Wastewater Management Plan (**Appendix 06**) to prevent attracting pest species that may prey on threatened fauna.
- Erosion and sediment control measures will be maintained on tracks in accordance with the controls outlined in the ESC Plan (**Appendix 05**).

A complete list of risk and controls is covered in **Appendix 04** (Risk Assessment).

There are no National Parks, World Heritage Properties, National Heritage Places, or Wetlands of International Importance within the Project Area. The closest Historical Reserve is Chamber's Pillar Historical Reserve, which is approximately 30km to the north of the Project Area.

**Figure 1.16—1** shows the protected areas in of the Project Area.

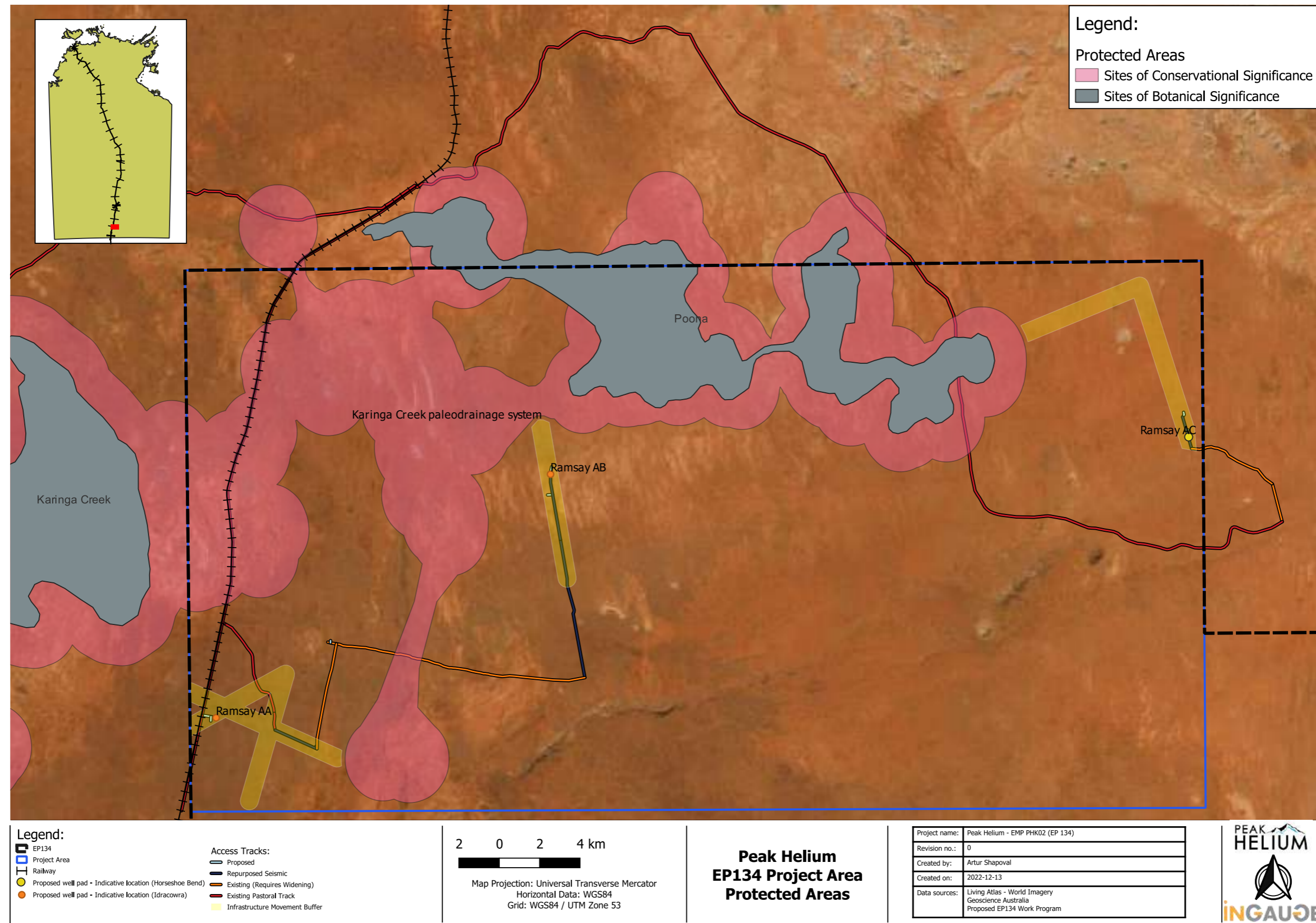


Figure 1.16—1 Protected Areas within the Project Area

## 1.17 Groundwater Dependent Ecosystems (GDEs)

GDEs are complex dynamic natural ecosystems that require groundwater access to meet all or some of their water requirements on a permanent or intermittent basis to maintain their communities of plants and animals, ecosystem processes and ecosystem 'services' [S. RICHARDSON et al., 2011]. These diverse ecosystems are primarily driven by temporal groundwater flow variability contingent on climate, geology, and land use [C. ALFARO et al., 1994; G. BERTRAND et al., 2012; T. M. DOODY et al., 2017; B. KLØVE et al., 2014].

A search of the National Groundwater Dependent Ecosystems (GDEs) Atlas conducted in June 2022 identified a low potential of aquatic or subterranean GDEs occurring within the Project Area. There are terrestrial GDEs present in the Project Area, mainly in the KCPS [BOM, 2022B].

The regulated activities under this EMP do not encroach on the KCPS system; therefore, no specific actions are required to avoid impacts on GDEs. Additionally, as detailed in **Section 3.6.3** of the **EMP**, the target groundwater aquifer will be at a sufficient depth as to not impact aquifers that would potentially be a resource for these GDEs.

**Figure 1.17—1** Groundwater Dependent Ecosystems shows the results of the GDE search for the Project Area.

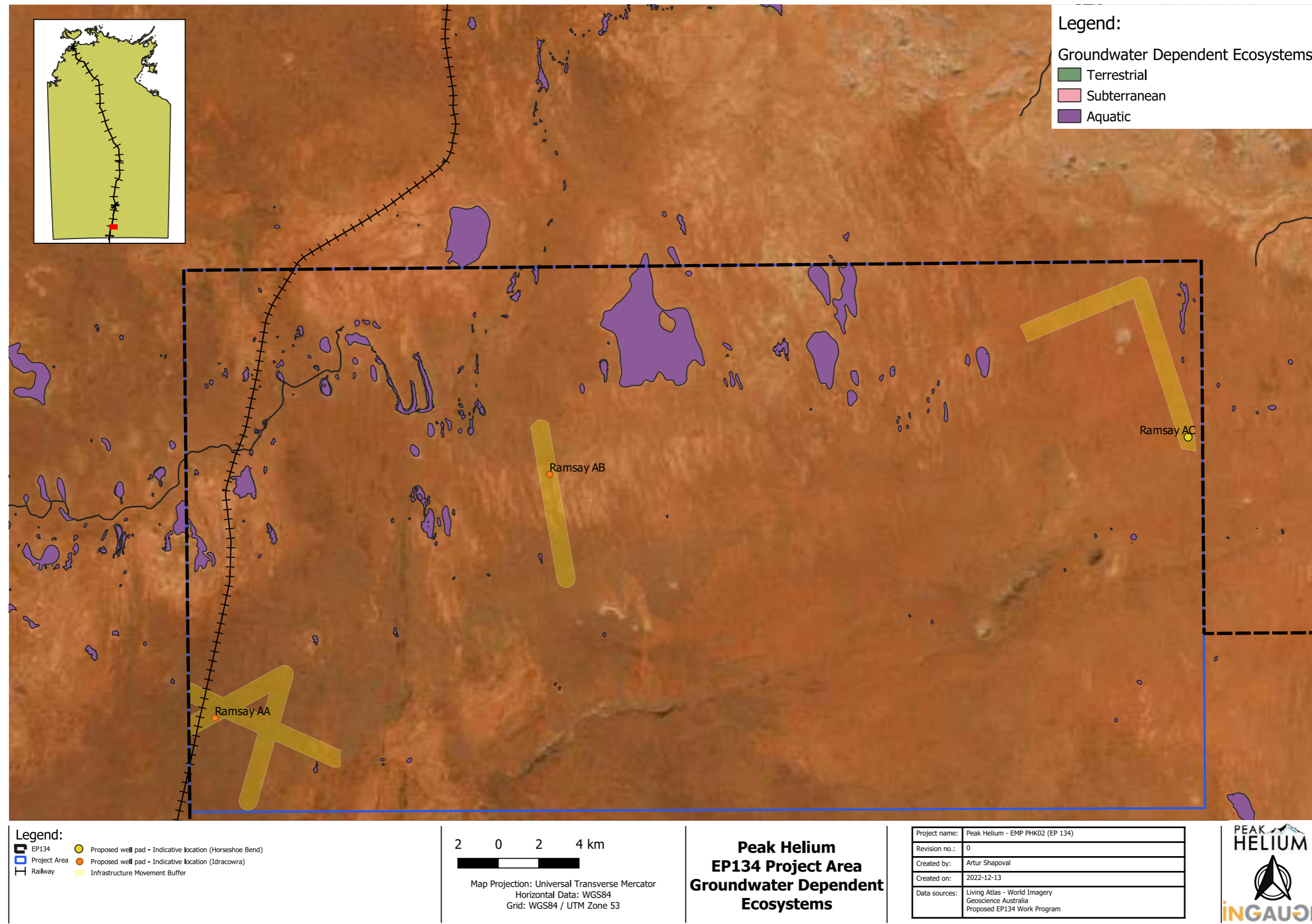


Figure 1.17—1 Groundwater Dependent Ecosystems

## 1.18 Fire Management

The Project Area of EP 134 is within the Finke bioregion, specifically within the Tieyon and Finke sub-regions. The area is characterised as open grassland savannah, comprised of low sandstone ranges, weathered tablelands, and rounded metamorphic hills and dunes.

The Project Area has been primarily pastoral land, with infrequent fires within the region. According to fire scar data, most of the Project Area was last burnt in 2012. There has not been a large-scale burn in the area for ten years; thus, it could be concluded that the Project Area has re-established fuel loads. However, vegetation has been slow to recover due to the arid climate, and the fuel loads remain very low to moderate. Only nine of 92 survey sites have a high fuel load, localised to Buffel Grass along drainage lines 1 and 3. There is currently no need for controlled burns in the Project Area for this EMP. However, conditions will be monitored, and if changed, Peak Helium will canvas solutions and procedures with the landholders and the Department of the Environment, Parks and Water Security (DEPWS).

The Project Area exists within the *Alice Springs Fire Management Zone* in the Northern Territory. Peak Helium's Fire Management Plan has been created in line with the *Alice Springs Bushfires Management Plan* [NT GOVERNMENT, 2018]. Fire breaks will be constructed around each well pad and campsite during civil construction works and be maintained during operations as required.

Peak Helium's Bushfire Management Plan was developed as part of the exploration program and is provided in **Appendix o8**.

Mapping obtained from the *North Australia Fire Information* website indicates when the Project Area, provided in **Appendix o8**, was last burnt.

## 1.19 Historical and Natural Heritage

An archaeological survey was conducted in June 2021, and revised in June 2022, by Ellengowan Enterprises [ELLENGOWAN ENTERPRISES, 2022], an approved NT archaeological consultant. The archaeological report from this survey is attached to this EMP as **Appendix o1.o1**.

A search of the *NT Heritage Register* for EP 134 was conducted, and no recorded NT heritage items or places were present in the Project Area [DTFHC, 2022]. A search of the EPBC PMST database showed no *World Heritage Properties* or *National Heritage Places* registered within 5 km of the Project Area [DAWE, 2022A, 2022B].

Peak Helium has an *Aboriginal Areas Protection Authority* (AAPA) Certificate; #C2021/o8o, which covers the regulated activities under this EMP.

Traditional Owner Representatives will be present at all land clearing activities for the project. The disturbance footprint for these activities is not within the vicinity of any known Aboriginal cultural or heritage sites. Therefore, Peak Helium considers that the likelihood of contamination or damage to these sites is remote.

### 1.19.1 AAPA

Peak Helium has an Aboriginal Areas Protection Authority (AAPA) Certificate; #C2021/080 which covers the regulated activities under this EMP.

The certificate has been forwarded to the relevant government departments.

The AAPA Authority Certificate aims to prevent damage to and interference with sacred sites by identifying and setting out the conditions for entering and working on the land. Proponents must obtain an AAPA certificate to identify and protect areas of significance for sacred sites from proposed activities.

## 1.20 Socioeconomic Environment

The EP 134 area is mainly used for pastoral grazing as directed under the *NT Pastoral Land Act* [DIPL et al., 1992]. The deed of agreement of informed consent and access to the land is facilitated through the *NT Petroleum Regulations* [NT GOVERNMENT, 2020].

Ghan is the nearest township community to the Project Area. Other than pastoral activities, there are a few notable tourist destinations in EP 134, except for the ruins of the Charlotte Waters Telegraph Station, located close to the SA border. In the broader Ghan region, tourist destinations include the Henbury Meteorite Craters, the Illamurta Springs Conservation Reserve, the Mac Clark (Acacia peuce) Conservation Reserve and the Old Andado Station, which are listed on the *NT Heritage Register* [DTFHC, 2021]. All of the above tourist destinations are outside of the permit area and will not be impacted by Peak Helium's operations. Crossing through the western side of the Project Area is the Alice Springs Tarcoola Railways, and to the east of EP 134 is Mt Dare Road.

### 1.21 Petroleum Reserved Block

The Project Area does not lie within a Reserved block or contain any Proposed Reserved Block as identified in the NT Government's *Petroleum Reserved Block Policy, July 2019* [NT GOVERNMENT, 2019].

### 1.22 Settlements

The Project Area is sparsely populated, with several leaseholders having homesteads scattered throughout; none are within a 10km radius of the proposed well pads. The closest settlement is Ghan, approximately 30km west of the Project Area, situated at the intersection between the Lasseter and Stuart Highways.

There are no Aboriginal communities in the vicinity of the Project Area. **Figure 1.22—1** shows the dwellings and settlements in the vicinity of the Project Area.

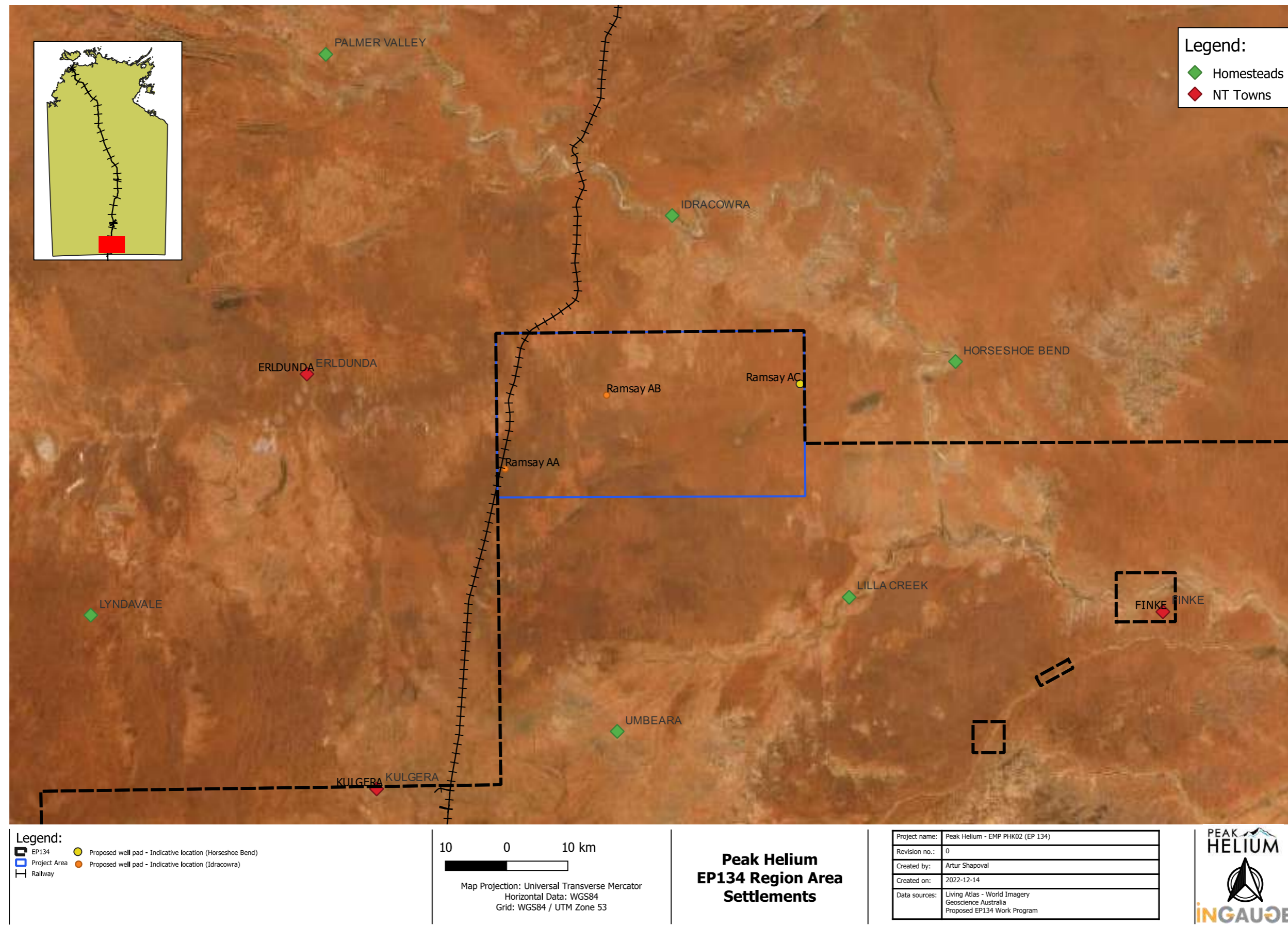


Figure 1.22—1 Settlements and Dwellings

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### 1.23 Environmental Values as Defined Under the Environmental Protection Act

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The *Environment Protection Act 2019* and the *Environment Protection Regulations 2020* require that any operator conducting an activity with a potential environmental impact assess all the matters fully and evaluate the effectiveness of the proposed safeguards to mitigate these impacts [DEPWS, 2019, 2020]. It also recommends actions to ensure the project's development and operational phases are managed in an environmentally sound manner.

A combination of desktop assessment and field surveys was conducted to describe the area's existing environmental values. The assessment determines the likelihood of occurrence for threatened fauna and flora species. **Appendix 01.02** shows the environmental values and likelihood of occurrence, the potential effect on the environmental factors due to activities, and applicable codes of practice to ensure risk and impacts are reduced to As Low As Reasonably Practical (ALARP).

## 1.24 References

- D. Hansen et al. (2016). *Revision of the East Asian-Australasian Flyway Population Estimates for 37 Listed Migratory Shorebird Species*.
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## 1.1 Appendix 01.01 – Archaeological Report

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# **ARCHAEOLOGICAL SURVEY REPORT – PEAK HELIUM EP: 134**



**A report for EcOz Environmental Consultants, Darwin NT**

**(With Addendum, June 2022)**

**Dr. Silvano Jung**  
Principal  
Ellengowan Enterprises – archaeological consultant  
ABN: 47 208 214 348

**July 2021**

Cover photo: LZ52 on top of mesa. Inset: #2349 blade on quartzite

## EXECUTIVE SUMMARY

Peak Helium are proposing to survey 173.66km of seismic lines on a section of Idracowra Station, approximately 200km south of Alice Springs and 65km north of the Northern Territory/South Australian boarder. A proposed worker's camp is to be surveyed as well, together with a 33km access track along the North Australia Railway. The work programme is bounded to the east by the Simpson Desert and to the west, 20km east of the Erldunda Roadhouse on the Lasseter Highway. EcOz Environmental Consultants engaged Ellengowan Enterprises to conduct an archaeological survey, in conjunction with an ecological assessment with one of their own ecologists. The team conducted an aerial survey for three days in June 2021. Eleven archaeological sites were found and over 20 isolated artefacts along the seismic lines. The survey results indicated that the proposed works would impact on archaeological sites, two of which were assessed as highly significant.

The nomenclature for the archaeological sites is derived from the station name: Idracowra. Hence Idracowra Archaeological Site 1 is referred to as IAS01 and so on. The proposed works will have a direct impact on three sites, IAS01, IAS02 and IAS08, the latter is one of the two highly significant sites. The following surmises the recommendations to best reduce the risk of the proposed Peak Helium seismic survey of possible damage to cultural heritage sites.

### Summary of recommendations:

- Diversion routes have been determined for two archaeological sites IAS01 and IAS02.
- IAS08 should be made a restricted works area and avoided. The last 900m of the northern end of line PH\_2021\_3.1 should be abandoned.
- Other sites have an existing track running through them and the seismic lines should follow those already disturbed tracks, while other sites are well away from the seismic centre line, but within the construction buffer. The following detailed mitigation schedule should be followed:

### Mitigation schedule:

Site ID	Site Type	Individual site type	GPS Grid Reference Datum: GDA94, Zone: 53J (Centroid)		Description	Significance	Recommendation
		Artefacts (n.)	Easting	Northing			
IAS01	Stone artefact scatter	>13	352748	7214539	375m x 280m on edge of clay pan and low sand dune	Moderate	Option 1: Avoid. Follow diversion suggestions for lines PH_2021_6.1 and PH_2021_7
IAS02	Stone artefact scatter	>7	350729	7211273	430m x 305m in and around clay pan/nearby stoney rise	Low	Option 1: Avoid. Follow diversion suggestions for lines PH_2021_6.2
IAS03	Stone artefact scatter	>4	377198	7214171	23m x 20m in 'bowl' depression on top of dune	Low	Option 1: Avoid. 70m east of centre line
IAS04	Stone artefact scatter	>14	377564	7215438	23m x 33m in 'bowl' depression on top of dune	Low	Option 1: Avoid. 20m east of centre line
IAS05	Stone artefact scatter	>5	379655	7221774	295m x 170m on top of stoney ridge near existing road and loamy depression – high ground	High	Option 1: Avoid. 20m east of centre line
IAS06	Stone artefact scatter	>6	380442	7226731	90m x 35 on banks of small creek	Low	Option 1: use existing track

IAS07	Stone artefact scatter	>4	380474	7227355	170m x 55m on banks of small creek	Low	Option 1: use existing track
IAS08	Stone artefact scatter/ Historic feature	>100	381826	7229176	830m x 500 numerous knapping floors. Wooden round horse pen	High	Option 1: stop line PH_2021 @ Wpt. 381539E, 7228790N
IAS09	Stone artefact scatter	>7	391854	7213181	12m x 10m in 'bowl' depression on top of dune	Low	Option 1: Avoid. 120m south of centre line
IAS10	Stone artefact scatter	>8	397370	7215553	10m x 10m on western bank of small drainage channel	Low	Option 1: Avoid. 20m south of centre line
IAS11	Stone artefact scatter	>8	394400	7221954	60m x 40m on southern bank of major erosion gully with stratified baulks	Moderate	Option 1: Avoid. 40m west of centre line

An addendum was added in June 2022 that contained location data on well sites, gravel pits, camp areas and access tracks. No data was available for these features in 2021, except for one camp location, on Line PH\_2021\_3.1. This seismic line was subsequently reduced in size to approximately one kilometre only from its southern origin. The campsite surveyed in 2021 was also subsequently revised. None of these features will likely impact on cultural heritage material, as they do not occur in high-risk areas, such as waterways and dune systems. The access track to Ramsay AC it is said, will augment an existing track from a bore off Horseshoe Bend (Smith, T. pers. comm., 6 June 2022). Furthermore, the proponent will require no further action to meet their obligations under the Northern Territory *Heritage Act (2011)*, as these new features occur in the seismic line buffer corridor and do not impact on recorded archaeological sites and background scatters.

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## 1.0 INTRODUCTION

### 1.1 Background and consultancy brief

Peak Helium proposes a seismic line and worker's campsite survey on a section of Idracowra Station near the Erldunda Roadhouse, approximately 200km south of Alice Springs and approximately 1.5km south of the Finke River in the Northern Territory. EcOz Environmental Consultants requested an archaeological heritage survey to assess the risks posed by the proposed works on any cultural heritage, in complying with the Northern Territory *Heritage Act 2011*. The scope of works was to survey 173.66km of seismic lines, divided into thirteen sections. These are listed below. In addition to the seismic lines, a proposed worker's camp area and access track along the existing railway easement was also to be surveyed.

- PH\_2021\_1 (16.80km)
- PH\_2021\_2.1 (13.90km)
- PH\_2021\_2.2 (20.00km)
- PH\_2021\_2.3 (09.47km)
- PH\_2021\_3.1 (19.00km)
- PH\_2021\_3.2 (09.77km)
- PH\_2021\_4.1 (05.31km)
- PH\_2021\_4.2 (12.80km)
- PH\_2021\_5 (19.80km)
- PH\_2021\_6.1 (08.77km)
- PH\_2021\_6.2 (08.55km)
- PH\_2021\_7 (06.99km)
- PH\_2021\_8 (22.50km)
- Railway access track (33.5km)
- Proposed camp area (100m<sup>2</sup>)

The seismic lines will essentially be a 5m wide track, but they have a 500m buffer zone on either side of the line, to allow relocation of the line around geographic obstacles and significant cultural heritage areas. Appendix 1 shows the survey lines and current vehicle access tracks. A three-day archaeological aerial survey was conducted from 11 to 13 June 2021 with Tom Ewers-Reilly, an ecologist from EcOz and our helicopter pilot, Fynn Blackhall from Airborne Solutions with principal archaeologist Silvano Jung. Our aircraft was a Robinson R44, registration number VH-WDI. The consultancy brief was specifically to:

- Identify any prescribed archaeological objects or places as defined under the Northern Territory *Heritage Act 2011*, and any archaeological sites located within the entire survey area.
- Assess the nature, distribution and significance of these objects or places and discuss possible constraints to the works posed by the presence of archaeological and historic sites and an indication of what sites are likely to be the most sensitive in this respect.
- Present a final report including a summary of survey results, determination of significance of sites and the likely impact of the proposed development, and recommendations regarding management strategies or mitigation procedures as appropriate under the Northern Territory *Heritage Act 2011*.

The results of the survey recorded eleven archaeological sites, all of which are stone artefact scatters and 23 background scatters, or isolated stone artefacts. A historic feature was also recorded. The archaeological sites are named Idracowra (the Aboriginal name for the station and 1:100 000 map sheet) Archaeological Site 1 (IAS01) and so on. The background scatters are simply referred to by their waypoint number. The proposed works would have an impact on archaeological sites. Four sites have been assessed as under threat by the proposed works. The following describes the methods and outcomes of the survey, together with detailed recommendations for the proposed works on how to reduce the risk of damage to the sites.

## 1.2 Location of the study areas and brief description

The survey area is on Idracowra Station, approximately 200km south of Alice Springs, 20km east of the Erldunda Roadhouse on the Lasseter Highway and 65km north of the Northern Territory/South Australian border (Fig. 1). Idracowra is an Arrernte name referring to the Gecko ancestor *Itirkawara* and is associated with the prominent Chambers Pillar (Parks and Wildlife Service of the Northern Territory, 2010). The survey area is mapped in Figure 2, which shows their distribution south of the Finke River, just 1.5km to the north of one of the seismic lines.

The survey area is on the western boundary of the Simpson Desert. Spinifex, acacia, blood woods, desert oak, mulga and coolabah trees are the main vegetation type in wetter areas, while clay pans, calcareous loamy swales, gibber and red sand dunes (between 5m to 7m in height) predominate along the seismic lines (AustPlots, 2012). Blue mallee is also found in patches. Mesa topped hills to 50m in height also occur to the east, but the seismic line follows along their base.

The geology consists of three main units:

- Qa – Alluvium
- Qs – Sand
- Pzi – White kaolinitic sandstone
- Pzh – Red-brown biotite shale, some fine sandstone (Fig. 3).

Ground Surface Visibility (GSV) was typically 90% due. Ground Integrity (GI) was assessed as 75% due to the impact of grazing by both cattle and camels. Water resources are shown in the 1:100 000 topological map, which shows a complex of drainage lines across seismic line PH\_2021\_6.1 (Fig. 4). Most of the water sources occurred in clay pans, some of which still contained water at the time of the survey. These water-bearing pans, however, were outside of the survey area. No water source was found along the seismic lines. The main water source adjacent to the survey area is the Finke River. No water was found in the creeks and drainage lines during the survey areas, but nearby clay pans outside of the survey area still had extensive bodies of water.

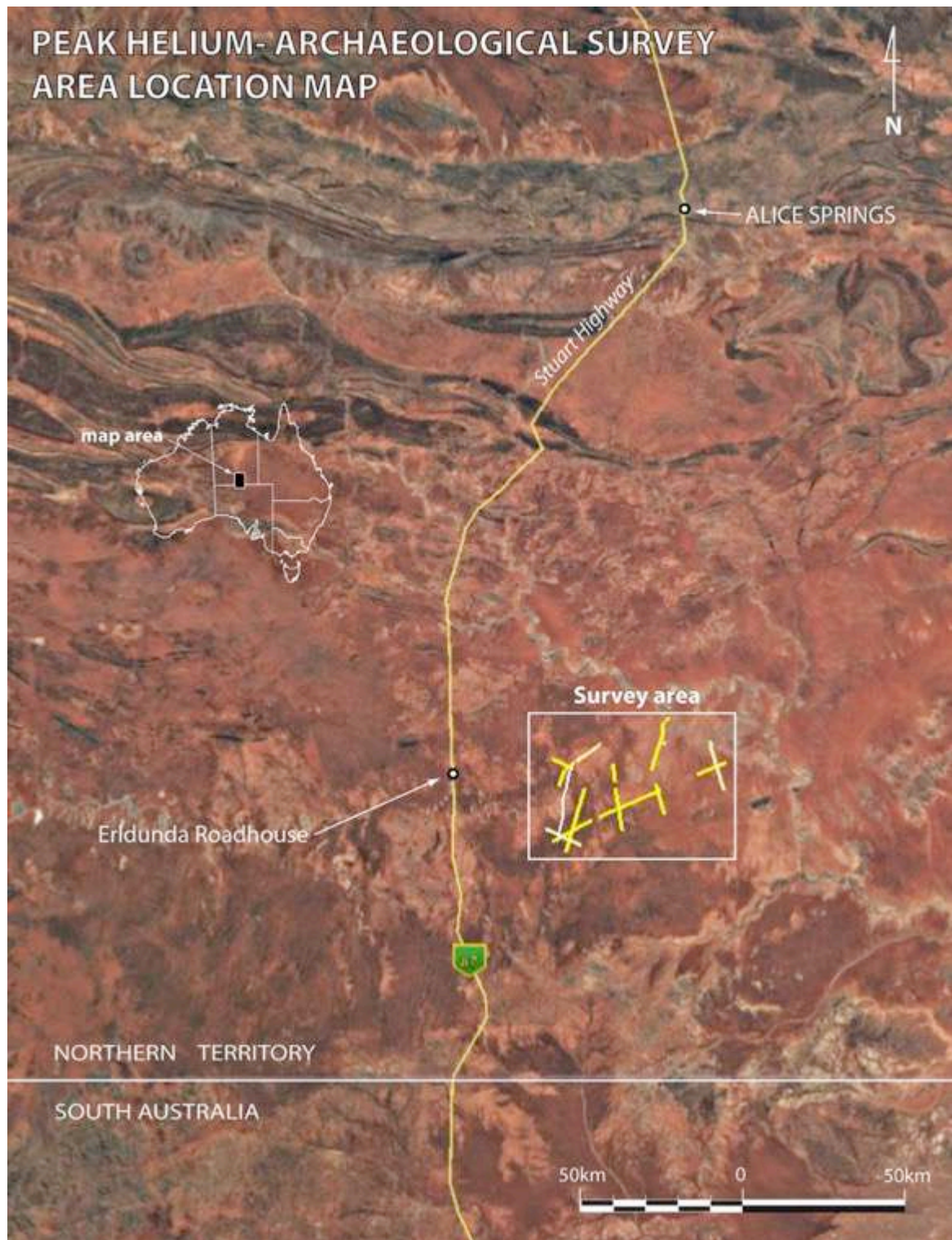


Figure 1. Location of the two study areas: Area of Interest 1 and 2 (After Google Earth).

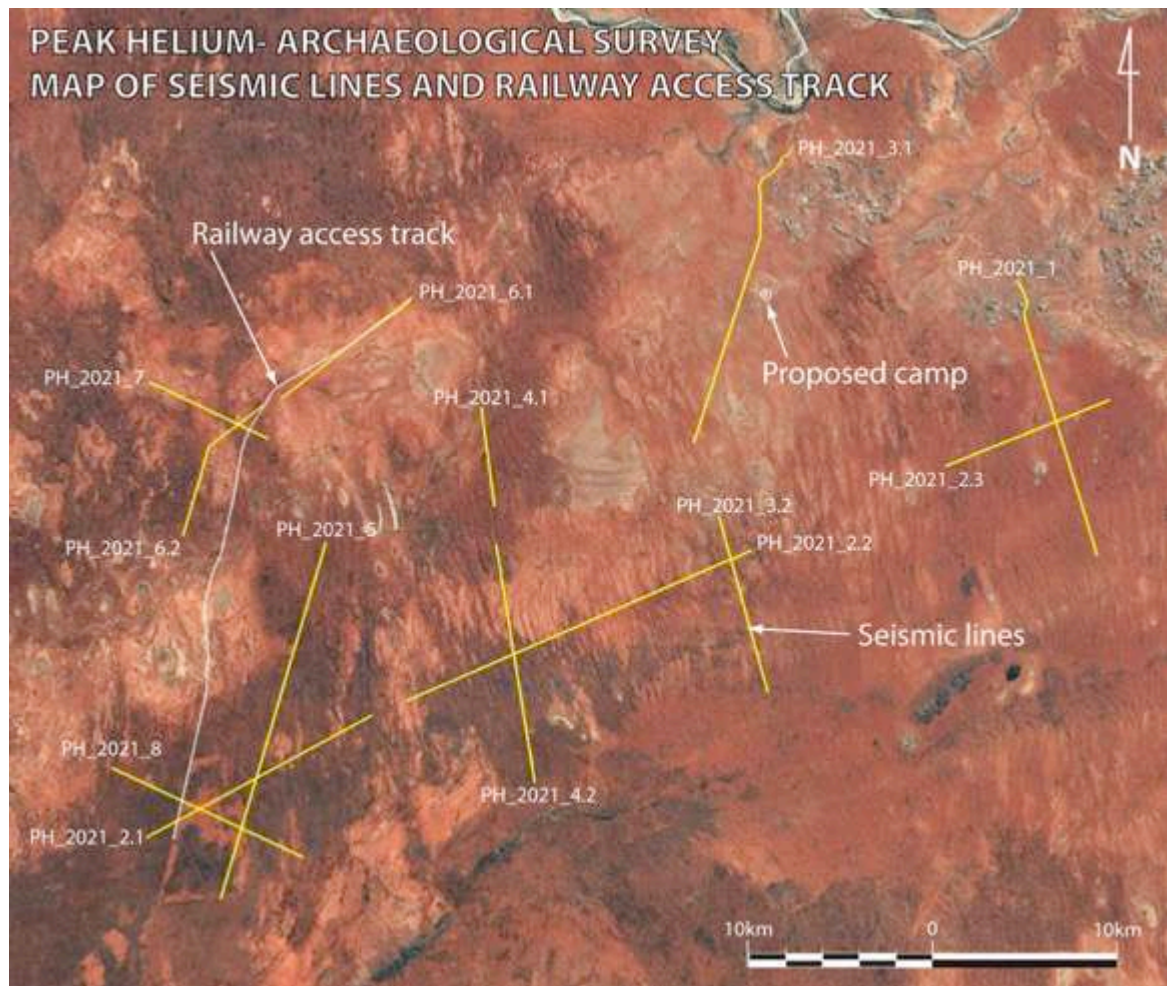


Figure 2. Map of survey transects, railway access track and proposed camp area (After Google Earth).

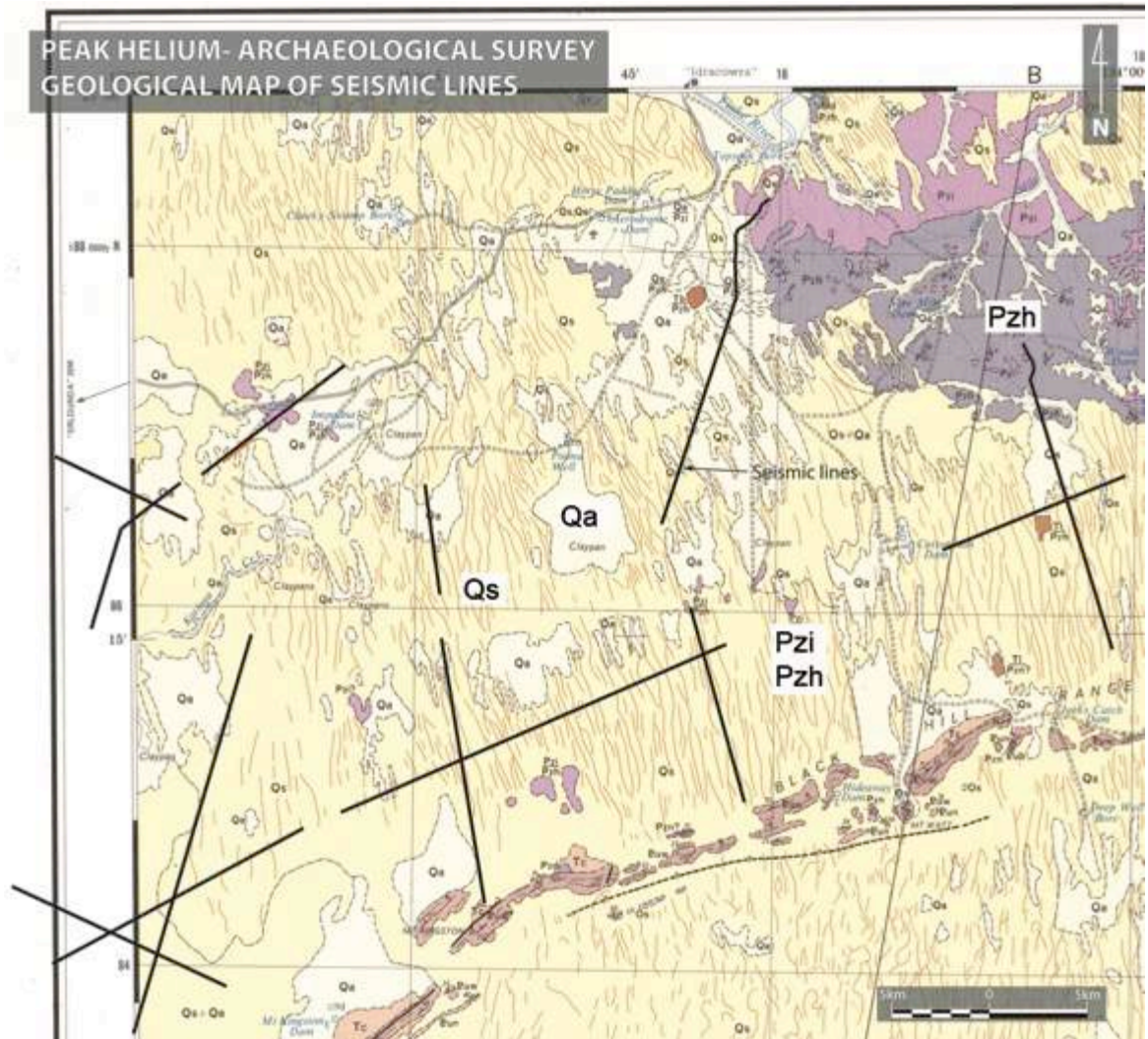


Figure 3. Geological map of the seismic lines (After FINKE SG536, 1: 250 000 Geological Map, 1<sup>st</sup> edition 1968).

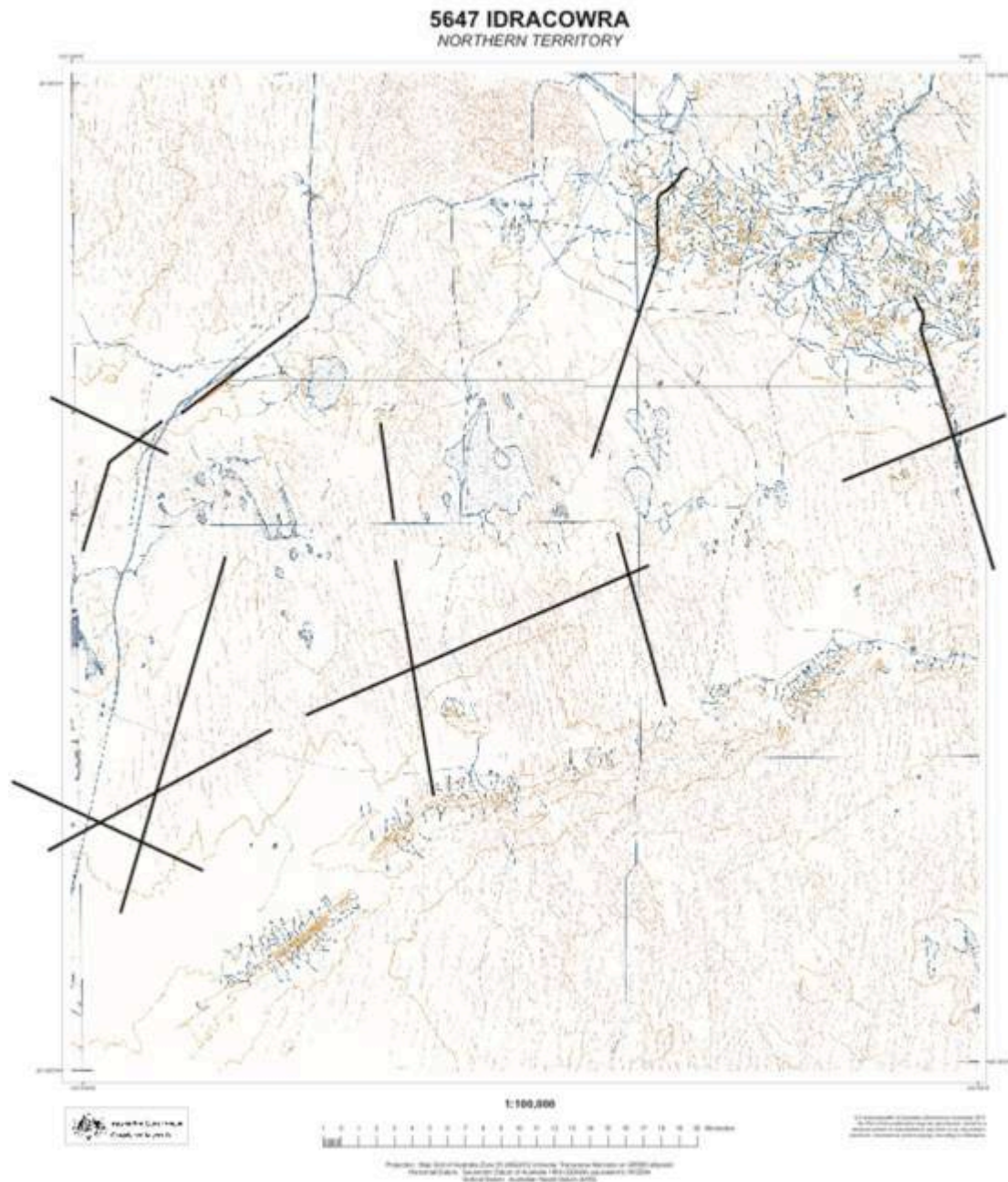


Figure 4. Topographical map of the seismic line survey routes (After 5647 IDRACOWRA 1:100 000, 2011. URL: <https://d28rz98at9flks.cloudfront.net/58987/5647.pdf>. Accessed 20 June 2021).

## 2.0 HERITAGE LEGISLATIVE FRAMEWORK

### 2.1. Northern Territory legislation

There are two kinds of heritage sites protected under the Northern Territory *Heritage Act 2011*, declared and prescribed places and objects. The Act places legal constraints on owners of private property, local government and the Crown:

- Places or objects listed on the Northern Territory Heritage Register are declared heritage places and objects that are protected under section 33 of the Act, and
- Prescribed archaeological places and objects, which may or may not be declared, are protected under sections 29 and 39 of the Act.

It is an offence under the Act to damage, destroy, alter or carry out work of any sort on declared or prescribed sites without the written consent of the Minister or Minister's delegate. If considered appropriate, the Heritage Branch may on occasion utilise the discretion available in the Act to give permission for small-scale disturbance (such as the relocation of isolated stone artefacts) without the need for a formal application. The discretion is allowed under s148 of the Act, which in effect says that a heritage officer (such as an archaeologist) may undertake actions (or authorize actions), not construed as an offence.

#### 2.1.1 Declared heritage places and objects

Categories, which describe the status of each site on the Northern Territory Heritage Register database, are listed in Table 1.

**Table 1. Site status on the Northern Territory Heritage Register database**

Status	Description
<b>D</b>	Declared heritage place.
<b>NR</b>	Not recommended. HC* determined that the place did not meet heritage assessment criteria and did not hold sufficient value to warrant declaration under the <i>Act</i> .
<b>RF</b>	Refused by the Minister. HC* recommended for declaration and Minister refused to do so.
<b>P</b>	Proposed. HC* has determined that the place warrants declaration under the <i>Act</i> but has not yet made its recommendations to the minister.
<b>RV</b>	Revoked. Declaration as a heritage place pursuant to Section 26(1) of the <i>Act</i> is revoked.
<b>N</b>	Nominated. HC* has yet to complete its assessment of the heritage value of the place.

\*Heritage Council

The Northern Territory Heritage Register contains places that possess special significance for the Northern Territory and have been recognized for a wide range of natural and cultural values. As a result it includes places that have been deemed significant because of their environmental and/or cultural characteristics. For the purposes of the current report, only places of historic or archaeological significance have been included. A search of the register indicates that no sites are listed in Heritage Register, in the proposed seismic lines, camp area and railway access track for Peak Helium.

#### 2.1.2 Prescribed archaeological places and objects

Most archaeological places and objects are listed in the *Heritage Conservation Regulations* (1999) as prescribed places and objects. The Heritage Branch, Heritage, Libraries and Sport, Department

of Territory Families, Housing and Communities, Northern Territory Government, formerly the Department of Tourism and Culture, hold the Archaeological Sites Register. Included in this register are the protected prescribed sites that consist of all archaeological sites and objects pertaining to the past occupation by Aboriginal people. Any historic sites listed on this register do not indicate that these sites are protected or hold legal significance under the Northern Territory *Heritage Act 2011*.

## 2.2. Constraints

### 2.2.1 *Ground Integrity (GI)*

Assessing ground surface integrity provides an indicator of whether or not the landscape under study has been modified, and if so the degree of disturbance encountered. It then becomes possible to gauge the degree to which modification has influenced the environmental context within which artefacts and/or places of cultural and/or scientific interest are located. Ground surface integrity must also be assessed from the perspective of the current legislation.

The *Aboriginal Cultural Heritage Act 2003* (in Queensland, but equally applicable to the Northern Territory) provides a definition for GI that includes the removal of native vegetation as inferring the ground has been subjected to ‘significant ground disturbance’. Under these criteria of modification, therefore, the *Act* assumes that archaeological integrity and significance is greatly reduced, is negligible, or even extinguished completely.

Contrary to this however, archaeologists are continually finding evidence that important cultural heritage material and/or places regularly survive not only land clearing activities but also invasive farming techniques such as ploughing.

Combined with this is the fact that, regardless of levels of GI, significant Aboriginal objects and/or significant Aboriginal areas can be defined on entirely cultural grounds, by Traditional Owners, not requiring any assessment of ground surface integrity.

Levels of GI are determined using a percentage range between 0-100% where 0% indicates all GI is gone, and 100% represents excellent preservation of the original context. Zero – 0%; Poor – 1-25%; Moderate- 26-50 %; Fair – 51-75 %; Good – 76-85%; Excellent 86-100%.

### 2.2.2 *Ground Surface Visibility (GSV)*

Assessments of ground surface visibility provide an indication of how much of the ground surface can actually be seen.

Ground surface visibility (GSV) is most commonly inhibited by vegetation but other inhibitors may include concrete, gravel and bitumen. Levels are determined using a percentage scale similar to that used for the calculation of Ground Integrity (GI), in that 0% represents zero visibility and 100% represents maximum visibility (bare ground). Zero – 0%; Poor – 1-25%; Moderate – 26-50 %; Fair – 51-75 %; Good – 76-85%; Excellent – 86-100%. The better the visibility, the more potential there is for locating cultural/archaeological material.

### 3.0 PREVIOUS RESEARCH

#### 3.1 Literature review

The survey areas overlap the traditional lands of the Arrernte and Luritja peoples (Fig. 5). From a historical perspective, Idracowra Station was established in 1876, but was abandoned by 1893 (Hartwig, 1965:379; Winnecke, 1897; see Heritage Branch, 2008). The station was restocked by 1905 and was run as outstation to Henbury (Pearce, 1985:60). The two tribal groups are responsible for the upkeep of country and traditions. The term 'kwertengwerle' refers to a caretaker's role:

On the western side of the Finke River, the country is associated with both Iterrkewarre (Idracowra) and Ilperle (Henbury) estate groups. Members of these groups act as kwertengwerle for each other (Gregory and Associates, 2016: 28).

A search of the Sites Register at the Heritage Branch, Northern Territory Government, provided a list of previously recorded archaeological sites north of the Finke River, around Chalmers Pillar and along the Stuart Highway (Table 2 and Fig. 6). The sites list, however, is nowhere near comprehensive of all previous work. Many more sites are listed in Gregory and Associates (2016), but these are all north of the Finke River.



Figure 5. Map of proposed Peak Helium seismic survey area in relation to Aboriginal tribal boundaries (After AIATSIS).

**Table 2. List of previously recorded sites – Idracowra survey area (Courtesy Heritage Branch, Northern Territory Government)**

ID	Name	Comment	Zone	Zone	Easting	Northing
W	Twelve Mile North	Historic object/place	52	L		
W	Twelve Mile Settlement & Battery	Historic object/place	52	L		
W	Twelve Mile Chinatown	Well, historic object/place	52	L		
W	Site 12	Stone artefact scatter	52	L		
W	Site 13	Stone artefact scatter	52	L		
W	Site 14	Stone artefact scatter	52	L		
W	Site 15	Quarry, stone artefact scatter	52	L		

*Figure 6. Map of previously recorded archaeological sites adjacent to the proposed Peak Helium seismic lines (Courtesy Heritage Branch, Northern Territory Government).*

## 4.0 METHODS

### 4.1 Survey method

The survey method was to assay any creek crossings and drainage channels, as well as to assess clay pans, particularly their edges, swales between sand dunes and stoney outcrops intersected by the seismic lines. The crests of sand dunes were also investigated. The seismic lines were flown over at a height of approximately 50 - 100m.

All finds are recorded with GPS grid references using a Garmin Montana 650T. Formal tool types were photographed. Artefact and raw material type were recorded.

#### 4.1.1 Identification of archaeological material

Stone artefacts, including tools and debitage, the by-product of manufacture, are identified on the following criteria after McCarthy (1976), Holdaway and Stern (2004):

- Bulb of percussion
- Ercure scar (on the ventral surface)
- Point of force application (PFA) and associated ring crack
- Termination types (e.g. feathered, stepped, hinged, plunge)
- Flake scars (dorsal scars and ridges)
- Cores (identified by the presence of negative flake scars)
- Hammer stones (identified by the presence of end-crushing on pebble stones)
- Retouch (reworking of flake margins)
- Raw material type
- Grinding stones (very smooth wear on upper surface)

List of artefact type abbreviations:

- Ax – axe
- Ad – Adze
- An – Anvil
- B – Blade
- C – core
- Cf – Core fragment
- Cp – core piece
- Ct – Core tool
- F – flake
- Fp – flake piece
- Gs – Grindstone/Grinding plate
- Hs – Hammer stone
- M – Manuport
- Rtf – retouched flake
- S – Scraper
- Sc – Single platform core
- Ts – Top stone
- X – Axe/wasted cobble
- Z – Other e.g., ceremonial

List of artefact raw material abbreviations:

- C – Chert
- Ch – Chalcedony
- H – Hornsfil

- Im – Indurated mudstone
- J – Jasper
- SS – Sandstone
- S – Silcrete
- Tu – Tuff
- Q – Quartz
- Qz – Quartzite
- V – Volcanic

#### 4.1.2 *Definition of archaeological sites*

##### 4.1.2.1 *Historical Sites*

Historical sites in north Australia are those that have physical evidence of European and non-European activities. These range from Macassan sites, Chinese mine sites, to military sites of WWII. These sites may overlap with Aboriginal heritage sites.

##### 4.1.2.2 *Aboriginal Heritage Sites*

Aboriginal archaeological sites can be classified by six main types: 1) stone knapping sites, including quarries, 2) background scatters, including isoliths, 3) stone arrangements, such as mounds, walls, fish traps or stone motifs, 4) shell middens, 5) burials, 6) scarred trees and 7) rock art sites, or rockshelters and engravings either pecked or incised.

Burke and Smith (2004:63) define an archaeological site as ‘any place that contains the physical evidence of past human activity. Australia, however, has what has been referred to as a background scatter of stone artefacts, which refers to low-density artefact scatters that either represent singular knapping events (‘dinner-time’ camps or ‘hunting camps’), or larger sites that have been buried or disturbed. To differentiate this site type from larger sites that may contain thousands of artefacts, the term Archaeological Site (AS) is used to describe home-camps or quarries i.e., places where people have been returning to for millennia, as opposed to sites that have very low artefact densities that represent sporadic visits i.e., background scatters (BS).

## 5.0 RESULTS

### 5.1 Archaeology

A total of 54 landing zones were made during the three-day survey. An overall view of the landing zones and survey tracklog is shown in Figure 7. For detailed map views of the landing zones, see Appendix 2. The landing zone photographs and descriptions are shown in Appendix 3. Eleven archaeological sites were recorded and over 20 isolated stone artefacts. The majority of the archaeological sites occur in clay pan areas and in close proximity to the Finke River. The most significant site, due to its range of implements, complexity and number of artefacts, IAS08 also occurs near the Finke.

Numerous sites were found not so much in the swales between dunes, but on top of the dunes themselves in what has been described as ‘bowls’ or depressions formed in the sand, referred to in this report as ‘embowlements’. These provided cover from prevailing winds and a comfortable place to sit. These types of sites were found to be typically small, unlike other sites around and on clay pans. The following provides site locations and descriptions of the archaeological finds.

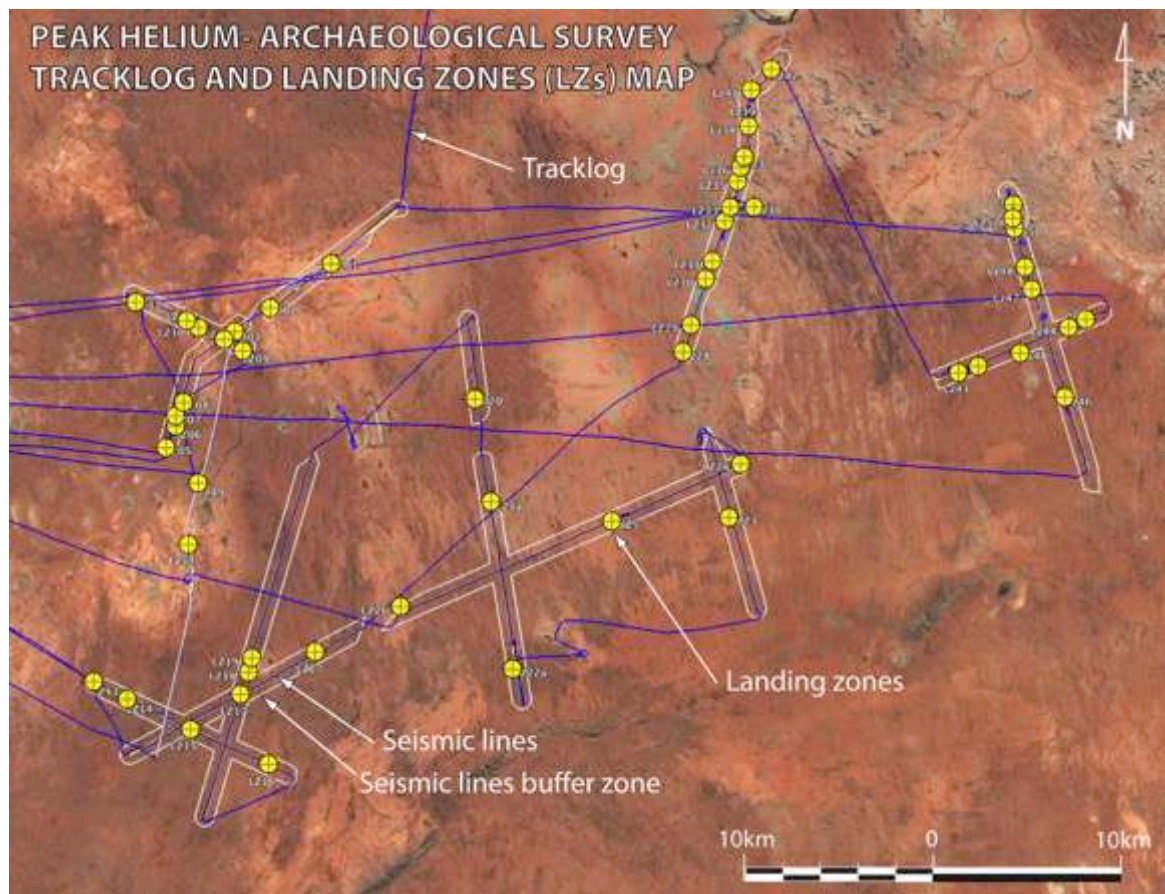


Figure 7. Peak Helium archaeological survey overall view of tracklogs, landing zones and map of the seismic lines (After Google Earth).

### 5.1.1 Idracowra Archaeological Site 01 (IAS01)

IAS01 is a stone artefact scatter on and around the edge of a small clay pan. The site extended beyond the initial clay pan, over a small dune and on to the other side. The site contains a medium density of artefacts, with higher concentrations per metre at discrete knapping sites. The site is assessed as having moderate significance. Table 3 shows the range of formal tool types and knapping floor. Figures 8 to 15 show photographs of the artefacts and Figures 16 and 17 are site context views, both from the ground and air. Seismic line PH\_2001\_6.2 runs through the site and a suggested diversion path around the main site artefact concentrations is shown in Figure 18.

**Table 3. Artefacts at IAS01**

Format: UTM M/D/Y H:M:S 9.50 hrs Datum[012]: Astrin Geod '84						
ID	Name	Comment	Zone	Zone	Easting	Northing
W	2352	F(S)X2	53	J		
W	2353	C(S)	53	J		
W	2353R		53	J		
W	2354	F(S)	53	J		
W	2355	F(S)	53	J		
W	2356	F(QZ)	53	J		
W	2357	C(S)	53	J		
W	2358	F(C)	53	J		
W	2359	FP(C)	53	J		
W	2360	GS(SS)	53	J		
W	2361	KNAPPING FLOOR	53	J		
W	2362	C(S) horse hoof	53	J		
W	2363	GS(SS)	53	J		
W	2364	C(S) horse hoof	53	J		

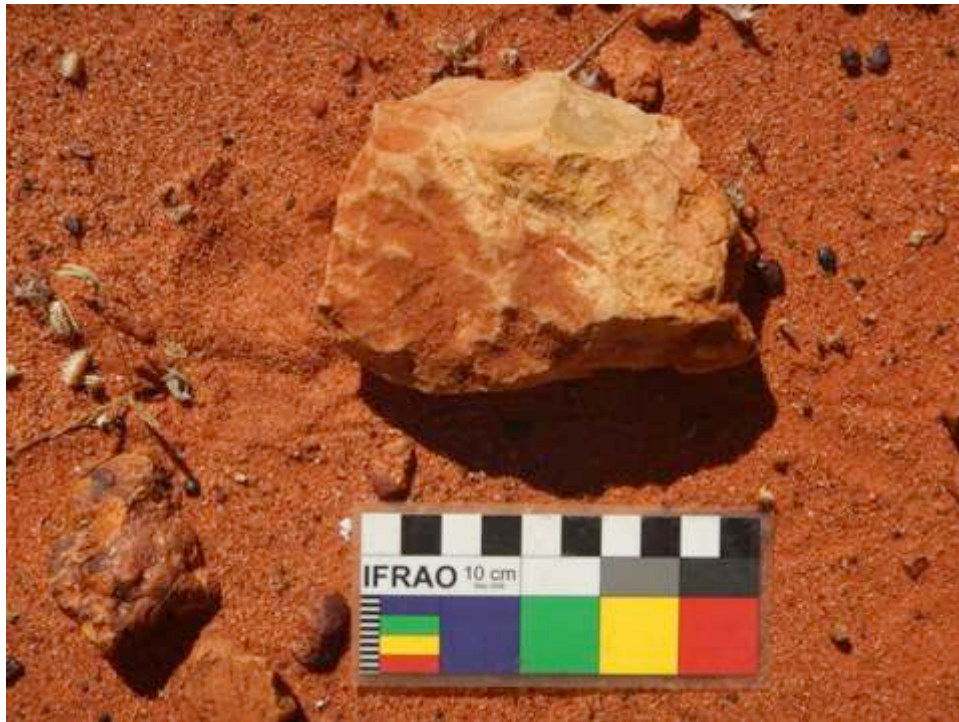


Figure 8. #2353 C(S) IAS01 (Scale in 1cm).



*Figure 9. IAS01 knapping floor (Scale in 1cm).*



*Figure 10. #2360 GS(SS) IAS01 (Scale in 1cm).*



*Figure 11. IAS01 knapping floor (Scale in 1cm).*



*Figure 12. #2363 GS(SS) IAS01 (Scale in 1cm).*



*Figure 13. #2364 C(S) horse hoof (Scale in 1cm).*



*Figure 14. #2361 GS(SS) in knapping floor IAS01 (Scale in 1cm).*



*Figure 15. #2362 C(S) horse hoof in IAS01 (Scale in 1cm).*



*Figure 16. IAS01 site context - terrestrial.*



*Figure 17. IAS01 site context - aerial.*

*Earth).*

### 5.1.2 Idracowra Archaeological Site 2 (IAS02)

Another site was found on a distinct circular clay pan, IAS02, again consisting of a low density of stone artefacts. Table 4 shows the range of formal tool types as well as a knapping floor. The site extends to a stoney rise, just to the north. IAS02 is assessed as having low significance. Figures 19 to 22 show photographs of the artefacts and Figures 23 and 24 show site context views both from the ground and air. Seismic line PH\_2021\_62 runs through the site. A diversion line is suggested on the map in Figure 25.

**Table 4. Artefacts at IAS02**

Format: UTM M/D/Y H:M:S 9.50 hrs Datum[012]: Astrln Geod '84						
ID	Name	Comment	Zone	Zone	Easting	Northing
W 2368		F(S)	53	J		
W 2369		C(S) SINGLE PLATFORM	53	J		
W 2370		C(S)	53	J		
W 2371		B(S)	53	J		
W 2372		KNAPPLNG FLOOR	53	J		
W 2373		F(QZ)	53	J		
W 2374		POLYGON #	53	J		



Figure 19. #2369 C(S) single platform IAS02 (Scale in 1cm).



Figure 20. #2370 C(S) IAS02 (Scale in 1cm).



Figure 21. #2371, B(S) IAS02 (Scale in 1cm).



Figure 22. #2372, knapping floor (Scale in 1cm).



Figure 23. IAS02 context view - terrestrial.



*Figure 24. IAS02 context view - aerial.*

*Google Earth).*

### 5.1.3 Idracowra Archaeological Site 3 (IAS03)

Moving away from the clay pan land units, the southern seismic lines traverse calcareous loamy swales with sand dunes to a height of 5m. The first of the sites found in this terrain is IAS03, which is a low-density artefact scatter. It is a ‘bowl’ site and could easily be spotted from the air. The GSV is very good at these types of sites and artefacts too could be spotted from the air at a height of 10m. Table 5 lists the artefacts. Figures 26 and 27 show the formal tool types, including a chert single platform core. The site has been assessed as having low significance and was found 70m to the east of seismic line PH\_2021\_3.1. The proposed works will not impact the site. Figures 28 and 29 show the site context, with its distinctive ‘bowl’ shape, from the ground and from the air. Figure 30 maps the site, showing its relation to the proposed seismic line.

**Table 5. Artefacts at IAS03**

Format: UTM M/D/Y H:M:S 9.50 hrs Datum[012]: Astrin Geod '84						
ID	Name	Comment	Zone	Zone	Easting	Northing
W	2382	F(Q), F(S), BU(S)	53	J		
W	2383	C(C)	53	J		



Figure 26. #2382, F(Q), F(S), Bu(S) RTF, IAS03 (Scale in 1cm).



Figure 27. #2383, C(C) Prismatic, IAS03 (Scale in 1cm).



Figure 28. IAS03 context view - terrestrial.



*Figure 29. IAS03 context view - aerial, depression in centre of photo.*

*Figure 30. Map of IAS03, LZ28 showing artefact locations and landing zone (After Google Earth).*

#### 5.1.4 Idracowra Archaeological Site 4 (IAS04)

IAS04 is another of the ‘bowl’ sites found on top of a sand dune. It is a low-density artefact scatter with a knapping floor as attested by artefact concentrations. Table 6 lists the finds, but only descriptions of the formal tool types were made. A simple count of flakes and flake pieces was done to expedite the time on the ground. The site has been assessed as having low significance and lies well off seismic line PH\_2021\_3.1. It lays approximately 15m from the centre line and will not be impacted by the proposed works. Figure 31 shows the dune landing area and Figures 32 and 33 show the formal tool types. Further site context views are shown in Figures 34 and 35. Figure 36 maps the site, together with finds made by Tom Reilly, isolated artefacts on the next dune to the north.

**Table 6. Artefacts at IAS04**

Format: UTM M/D/Y H:M:S 9.50 hrs Datum[012]: Astrin Geod '84				
ID	Name	Comment	Zone	Zone
W	2384	C(S)	53	J
W	2385	C(S), Bu(S), F(S)	53	J
W	2386	Count only	53	J
W	2387	Count only	53	J
W	2388	Count only	53	J
W	2389	Count only	53	J
W	2390	Count only	53	J
W	2391	Count only	53	J
W	2392	Count only	53	J
W	2393	Count only	53	J
W	2394	Count only	53	J
W	2395	Count only	53	J



*Figure 31. IAS04 context view – terrestrial landing zone on top of dune.*

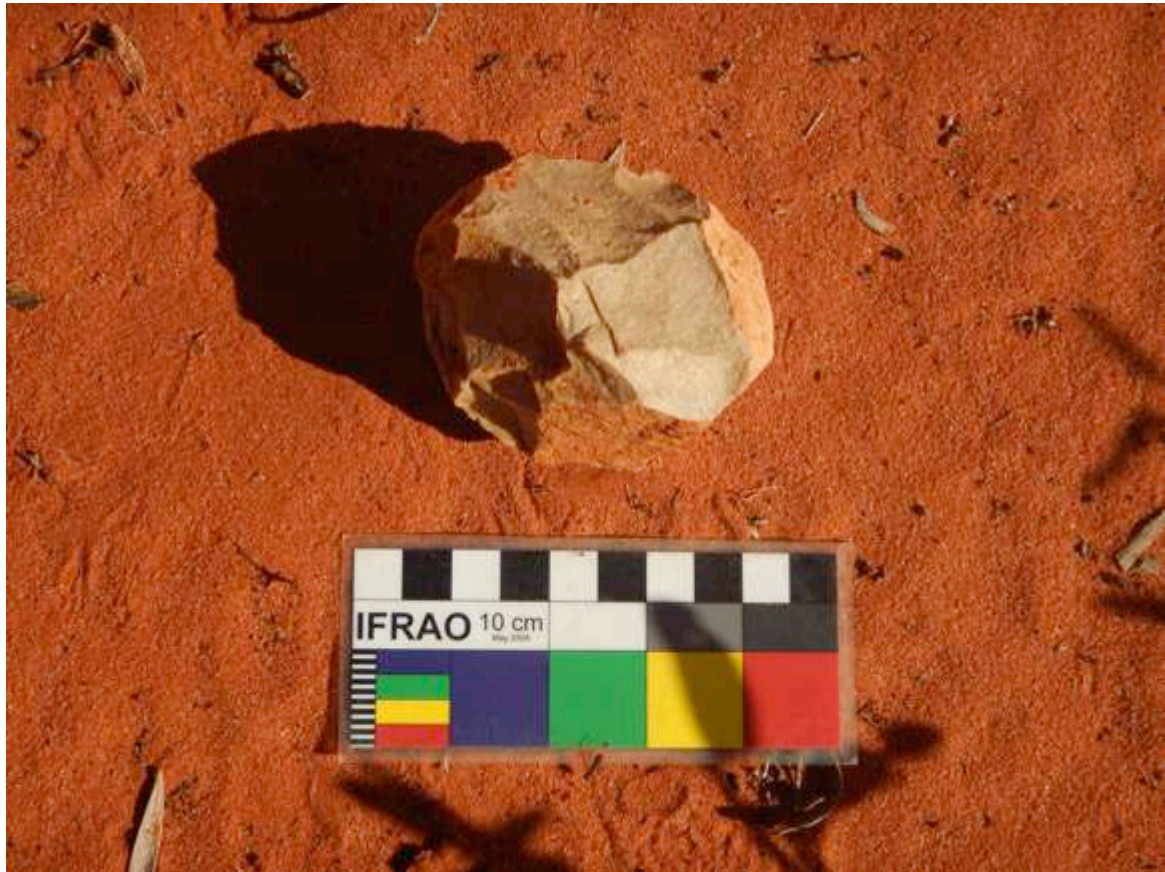


Figure 32. #2384 C(S) IAS04 (Scale in 1cm).



Figure 33. #2385 C(S), Bu(S)RTF, F(S) IAS04 (Scale in 1cm).



*Figure 34. IAS04 context view - terrestrial.*



*Figure 35. IAS04 context view - aerial.*

*Figure 36. Map of IAS04, LZ29 showing artefact locations and landing zone, together with the location of the Reilly finds (After Google Earth).*

### 5.1.5 Idracowra Archaeological Site 5 (IAS05)

Dominating a loamy depression is IAS05 rises approximately five metres and consists of a stone rise. The site has extensive knapping floors and large cores, still in the primary phase of reduction. Table 7 lists the finds and Figures 37 to 40 shows photographs of the formal tool types including the large silcrete cores. The site has been assessed as having high significance, due to its extent and range of artefacts. Figures 41 and 42 show the site context. Figure 43 maps the site, which is basically the entire stoney rise, just south of a main access track. Seismic line PH\_2021\_3.1 will not impact the site, as the site is approximately 40m from the centre line.

**Table 7. Artefacts at IAS05**

Format: UTM M/D/Y H:M:S 9.50 hrs Datum[012]: Astrln Geod '84						
ID	Name	Comment	Zone	Zone	Easting	Northing
W	2397	F(S)	53	J		
W	2398	C(S)	53	J		
W	2399	C(S)	53	J		
W	2400	C(S)	53	J		
W	2401	KNAPPING FLOOR	53	J		
W	2402	C(S)	53	J		



Figure 37. #2398 C(S), multi-platform IAS05 (Scale in 1cm).



Figure 38. #2399 C(S) IAS05 (Scale in 1cm).



Figure 39. #2400 C(C) prismatic IAS05 (Scale in 1cm).



*Figure 40. #2401, IAS05 knapping floor (Scale in 1cm).*



*Figure 41. IAS05 context view - terrestrial.*



*Figure 42. IAS05 context view - aerial of ridge site. Access track on flats in background of photo.*

*Figure 43. Map of IAS05, LZ33 showing artefact locations and landing zone (After Google Earth).*

### 5.1.6 Idracowra Archaeological Site 6 (IAS06)

North of IAS05 begins a series of drainage channels, some of which were intersected by the line. The first of these sites is IAS06 that has already the existing track running through it. The site is a low-density artefact scatter on flat ground, of low significance. Table 8 lists the artefacts recorded and Figure 44 shows flakes and a formal tool type, a burren adze. Figure 45 is of the site context showing its proximity to the drainage line and Figure 46 maps the site. One artefact was relocated, #2403, a silcrete flake, off the line.

**Table 8. Artefacts at IAS06**

Format: UTM M/D/Y H:M:S 9.50 hrs Datum[012]: Astrln Geod '84						
ID	Name	Comment	Zone	Zone	Easting	Northing
W	2403	F(S)	53	J		
W	2403R		53	J		
W	2404	B(QZ)	53	J		
W	2405	FP(QZ)	53	J		
W	2406	F(S)X2, Bu(S)	53	J		



Figure 44. #2406, F(S)X2, Bu(S) RTF, IAS06 (Scale in 1cm).



*Figure 45. IAS06 context view - terrestrial.*

*Figure 46. Map of IAS06, LZ39 showing artefact locations and landing zone (After Google Earth).*

### 5.1.7 Idracowra Archaeological Site 7 (IAS07)

Similar to IAS06 is IAS07, which is again another low-density artefact scatter along the banks of a drainage channel. Table 9 lists the artefacts and Figures 47 and 48 are of formal tools types, namely a scraper and a heavily reduced core respectively. The site has low significance. One artefact was relocated, the scraper off the existing track, which runs through the site. The seismic line runs along a fence line to the west of the track, but should be relocated to the existing track to avoid further unrecorded artefacts that may be on site, either buried or obscured by vegetation. The site may extend west of the fenceline.

**Table 9. Artefacts at IAS07**

Format: UTM M/D/Y H:M:S 9.50 hrs Datum[012]: AstrIn Geod '84						
ID	Name	Comment	Zone	Zone	Easting	Northing
W	2410	FP(QZ)	53	J		
W	2411	S(S)	53	J		
W	2411R		53	J		
W	2412	C(QZ)	53	J		
W	2413	F(QZ)	53	J		



Figure 47. #2411 S(S) IAS07 (Scale in 1cm).



*Figure 48. #2412 C(QZ) IAS07 (Scale in 1cm).*



*Figure 49. IAS07 context view - aerial.*

*Figure 50. Map of IAS07, showing artefact locations. Note: no landing zone (After Google Earth).*

### 5.1.8 Idracowra Archaeological Site 8 (IAS08)

The site occurs approximately 2km south of the Finke River and lies on both banks of a small tributary feeding into the Finke. IAS08 is a high-density artefact scatter with a range of formal tool types and discrete knapping floors. Table 10 lists the finds, with only a count made for many of the finds, to determine density numbers. A feature of this site is the large primary and secondary flakes, which provide an insight into manufacturing practices. Figure 51 shows three flakes on silcrete that were over 20cm long. This is the first site found with such large artefacts. All previous sites contained microliths and heavily reduced cores, with the exception of IAS05 that also had large cores. Figures 52 and 53 are of two knapping floors found.

Moving north of the tributary, the previous Santos seismic lines could be seen (Fig. 54). Numerous Artefacts were found along the existing line, which would indicate that Santos may not have conducted a cultural heritage assessment, or if it had, the site was missed. Figure 55 shows an obvious find, a large core. Figure 56 shows an aerial context view of the site, with the main tributary where artefacts were concentrated. Figure 58 maps the site and marks the suggested survey end point for the line. It is suggested that the line stops approximately 900m from its northern termination, so as not to damage the site further. A historic site overlaps the Aboriginal heritage site, which consists of a wooden post round horse pen, possibly dating from the 19<sup>th</sup> Century. It's quite likely that Aboriginal stockmen worked in the pen, breaking in horses. The site has, therefore, been assessed as having high significance for its insight into both prehistoric and historic lifeways.

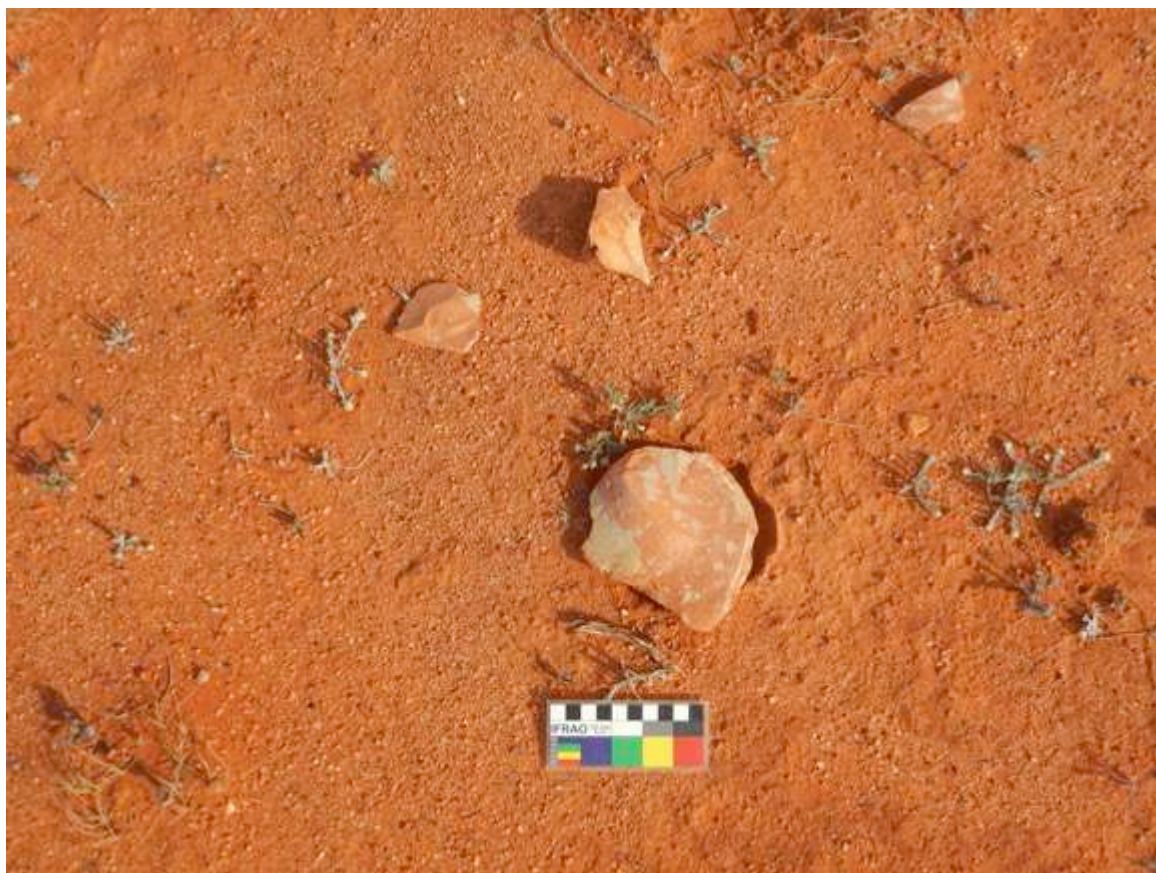
**Table 10. Artefacts at IAS08**

Format: UTM M/D/Y H:M:S 9.50 hrs Datum[012]: Astrln Geod '84						
ID	Name	Comment	Zone	Zone	Easting	Northing
W	2415	Count only	53	J		
W	2416	Count only	53	J		
W	2417	Count only	53	J		
W	2418	Count only	53	J		
W	2419	Count only	53	J		
W	2420	Count only	53	J		
W	2421	Count only	53	J		
W	2422	Count only	53	J		
W	2423	F(S)x3	53	J		
W	2424	Count only	53	J		
W	2425	Count only	53	J		
W	2426	Count only	53	J		
W	2427	Count only	53	J		
W	2428	Count only	53	J		
W	2429	BFF	53	J		
W	2430	KNAPPING FLOOR	53	J		
W	2431	KNAPPING FLOOR	53	J		
W	2432	Count only	53	J		
W	2433	Count only	53	J		
W	2434	Count only	53	J		
W	2435	Count only	53	J		
W	2436	Count only	53	J		
W	2437	Count only	53	J		

W	2438	Count only	53	J
W	2439	BFF F(S)	53	J
W	2440	OLD SANTOS SEISMIC LINE	53	J
W	2441	C(S)	53	J
W	2442	Count only	53	J
W	2443	C(S)	53	J
W	2444	Count only	53	J
W	2445	Count only	53	J
W	2446	Count only	53	J
W	2447	Count only	53	J
W	2448	F(S)	53	J
W	2449	C(S)	53	J
W	2450	F(S)	53	J
W	2451	Count only	53	J
W	2452	F(S)	53	J
W	2453	HORSE ROUND PEN (HISTORIC)	53	J



Figure 51. #2423 F(S)x3 IAS08 (Scale in 1cm).



*Figure 52. #2430 IAS08 knapping floor (Scale in 1cm).*



*Figure 53. #2431 IAS08 knapping floor (Scale in 1cm).*



*Figure 54. Previous Santos seismic line.*



*Figure 55. #2441 C(S) IAS08 (Scale in 1cm).*



*Figure 56. IAS08 site context – aerial*

*Figure 57. Historic horse round pen, IAS08 context view - aerial.*

*Figure 58. Map of IAS08, LZ41 showing artefact locations and landing zone (After Google Earth).*

### 5.1.9 Idracowra Archaeological Site 9 (IAS09)

IAS09 is another of the typical ‘bowl’ sites, nestled on top of a red sand dune. An artefact counted was conducted to assess the density of artefacts at the site (Table 11). The site is a low-density artefact scatter and may represent a singular knapping event. It has been assessed as of low significance. Figure 59 is of the site context view when artefacts in the middle of frame. The site is mapped in Figure 60. The seismic line, PH\_2021\_2.3, will not impact on the site as it lays approximately 120m to the south of the centre line.

**Table 11. Artefacts at IAS09**

Format: UTM M/D/Y H:M:S 9.50 hrs Datum[012]: Astrln Geod '84						
ID	Name	Comment	Zone	Zone	Easting	Northing
W	2456	Count only	53	J		
W	2457	Count only	53	J		
W	2458	Count only	53	J		
W	2459	Count only	53	J		
W	2460	Count only	53	J		
W	2461	Count only	53	J		
W	2462	Count only	53	J		



*Figure 59. IAS09 site context view - terrestrial. Artefacts in foreground.*

*Figure 60. Map of IAS09, LZ43 showing artefact locations and landing zone (After Google Earth).*

#### 5.1.10 Idracowra Archaeological Site 10 (IAS10)

IAS10 consists of a small knapping floor with eight quartz flakes. The site lies at the edge of a narrow drainage line that runs off the base of a small nearby hill. The finds are listed in Table 12. The site is almost certainly a singular knapping event of flakes on quartz. Figure 61 shows the context of the site. It is considered of low significance. It too lies some considerable distance from the centre line of the seismic corridor, approximately 27m and will not be impacted by the proposed works. Figure 62 is of the suggested crossing over the drainage line (see Table 12 for grid reference). The site and crossing location is mapped in Figure 63.

**Table 12. Artefacts at IAS10**

Format: UTM M/D/Y H:M:S 9.50 hrs Datum[012]: Astrln Geod '84						
ID	Name	Comment	Zone	Zone	Easting	Northing
W	2463	F(Q)X8 KNAPPING FLOOR	53	J		
W	XING		53	J		



*Figure 61. ISAS10 site context view - terrestrial. Knapping floor in foreground.*



*Figure 62. IAS10 view of suggested creek crossing.*

*Figure 63. Map of IAS10, LZ45 showing artefact locations and landing zone, together with suggested alternative creek crossing (After Google Earth).*

### 5.1.11 Idracowra Archaeological Site 11 (IAS11)

The last site to be found in the survey was towards the northern end of seismic line PH\_2021\_1, the eastern most lines in the sandstone country, which was surrounded by low mesa top hills. The site occurs in an erosion gully on the southern side of a significant creek. Formal tool types were found and are listed with other finds in Table 13. The site is a low-density artefact scatter, of moderate significance. Figure 64 shows the blade on quartzite and Figure 65 the scraper on quartzite. The site is of moderate significance for its stratified northern creek bank with horizontal layering of shale (Fig. 66). This feature was only seen at this site. The site lays approximately 45m west of the seismic line and will not be impacted by the proposed works. The site context is shown in Figures 67 and 68 and is mapped in Figure 69.

**Table 13. Artefacts at IAS11**

Format: UTM M/D/Y H:M:S 9.50 hrs Datum[012]: Astrin Geod '84						
ID	Name	Comment	Zone	Zone	Easting	Northing
W	2468	B(QZ)	53	J		
W	2469	Count only	53	J		
W	2470	Count only	53	J		
W	2471	Count only	53	J		
W	2472	Count only	53	J		
W	2473	Count only	53	J		
W	2474	Count only	53	J		
W	2475	S(QZ)	53	J		



Figure 64. #2468 B(QZ) IAS11 (Scale in 1cm).



*Figure 65. #2475 S(QZ) IAS11 (Scale in 1cm).*



*Figure 66. Horizontal stratigraphic layering of shale deposits in the creek banks at IAS11.*



*Figure 67. IAS11 site context view - terrestrial.*




*Figure 68. IAS11 site context view – aerial.*






*Figure 69. Map of IAS11, LZ49 showing artefact locations and landing zone (After Google Earth).*




### 5.1.12 Idracowra Background Scatters (IBS)

A range of formal tool types and flakes were found throughout the seismic lines. Their concentration, however, occurred in the northern and eastern sections of the seismic lines, close to the clay pan and dune sites. Their locations and descriptions are listed in Table 14, together with photographs of formal tool types. Some were found directly on the proposed seismic lines, or within 10m of the centreline.

**Table 14. List of isoliths. Artefacts within 10m of the centerline noted**

Format: UTM M/D/Y H:M:S 9.50 hrs Datum[012]: Astrl Geod '84							Image
ID	Name	Comment	Zone	Zone	Easting	Northing	
W	2347	F(S)	53	J			
W	2348	F(S) – on line	53	J			
W	2349	B(QZ) MASSIVE!	53	J			
W	2350	F(C)	53	J			
W	2351	F(S)	53	J			
W	2366	F(S) – 6m offline	53	J			
W	2367	F(S) – 4m offline	53	J			
W	2375	F(S)	53	J			
W	2376	F(S)	53	J			
W	2377	F(S)	53	J			
W	2378	FP(S)	53	J			

W	2379	GS(SS)	53	J	
W	2396	B(QZ) RTF DISTAL	53	J	
W	2409	F(S) – 4m off line	53	J	
W	2414	F(S)	53	J	
W	2455	F(Q)	53	J	
W	2464	F(S) RETOUC HED	53	J	
W	2465	B(QZ) UNIFACIA L RETOUC HED	53	J	
W	2466	F(S) – 4m offline	53	J	
W	2467	F(S), S(S) – 10m offline	53	J	
W	2476	F(QZ). Off railway line	53	J	

	WP2313	F(S)	53	J		
	WP2314	C(S)	53	J		
	WP2315	F(S)	53	J		

### *5.1.13 Proposed camp area*

The proposed worker's camp area is on flat ground at a major track intersection. No vegetation occurs at the site and calcareous rocks dominate it. No archaeological material was found. The proposed works will unlikely impact on cultural heritage.



*Figure 70. Proposed camp area context view - terrestrial.*



Figure 71. Proposed campsite context view - aerial (approximately at helicopter shadow).

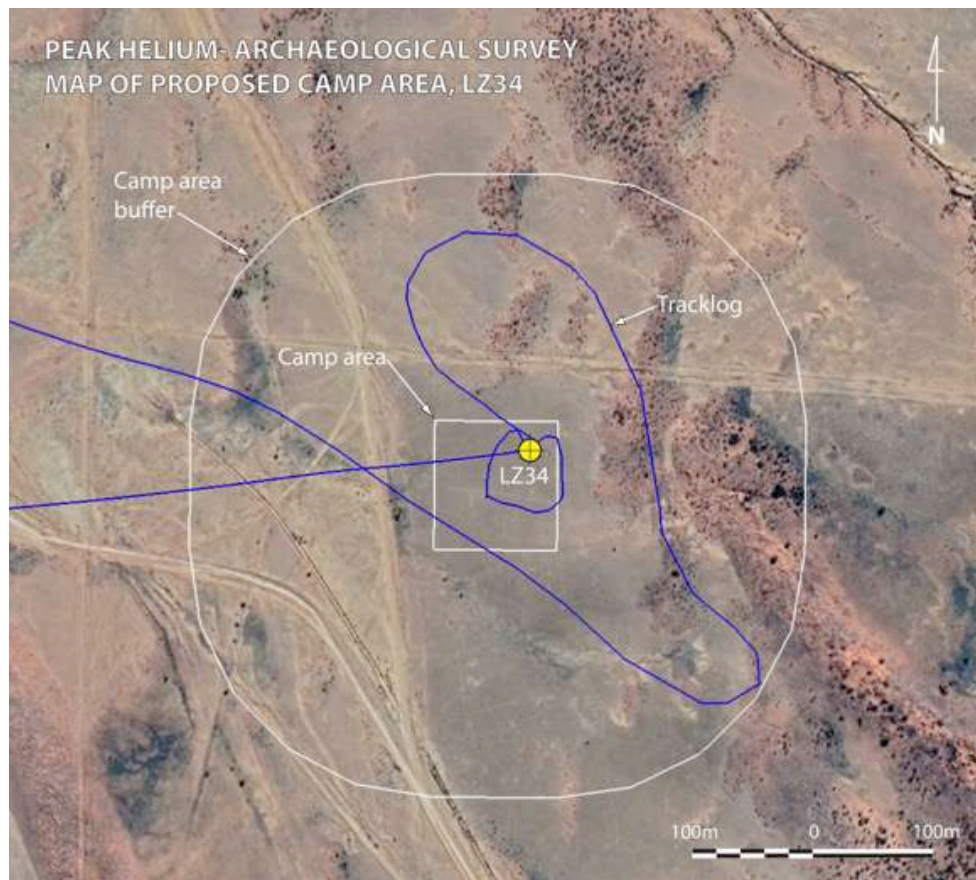


Figure 72. Map of proposed camp area survey tracklog and landing zone, LZ34 (After Google Earth).

#### *5.1.14 Railway line access track*

The access track along the railway line was found to have no archaeological material. There was only one water source, a creek crossing, which was bridged by the railway works. Figure 73 maps the landing zones along the access track and Figure 74 shows the LZ context. The second landing, LZ54 on the track, was to assess weed vegetation and a isolated artefact was found, #2476 a flake on quartzite, but well off the track.

*Figure 73. Map of tracklog and landing zones (LZ53 and LZ54) for the railway access track (After Google Earth).*



*Figure 74. LZ53 railway creek crossing.*

## 6.0 CONCLUSIONS AND RECOMMENDATIONS

### 6.1 Conclusions

This report was of an archaeological survey of Peak Helium’s proposed seismic lines, camp area and railway access track on Idracowra Station, approximately 173km south of Alice Springs. Over 200km of seismic lines were covered in a three-day survey that was conducted by helicopter. Eleven archaeological sites were recorded and over 20 isolated stone artefacts were found. All of the sites recorded were stone artefact scatters of varying densities and significance. One of the sites, however, contained a significant historic feature that of a 19<sup>th</sup> Century horse round pen. Of the eleven sites, two were assessed as having high significance, two were moderately significant and the rest of low significance.

The sites were mainly found around clay pans and surprisingly enough, also on top of low sand dunes. It was predicted that they’d occur in the swales between dunes, but almost no archaeological material was found in loamy swales. The dune tops were particularly favoured for camping. The dune sites were typically in bowl shaped depressions, which provided windbreaks and most likely also provided cover for hunting purposes. These bowls, or ‘embowlements’ on the top of sand dunes are a useful indicator in predicting where sites may be found in the terrain in and around Idracowra Station. Furthermore, calcareous loamy swales are an indicator for the low probability of sites. The corollary to this is clay pans, which are an indicator for high probability of sites.

No archaeological material was found at the proposed campsite. Works may proceed there as well as along the railway access corridor. Only one isolated stone artefact was found near the corridor, which will not be impacted by the proposed works. Most isolated stone artefacts were found offline and most of those that were within 10m of the centre line were relocated.

The proposed works by Peak Helium will have an impact on archaeological sites. The following recommendations are suggested to minimize the risk to the cultural heritage.

### 6.2 Recommendations

#### 6.2.1 Recommendation 1 – Diversion routes around IAS01

- Line PH\_2021\_6.2. will impact a highly significant archaeological site (IAS01). Two diversion routes are suggested. The site occurs at the intersection of two lines, the other seismic line is PH\_2021\_7. The diversion routes are mapped in Figure 18. The waypoints for these diversion routes around the site are as follows:

Name	Zone	Zone	Easting	Northing
DR01	53	J		
DR02	53	J		
DR03	53	J		
DR04	53	J		
DR05	53	J		
DR06	53	J		
DR1A	53	J		

### 6.2.2 Recommendation 2 – Diversion route around IAS02

- Seismic line PH\_2021\_6.2 also passes through a moderately significant site, IAS02. A diversion route is suggested for this site. The diversion route is mapped in Figure 25. The waypoints for these diversion routes around the site are as follows:

Name	Zone	Zone	Easting	Northing
DR07	53	J		
DR08	53	J		
DR09	53	J		
DR10	53	J		
DR11	53	J		

### 6.2.3 Recommendation 3 – Archaeological sites on existing tracks

- The seismic lines will go through two sites, but these sites already have an access track running through them. The seismic lines should stay on the already disturbed tracks. The following sites are affected:
  1. IAS06
  2. IAS07

### 6.2.4 Recommendation 4 – Restricted Work Area (RWA)

- IAS08 - existing Santos seismic track runs through the site. It is suggested that the northern section of Line: PH\_2021\_3.1 should be cancelled, from the fence line leading to timber horse round pen. A Restricted Work Area (RWA) should be put in place. This distance will shorten the line by approximately 900m. IAS08 is a high-density artefact scatter, with high archaeological significance. It represents a 'home' camp not far from the Finke River. People have used the site for millennia. The seismic survey should stop at the following waypoint:

Name	Zone	Zone	Easting	Northing
PH_2021_3.1 cancel	53	J		

### 6.2.5 Recommendation 5 – Archaeological sites not impacted by the proposed development

- The seismic lines will not have an impact on the following sites, as they are greater than 10 metres from the seismic centre line. The proposed works may proceed without further action:
  1. IAS03
  2. IAS04
  3. IAS05
  4. IAS09
  5. IAS10
  6. IAS11

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# APPENDIX 1: Map of seismic lines with 500 m buffer and survey tracks; map of survey area location, showing sites of conservation significance (EcOz supplied)

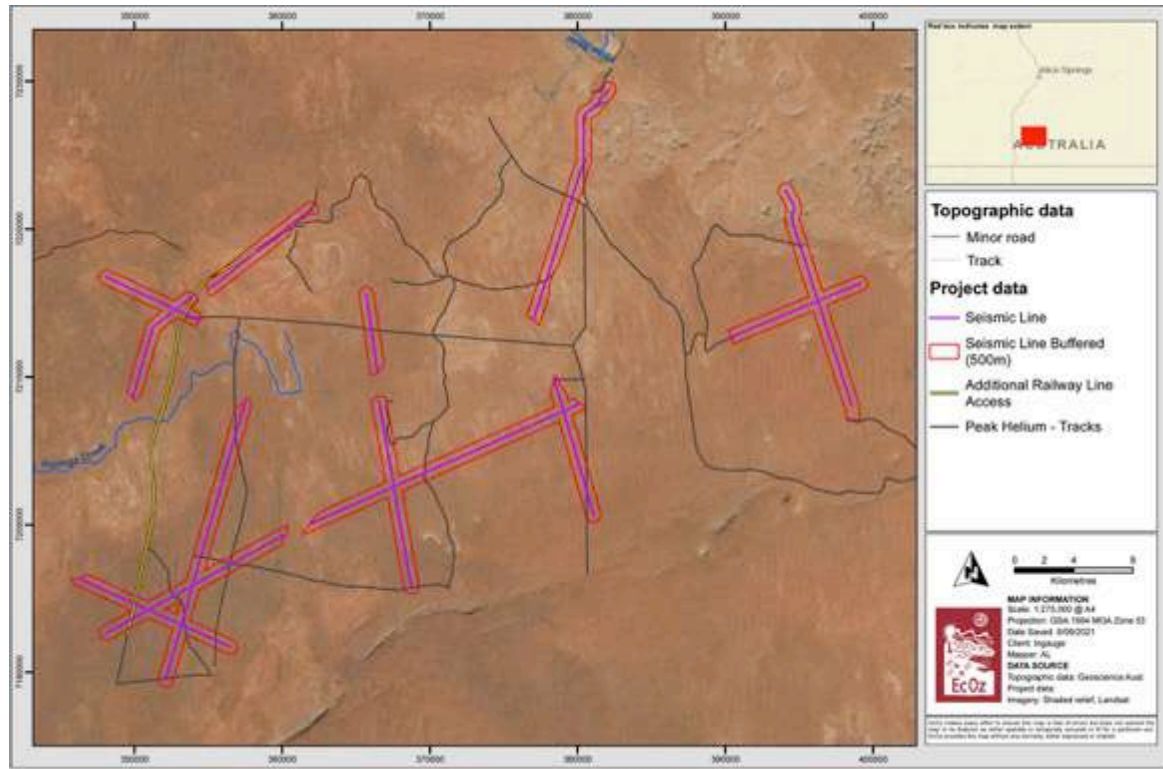
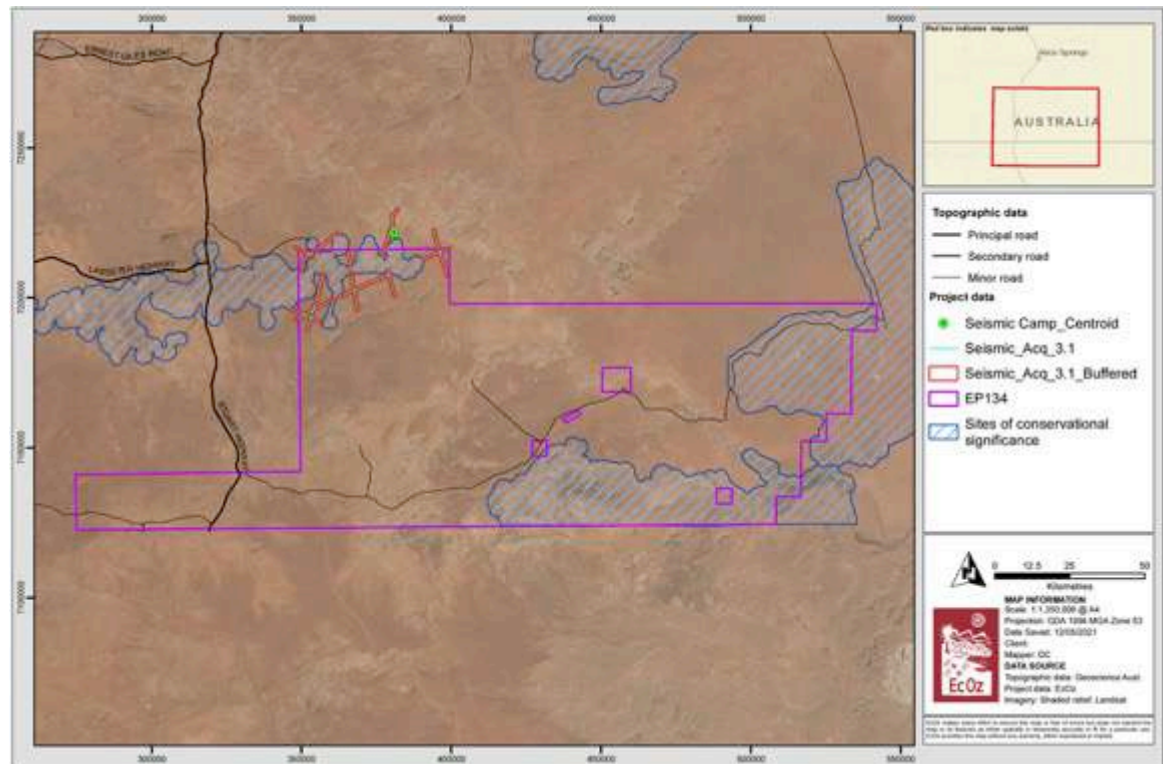


Figure X-X. Map of seismic lines with 500 m buffer and survey tracks

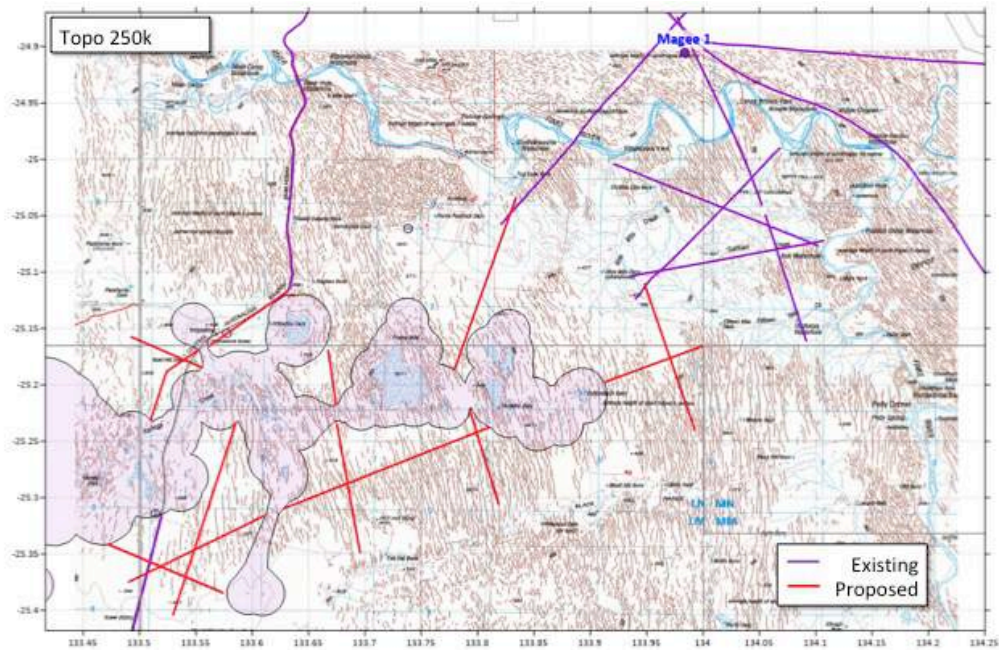


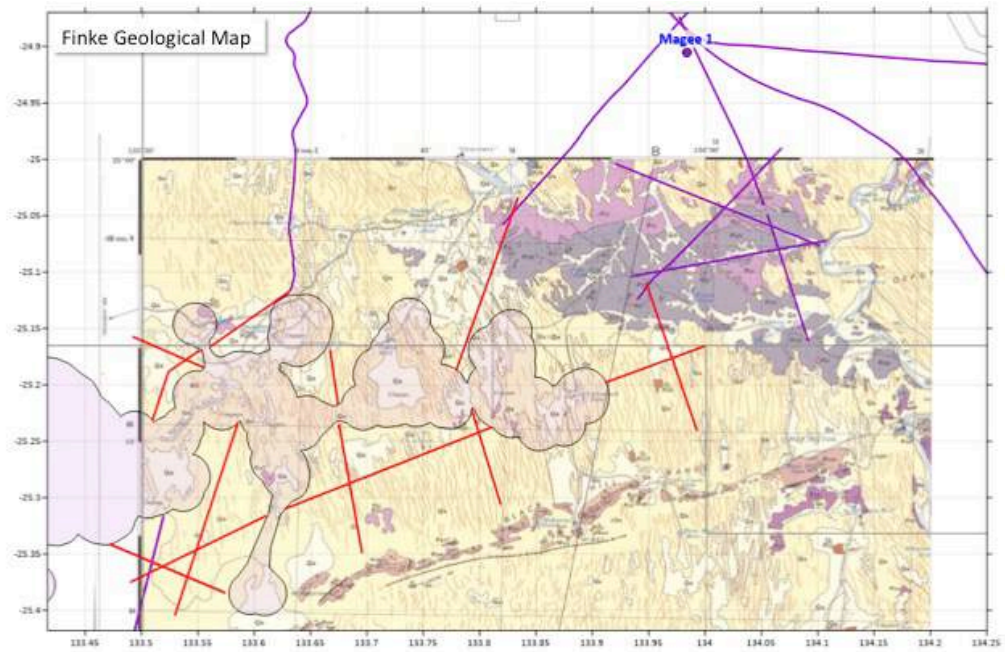
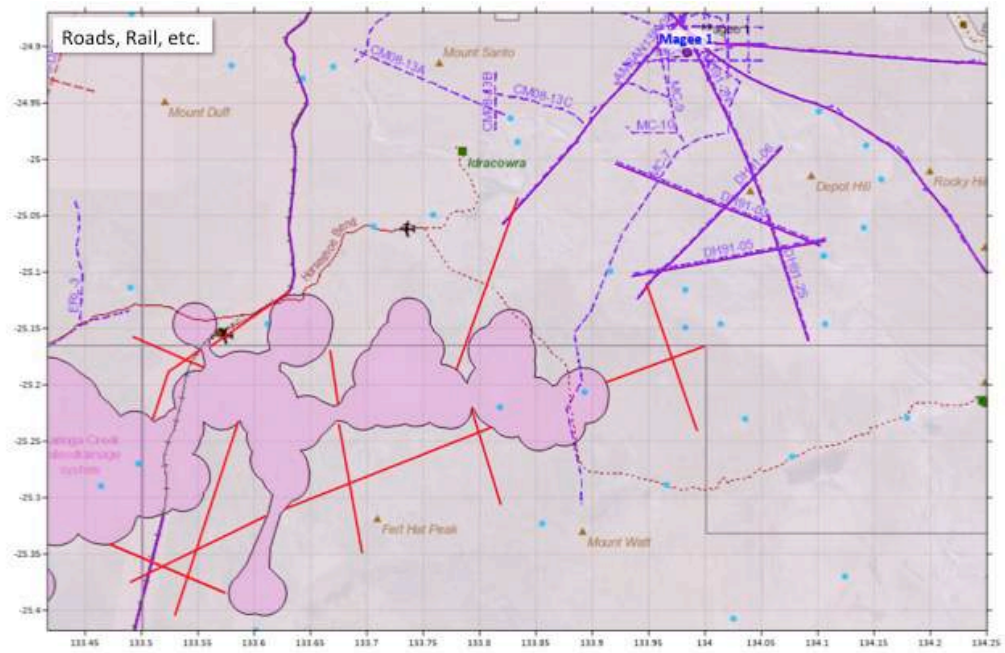


## EP134 Proposed Seismic Lines (Lat/ Long GDA94. WGS84 Base)

*Total Length 170.1 km*

22/04/21





## **APPENDIX 2: Maps of seismic line tracklogs and landing zones – detail**

*Figure 75. Line PH\_2021\_6.1, map of survey tracklog and landing zones (After Google Earth).*

*Figure 76, Line PH\_2021\_6.2 and Line PH\_2021\_7, map of survey tracklog and landing zones (After Google Earth).*

*Figure 77. Lines PH\_2021\_2.1, PH\_2021\_5 and PH\_2021\_8, map of survey tracklog and landing zones (After Google Earth).*

*Figure 78. Lines PH\_2021\_2.2, PH\_3.2 and Line PH\_4.2, map of survey tracklog and landing zones (After Google Earth).*

*Figure 79. Line PH\_2021\_4.1, map of survey tracklog and landing zone (After Google Earth).*

*Figure 80. Line PH-2021\_3.1, map of survey tracklog and landing zones including proposed campsite (After Google Earth).*

*Figure 81. Lines PH\_2021\_1 and PH\_2021\_2.3, map of tracklogs and landing zones (After Google Earth).*

### APPENDIX 3: Landing zone locations, descriptions and photographs

Format: UTM M/D/Y H:M:S 9.50 hrs Datum[012]: AstrIn Geod '84						
ID	Name	Comment	Zone	Zone	Easting	Northing
W	LZ01	Clay pan	53	J		
W	LZ02	On sandy rise @ end of Line, near railway, red soils, sandy	53	J		
W	LZ03	Clay pan and stoney rises, ephemeral drainage line	53	J		
W	LZ04	Near soak, stoney rise	53	J		
W	LZ05	No stone, loamy depression	53	J		
W	LZ06	No stone, loamy depression	53	J		
W	LZ07	Clay pan	53	J		
W	LZ08	Stoney clay pan	53	J		
W	LZ09	No stone, loamy depression	53	J		
W	LZ10	Stoney clay pan, no artefacts – too flat, no 'bowl'	53	J		
W	LZ11	Drainage channel with mulga, no stone, no embowment	53	J		
W	LZ12	Stoney rise, no embowment	53	J		
W	LZ13	Outside of survey area by 180m, at edge of clay pan	53	J		
W	LZ14	Loamy depression, iron wood, mulga trees, cattle impact	53	J		
W	LZ15	Sand plain, control sample, no stone, sandy GI95, GSV80	53	J		
W	LZ16	Rocky depression, calcrete, desert oaks, bloodwoods in wetter areas	53	J		
W	LZ17	Swale, loamy depression, clacrete, quartz nodules	53	J		
W	LZ18	Calcrete loamy depression	53	J		
W	LZ19	Clay pan, but more calcrete loamy depression	53	J		
W	LZ20	Calcrete loamy depression	53	J		
W	LZ21	Swale, clay pan to the right, calcrete, acacia on dunes	53	J		
W	LZ22	Blue mallee patch	53	J		
W	LZ23	Calcrete loamy depression	53	J		

W	LZ24	Stoney outcrop @ eastern end of line, calcrete and quartz, lots of it!	53	J
W	LZ25	Drainage, more of an eroded cattle track, disturbed	53	J
W	LZ26	Green clay pan, verdant still	53	J
W	LZ27	Calcrete loamy depression	53	J
W	LZ28	Loamy pan @ base of dune	53	J
W	LZ29	On top of dune with bowl	53	J
W	LZ30	Erosion gully with riparian zone	53	J
W	LZ31	On top of dune with bowl	53	J
W	LZ32	Rocky rise	53	J
W	LZ33	Rocky rise	53	J
W	LZ34	CAMP	53	J
W	LZ35	Creek, no finds	53	J
W	LZ36	Rocky hill	53	J
W	LZ37	Creek	53	J
W	LZ38	Vegetation survey and crossing	53	J
W	LZ39	Creek on existing track GI <5%, erosion damage	53	J
W	LZ40	Creek	53	J
W	LZ41	Creek with major artefact scatter	53	J
W	LZ42	On top of dune with bowl	53	J
W	LZ43	On top of dune with bowl	53	J
W	LZ44	Swamp	53	J
W	LZ45	Drainage channel	53	J
W	LZ46	Drainage line, no finds	53	J
W	LZ47	@base of the first large red sand dunes of 7m in height or higher	53	J
W	LZ48	Drainage channel	53	J
W	LZ49	Drainage channel	53	J
W	LZ50	Erosion gully at start of creek system at base of mesa	53	J
W	LZ51	Erosion gully	53	J
W	LZ52	On top of mesa	53	J
W	LZ53	Railway	53	J
W	LZ54	Railway	53	J



Figure 82. LZ01, Ph: DSC00112



Figure 83. LZ02, Ph: DSC00114



Figure 84. LZ03, Ph: DSC00115



Figure 85. LZ04, Ph: DSC00116



Figure 86. LZ05, Ph: DSC00117



Figure 87. LZ06, Ph: DSC00118



Figure 88. LZ07, Ph: DSC00119

Figure 89 – LZ08 no photo

 <p><i>Figure 90. LZ09, Ph: DSC00120</i></p>	<p><i>Figure 91. – LZ10 no photo</i></p>
 <p><i>Figure 92. LZ11, Ph: DSC00121</i></p>	 <p><i>Figure 93. LZ12, Ph: DSC00122</i></p>
<p><i>Figure 94. – LZ13 no photo</i></p>	 <p><i>Figure 95. LZ14, Ph: DSC00124</i></p>

 <p><i>Figure 96. LZ15 – Ph: DSC00125</i></p>	 <p><i>Figure 97. LZ16 – DSC00126</i></p>
 <p><i>Figure 98. LZ17 – DSC00127</i></p>	 <p><i>Figure 99. LZ18 – DSC00128</i></p>
 <p><i>Figure 100. LZ19 – DSC00129.</i></p>	 <p><i>Figure 101. LZ20 – DSC00130</i></p>
 <p><i>Figure 102. LZ21 – DSC00131</i></p>	<p><i>Figure 103 – LZ22 no photo</i></p>



*Figure 104. LZ23 – DSC00132*



*Figure 105. LZ24 – DSC00133*



*Figure 106. LZ25 – DSC00134*



*Figure 107. LZ26 – DSC00135*



*Figure 108. LZ27 – DSC00136*



*Figure 109. LZ28 – DSC0017*



*Figure 110. LZ29 – DSC00138*



*Figure 111. LZ30 – DSC00139*

*Figure 112 – LZ31 no photo*



*Figure 113. LZ32 – DSC00140*



*Figure 114. LZ33 – DSC00141*



*Figure 115. LZ34 – DSC00143*



*Figure 116. LZ35 – DSC00144*



*Figure 117. LZ36 – DSC00145*

*Figure 118. LZ37 – no photo*

*Figure 119. LZ38 – no photo*

 <p><i>Figure 120. LZ39 – DSC00146</i></p>	 <p><i>Figure 121. LZ40 – DSC00147</i></p>
<p><i>Figure 122. LZ41 – no photo</i></p>	 <p><i>Figure 123. LZ42 – DSC00148</i></p>
 <p><i>Figure 124. LZ43 – DSC00149</i></p>	 <p><i>Figure 125. LZ44 – DSC00150 – green clay pan</i></p>
<p><i>Figure 126. LZ45 – no photo</i></p>	 <p><i>Figure 127. LZ46 – DSC00151</i></p>

 <p><i>Figure 128. LZ47 – DSC00152, the first of the large red sand dune country</i></p>	 <p><i>Figure 129. LZ48 – DSC00153</i></p>
 <p><i>Figure 130. LZ49 – DSC00154</i></p>	<p><i>Figure 131. LZ50 – no photo</i></p>
<p><i>Figure 132. LZ51 – no photo</i></p>	<p><i>Figure 133. LZ52 – no photo</i></p>
 <p><i>Figure 134. LZ53 – DSC00155, railway access track</i></p>	 <p><i>Figure 135. LZ54 - DSC00156, western side of railway</i></p>

## **ADDENDUM: PROPOSED WELL SITES, ACCESS TRACKS, FLY CAMPS AND GRAVEL PIT LOCATIONS (June 2022)**

Notes: InGauge proposed the location for three well sites in June 2022 including the provision of four gravel pits and three camp locations. The location of the well sites all occur within the seismic line buffer at the following grid references:

- Ramsay AA (Not inspected)
  - Easting 350057 (Zone 53 J)
  - Northing 7193334 (Zone 53 J)
- Ramsay AB (Not inspected)
  - Easting 367076 (Zone 53 J)
  - Northing 7205810 (Zone 53 J)
- Ramsay AC (Not inspected)
  - Easting 398699 (Zone 53 J)
  - Northing 7207658 (Zone 53 J)

The proposed gravel pits occur at the following grid references:

- Gravel Pit 01 (@Ramsay AB) – 115m x 100m<sup>2</sup> (Not inspected)
  - Easting 366920 (Zone 53 J)
  - Northing 7204802 (Zone 53 J)
- Gravel Pit 02 (@Ramsay AC) – 115m x 100m<sup>2</sup> (Not inspected)
  - Easting 398462 (Zone 53 J)
  - Northing 7208933 (Zone 53 J)
- Gravel Pit 03 (PH\_2021\_2.1) – 115m x 100m<sup>2</sup> (Not inspected)
  - Easting 356158 (Zone 53 J)
  - Northing 7197615 (Zone 53 J)
- Gravel Pit 04 (PH\_2021\_8) – 115m x 100m<sup>2</sup> (Inspected)
  - Easting 355399 (Zone 53 J)
  - Northing 7192304 (Zone 53 J)

The proposed camp locations occur at the following grid references:

- PH Camp 01 (@ Ramsay AA) – 100m x 100m<sup>2</sup> (Not inspected)
  - Easting 350330 (Zone 53 J)
  - Northing 7193655 (Zone 53 J)
- PH Camp 02 (@Ramsay AB) – 100m x 100m<sup>2</sup> (Not inspected)
  - Easting 367128 (Zone 53 J)
  - Northing 7206224 (Zone 53 J)
- PH Camp 03 (@Ramsay AB) – 100m x 100m<sup>2</sup> (Not inspected)
  - Easting 398629 (Zone 53 J)
  - Northing 7208034 (Zone 53 J)

Figure 1 maps all the additional works features i.e., well sites, gravel pits, camps and access tracks. There is one variation in the access tracks and that is the approaches from the northwest from the Stuart Highway, which now follows Horseshoe Bend (Fig. 1A). The proposed access

tracks will following existing tracks, although the access track to Ramsay AC will need to augment what is said to be an access track from the bore (Fig. 2). Figure 3 maps two additional features on Line PH\_2021\_2.1: Ramsay AA and Camp 1. Figure 4 maps three additional features on Line PH\_2021\_4.2: Ramsay AB, Camp 2 and Gravel Pit 1. Figure 5 maps Ramsay AC, Camp 3, Gravel Pit 2 and proposed access track from Horseshoe Bend. Figure 6 maps the location of Gravel Pit 3 on Line PH\_2021\_1. Figure 7 maps the location of Gravel Pit 4 on Line PH\_2021\_2.1. Figure 8 maps Gravel Pit 4 on Line PH\_2021\_8. This was the only site, which was, coincidentally, inspected during the 2021 survey, as it corresponds to LZ16.

The amended sites are all in areas of low-risk to the archaeological resources, as they do not correspond with waterways, nor dune crescents that were favoured by Luritja and Arrente people. The proposed well sites, camps and gravel pits are, therefore, cleared for works. The proponent requires no further action to comply with the NT *Heritage Act (2011)*.

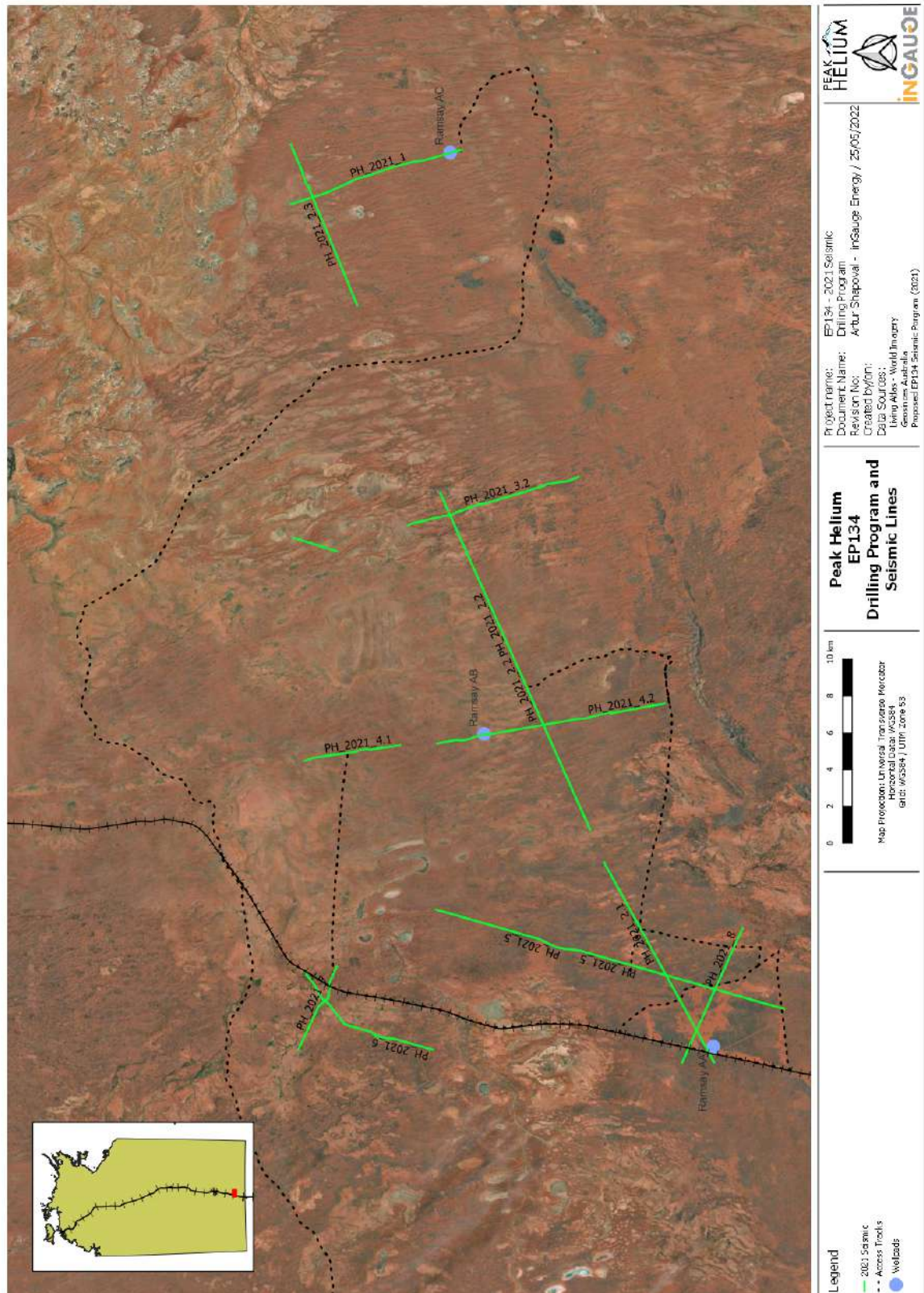


Figure 1. Peak Helium – Map of well sites (blue dots) and access tracks (Client supplied).

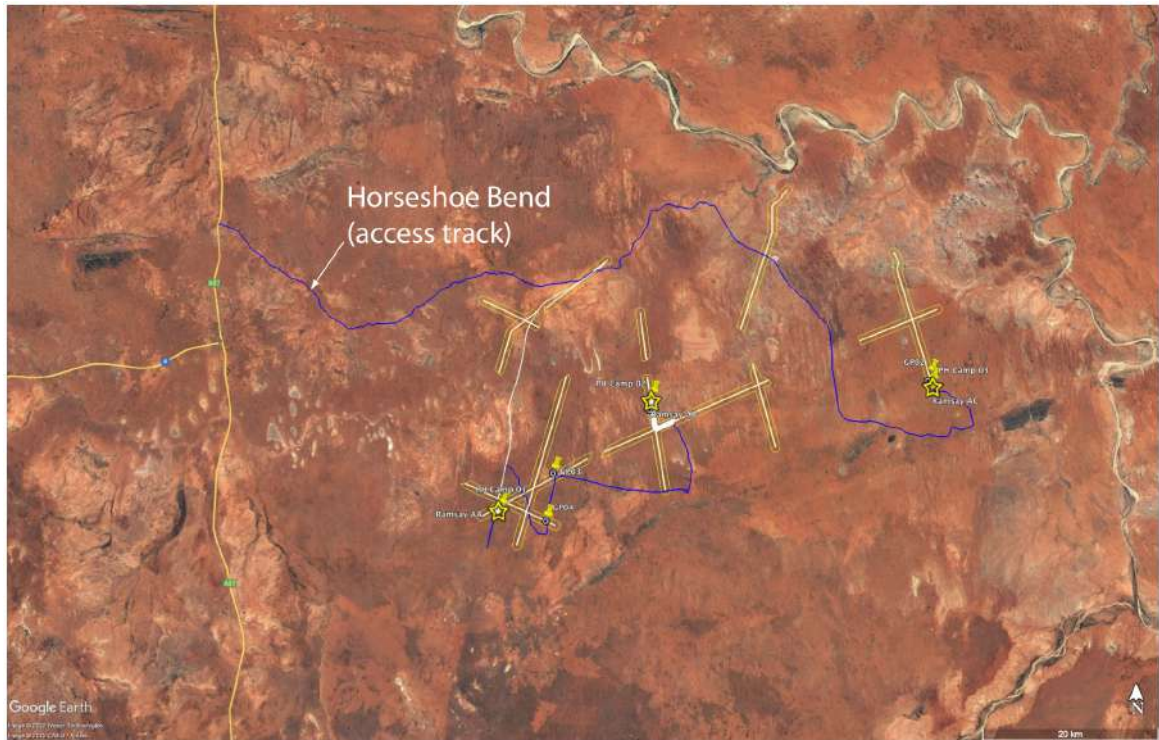


Figure 1A. Amended access track – Horseshoe Bend from the Stuart Highway to Ramsay AC (After Google Earth).

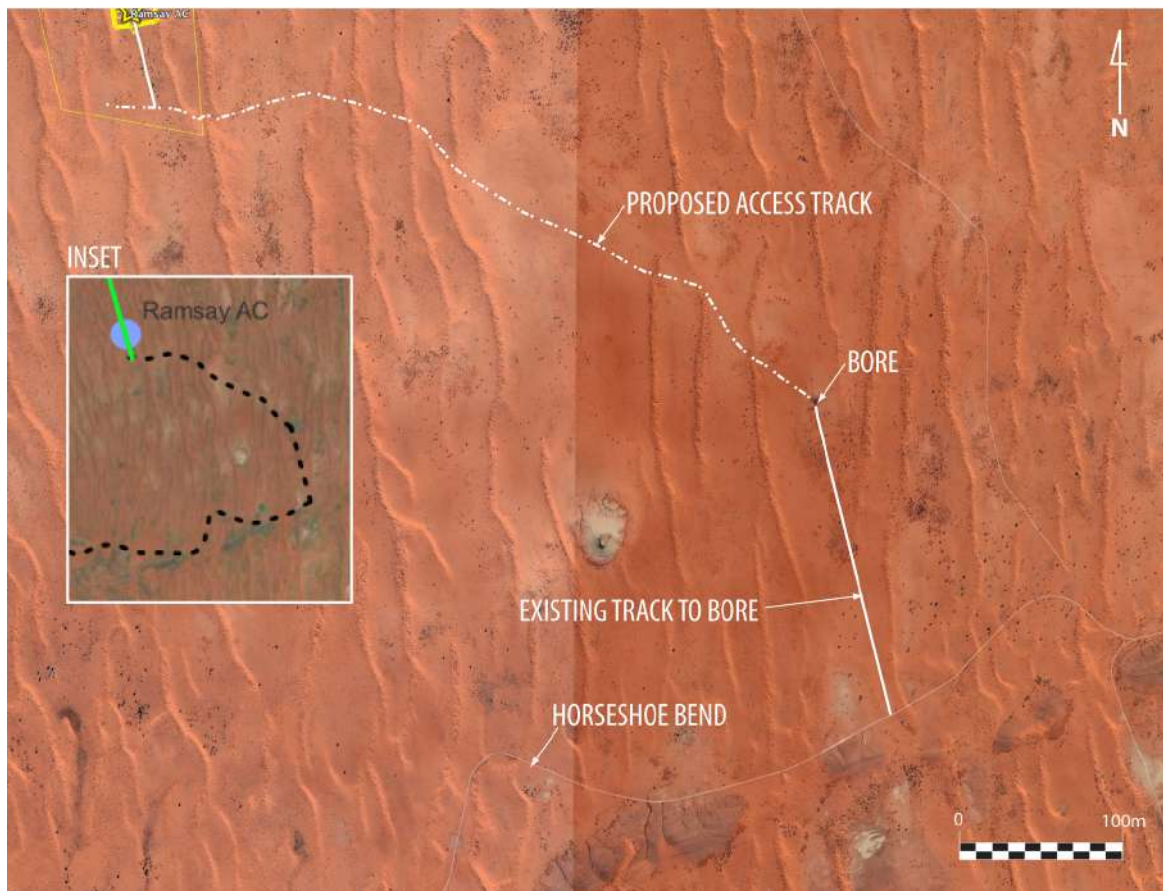


Figure 2. Peak Helium – Map of access track to Line PH\_2021\_1 and Ramsay AC via bore track from Horseshoe Bend (After Google Earth).

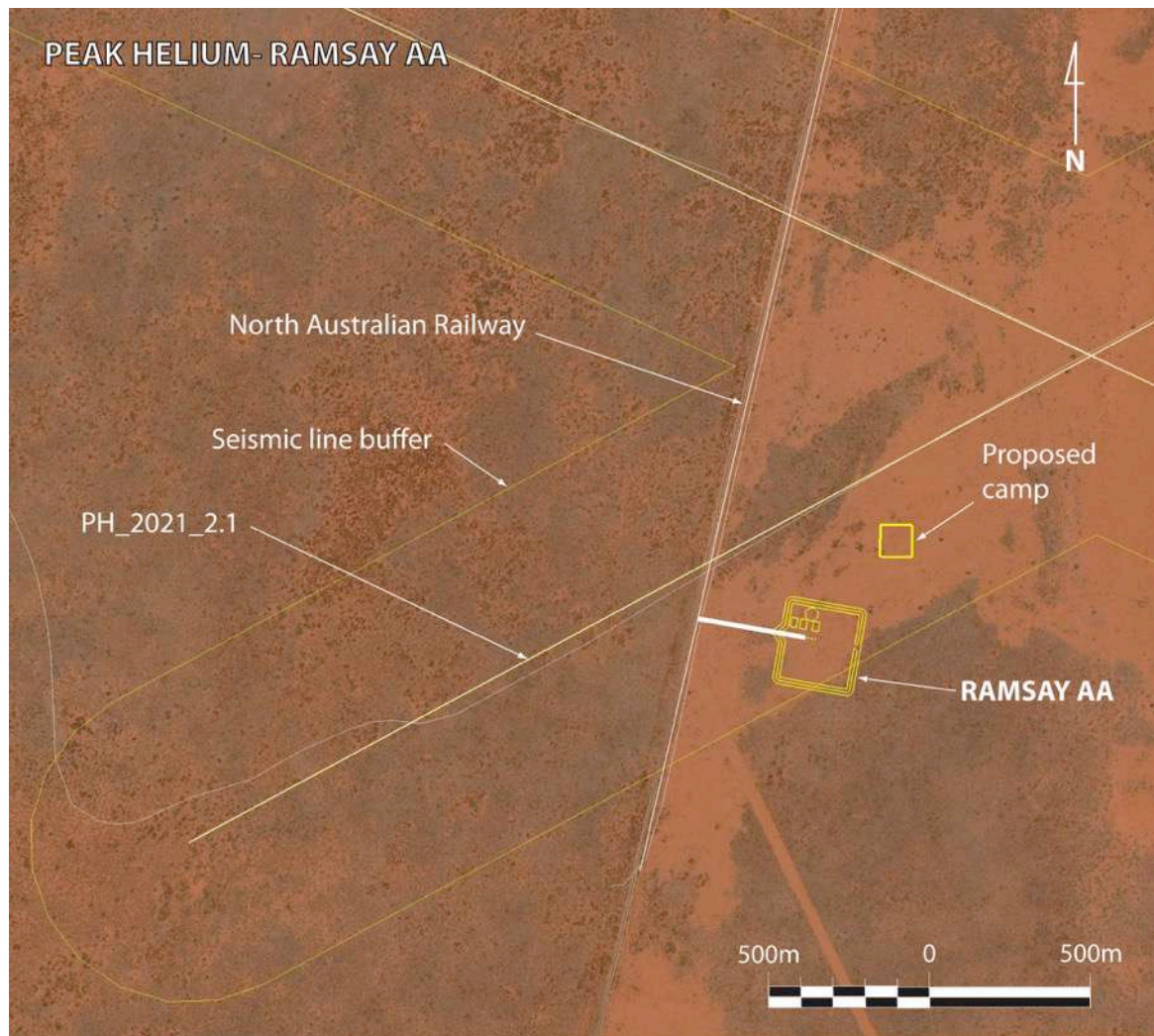


Figure 3. Peak Helium – Ramsay AA well site on the PH\_2021\_2.1 seismic line and location of Camp 1 (After Google Earth).

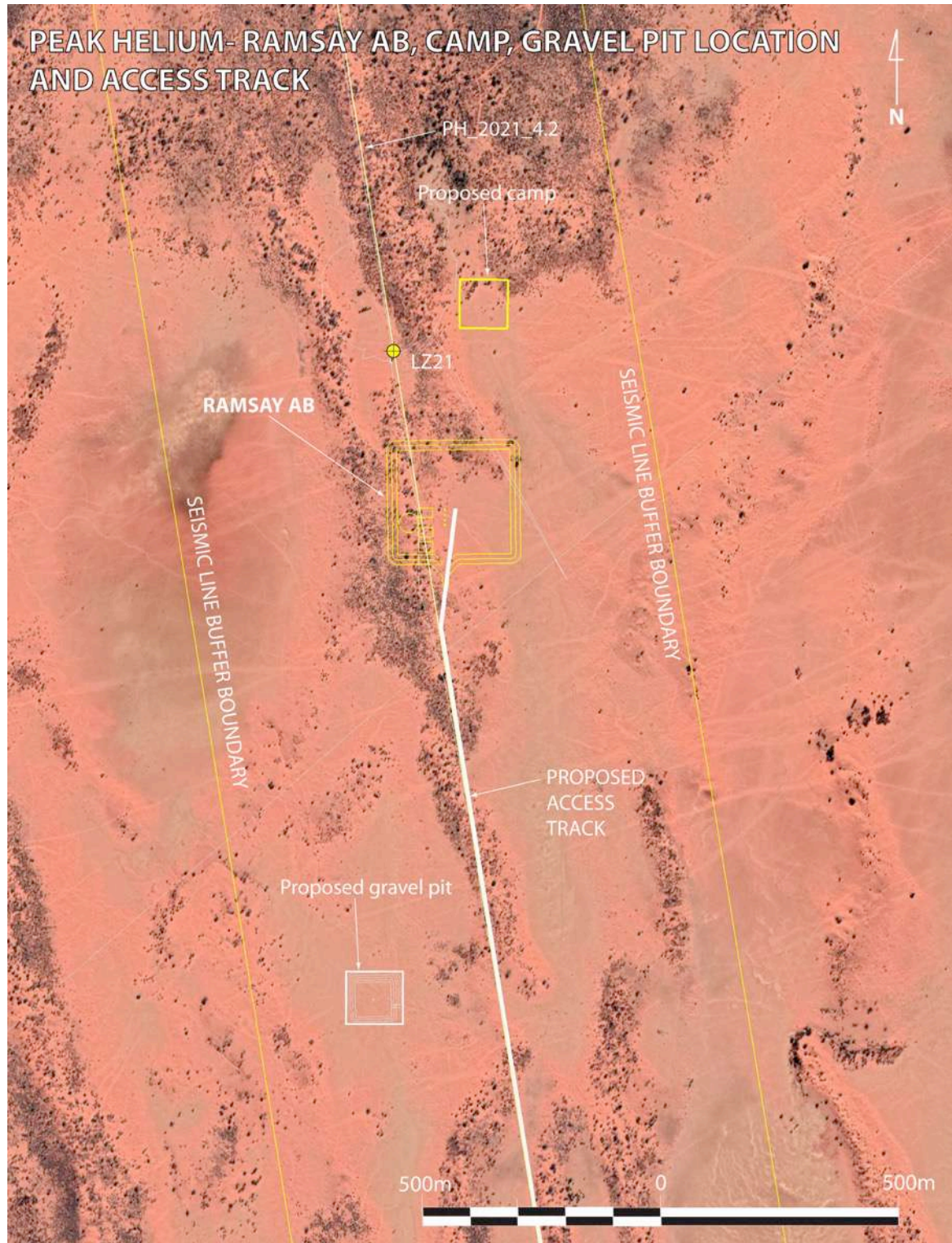


Figure 4. Peak Helium – Ramsay AB, Camp 02, Gravel Pit 1 (GP01), location and access track (After Google Earth).

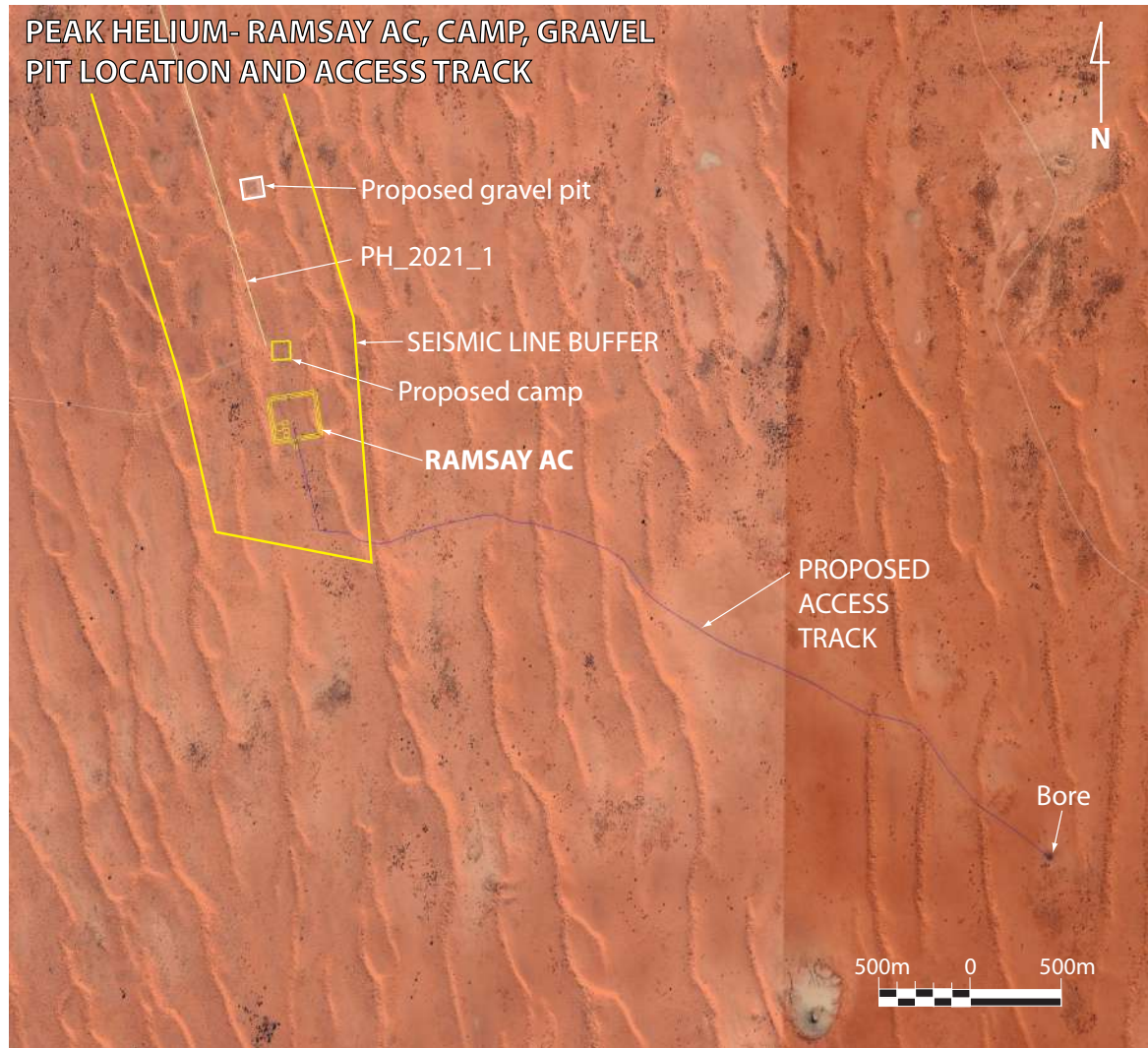


Figure 5. Peak Helium – Ramsay AC, Camp 03, Gravel Pit 2 (GP02), location and access track from existing bore to Horseshoe Bend (After Google Earth).



Figure 6. Peak Helium – proposed Gravel Pit 3 (GP03) location on the PH\_2021\_2.1 seismic line (After Google Earth).



Figure 7. Peak Helium – proposed Gravel Pit 4 (GP04), location on the PH\_2021\_8 seismic line (After Google Earth). Note: tracklog denotes landing zone.

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## 1.2 Appendix 01.02 – Ecological Report

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# Ecological Assessment for EP134 Drilling Program 2022

PEAK HELIUM



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Appendix B	EPBC Protected Matters Search Tool report
Appendix C	Threatened species likelihood of occurrence assessment

# 1 INTRODUCTION

---

Peak Helium (Peak) is a leading helium explorer in Australia, with a focus on exploring and developing its highly prospective Amadeus Basin pure helium permit. Peak Helium operates exploration permit (EP) 134 (project area), located over pastoral leases, approximately 275 km South of Alice Springs in the Northern Territory (NT).

In 2021, Peak established approximately 120 km of seismic lines under the approved EMP – 2021 Seismic Exploration Environmental Management Plan EP134 dated December 6 2021 (PRK1-6). Peak Helium now plan to undertake drilling of three wells between September 2022 and September 2023. These works will be regulated through an Environmental Management Plan (EMP) approved by the Department of Environment, Parks and Water Security (DEPWS). EcOz were engaged to prepare this Ecological Assessment, which is required under the Petroleum (Environment) Regulations (the Regulations).

## 1.1 Planned works

Key components associated with the project are described below and shown in Figure 1-1. The 'project area' refers to the physical footprint of the proposed activities.

### *Drilling of wells*

Peak Helium proposes to drill four wells on three well pads between September 2022 and September 2023. Well pads will be approximately 300 m x 300 m. Exact locations for these well pads have not yet determined. Instead, for flexibility of final well pad placement, three indicative corridors have been identified (A, B and C). Environmental constraints have been identified to inform planning and mitigate impacts to environment and archaeology within the indicative corridor. The indicative corridors are centred on the seismic lines, and a buffer of 500 m either side, totalling a 1000 m wide corridor.

The well pads will be located within the proposed indicative corridors, as shown in Figure 1-1. To undertake these works the following key activities are required:

- Vegetation clearing
- Grading, excavation, stockpiling, compaction of soil material
- Re-spreading of any removed vegetation on the well pads following completion of the program, to promote regeneration
- Upon completion, removal of all surface infrastructure and rehabilitation.

### *Borrow pits*

Peak Helium propose to construct four borrow pits. These borrow pits will be approximately 116 m x 100 m and three of the borrow pits will be located within indicative corridors, as shown in Figure 1-1. Borrow pit 2 will be located within the previous seismic line corridor works area as shown in Figure 1-1. Borrow pits will have material excavated from the pits for use within the project areas. On completion of the drilling works, borrow pits will be re-formed into a stable surface that blends into the natural surrounding environments. Any removed vegetation and topsoil will be re spread over the area to promote regeneration of the area.

### *Access tracks*

Access to drill sites are on either existing station tracks or seismic lines. The creation of some small access tracks will be required within the corridor area to access borrow pits (Figure 1-1), but the seismic line will provide suitable access to well pads and camps. General maintenance of tracks may be required during and following project activities, undertaken in agreement with Station owner. This may include grading, patching and watering. No track upgrades or widening or other activities that require vegetation clearing will be conducted within the SOCS and SOBS.

To minimise damage to access tracks works will cease if there is a forecast for 50 mm of rain or more within the next 48 hours.

### ***Campsites***

There will be three campsites constructed as part of the drilling works. Campsites will be established at each of the drill sites. Campsites will be approximately 100 m x 100 m and will be located nearby the well pads, within the proposed well pad corridors, as shown in Figure 1-1. Campsites will be established in areas where minimal clearing is required.

### ***Clearing estimates***

Based on the information provided above, it is estimated that approximately 35 ha (excluding short access tracks to borrow pits) will be cleared as part of the drilling program.

## **1.2 Scope**

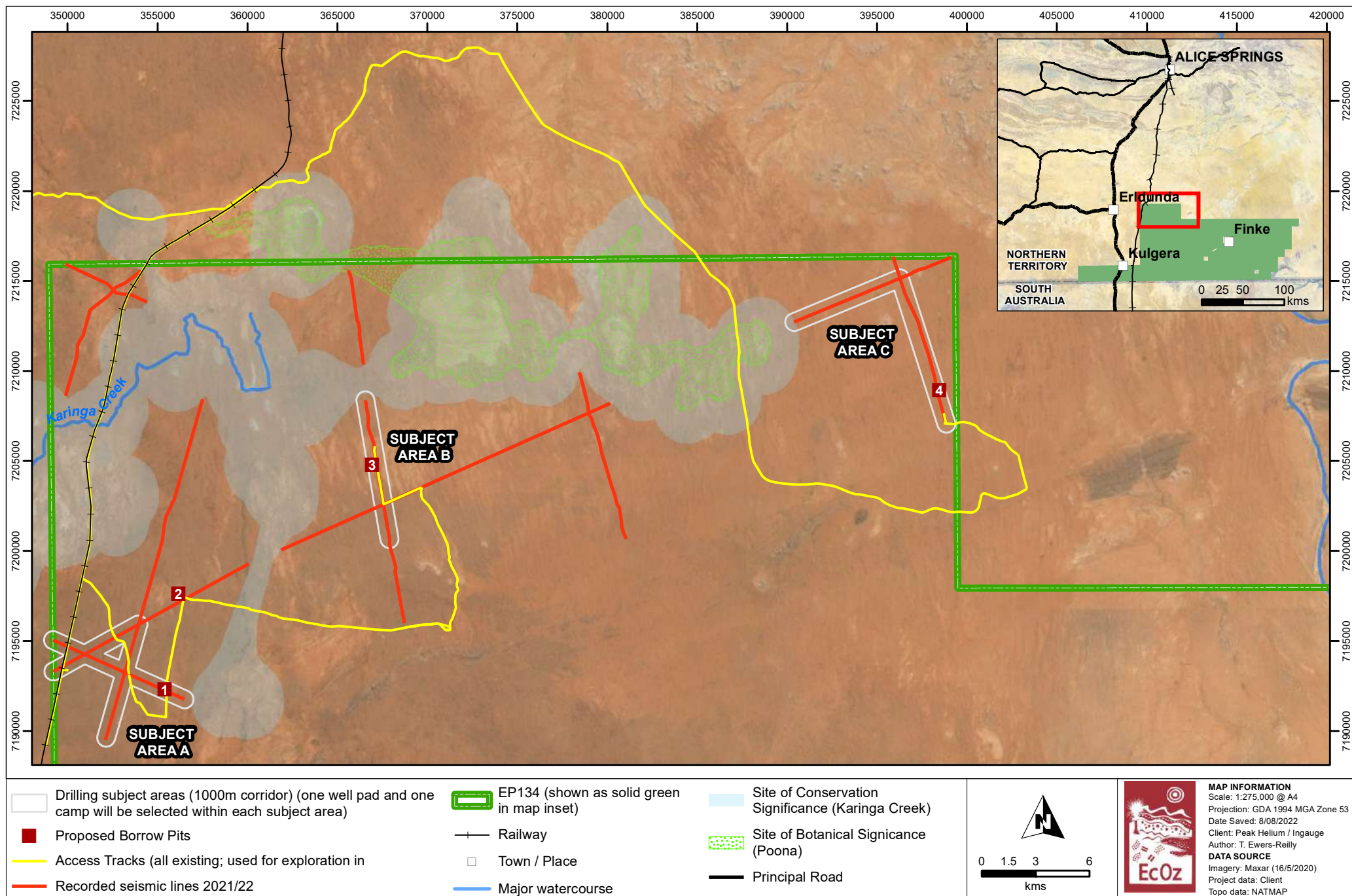
The drilling works will be regulated through a project-specific EMP. To inform the EMP, an assessment of the ecological values of the proposed drilling program is required. The assessment will describe ecological values within three subject areas (A, B and C) that includes a 1000m corridor, so that well pad and other infrastructure can be placed within these indicative corridors, in areas that will minimise ecological disturbance (shown on Figure 1-1). The only proposed aspect not located within the indicative corridor areas (A, B and C) is borrow pit 2, this will be located within the previous seismic line corridor works area.

This report has been based on previous data collected during a comprehensive ecological assessment that was undertaken as part of the seismic exploration approvals in June 2021 (EcOz 2021). As the proposed drilling subject areas overlap with the previous study corridor, the current data set is considered as suitable for identifying and assessing ecological risk for the drilling program (and the fact that those studies did not identify any priority ecological aspects that need repeat surveys to adequately assess risk of the proposed drilling program).

Field studies for the environmental site assessment was conducted by Tom Reilly (Senior Ecologist, EcOz) between the 11 and 13 June 2021. The field work was carried out using ground-based and aerial (helicopter) survey methods and was conducted in conjunction with an archaeology survey by Dr Silvano Jung (see the Heritage Management Plan).

This ecological assessment has been prepared for the subject areas and presents:

- A desktop review of the environmental context of the subject areas (land use, climate, bioregions, significant areas, surface water, and land systems).
- An overview of the existing environment (as surveyed in June 2021), including landform and vegetation description, number of waterway crossings, a baseline weed survey, presence of sensitive habitats and vegetation, and a land condition assessment overview.
- A threatened species 'likelihood of occurrence' assessment using desktop and field results from June 2021 to determine which species have a reasonable likelihood of occurring within the subject areas (and therefore need to be considered in the EMP risk assessment).
- Recommendations to reduce the potential for negative environmental impact from the program.



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**Figure 1 -1. Map of project location and proposed drilling works (Subject Areas)**

## 2 ECOLOGICAL ASSESSMENT

---

### 2.1 Land use

Land use within the region is predominantly pastoralism (cattle), with the drilling program occurring within two stations – Idracowra and Horseshoe Bend (Figure 1-1). Mineral and mining exploration has occurred in the region historically but there is no evidence of mining activity.

### 2.2 Climate

The region experiences an arid to semi-arid climate, which is characterised by hot dry summers and cool dry winters, with a low average annual rainfall. Typically for this region, maximum and minimum temperatures are highest in summer. The closest long-term Bureau of Meteorology weather station is Kulgera (station number 015603) approximately 65 km south-west of the subject areas. Average annual rainfall is 249.9 mm; however, the amount of rainfall in the region is highly variable. For example, 2001 experienced 652.3 mm of rain, while 2002 experienced 153.4 mm of rain. If heavy rainfall occurs, it is generally in the summer months from November to March.

### 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 a useful means for simplifying and reporting on more complex patterns of biodiversity (NSW 2003).

The drilling program occurs within the Finke bioregion – specifically within the Tieyon sub-region – which is a complex area characterised low sandstone ranges, weathered tablelands and rounded metamorphic hills (Baker et al. 2005). Vegetation is dominated by hummock grasslands, acacia shrublands and saltbush/bluebush open shrublands.

### 2.4 Significant areas

The drilling program occurs within close proximity to a Site of Conservation Significance (which also incorporates a Site of Botanical Significance (Figure 1-1). However, the drilling program avoids these areas, with only a small section traversed (transit only) on existing roads and station track (of which both were recently used for the seismic exploration program in 2021) (tracks shown on Figure 1-1, noting that the track falls within a buffer area of the SOCS only and does not traverse significant lake habitat associated with the SOCS values, including EPBC listed migratory species).

No national parks or reserves occur within or proximate to the drilling program.

#### ***Sites of Conservation Significance (SOCS)***

The Karinga Creek paleo-drainage system SOCS is considered to be of international significance (Harrison et al. 2009). This system provides vital stop-over grounds for migratory shorebirds, including internationally significant records of Banded Stilt, Red-capped Plover, and Sharp-tailed Sandpiper. The Karinga Creek paleo-drainage system provides important temporary salt pans and lakes, which support a diverse assemblage of flora and fauna species in an otherwise arid landscape.

### ***Sites of Botanical Significance (SOBS)***

One Site of Botanical Significance (SOBS) occurs close to the subject areas – Poona SOBS. This SOBS is of bioregional significance (as described by White et al. 2000). It occurs within Karinga Creek paleo-drainage system SOCS and are part of an ancient river system. Saline lakes and basins, hold potential to be important habitats for 49 rare, threatened, and poorly known species. It is important to note that botanical attributes of these areas of significance are rarely well documented due to a lack of surveying history because of their remote location.



**Figure 2-1. Aerial photographs of salt pans and lakes within Karinga Creek paleo-drainage system (which will be avoided by the proposed drilling program)**

## **2.5 Surface water catchment and drainages**

The drilling program lies within the Diamantina-Georgina Rivers catchment.

Karinga Creek, a major and ecologically significant watercourse, occurs in close proximity to the drilling program; however, no new disturbances are proposed (Figure 1-1). Karinga Creek will only be crossed on transit to drilling sites, and will be on well-established roads adjacent to the railway. Karinga Creek, as well as all drainages in the region, only flow after heavy rainfall events (which is very intermittent).

Based on field data collected as part of the seismic exploration ecological assessment (EcOz 2021), there are no drainages present within the subject areas (major or minor). This assessment included detailed review of aerial imagery (viewed at a scale of 1:3000) coupled with on-ground observations by helicopter to ground truth potential drainages.

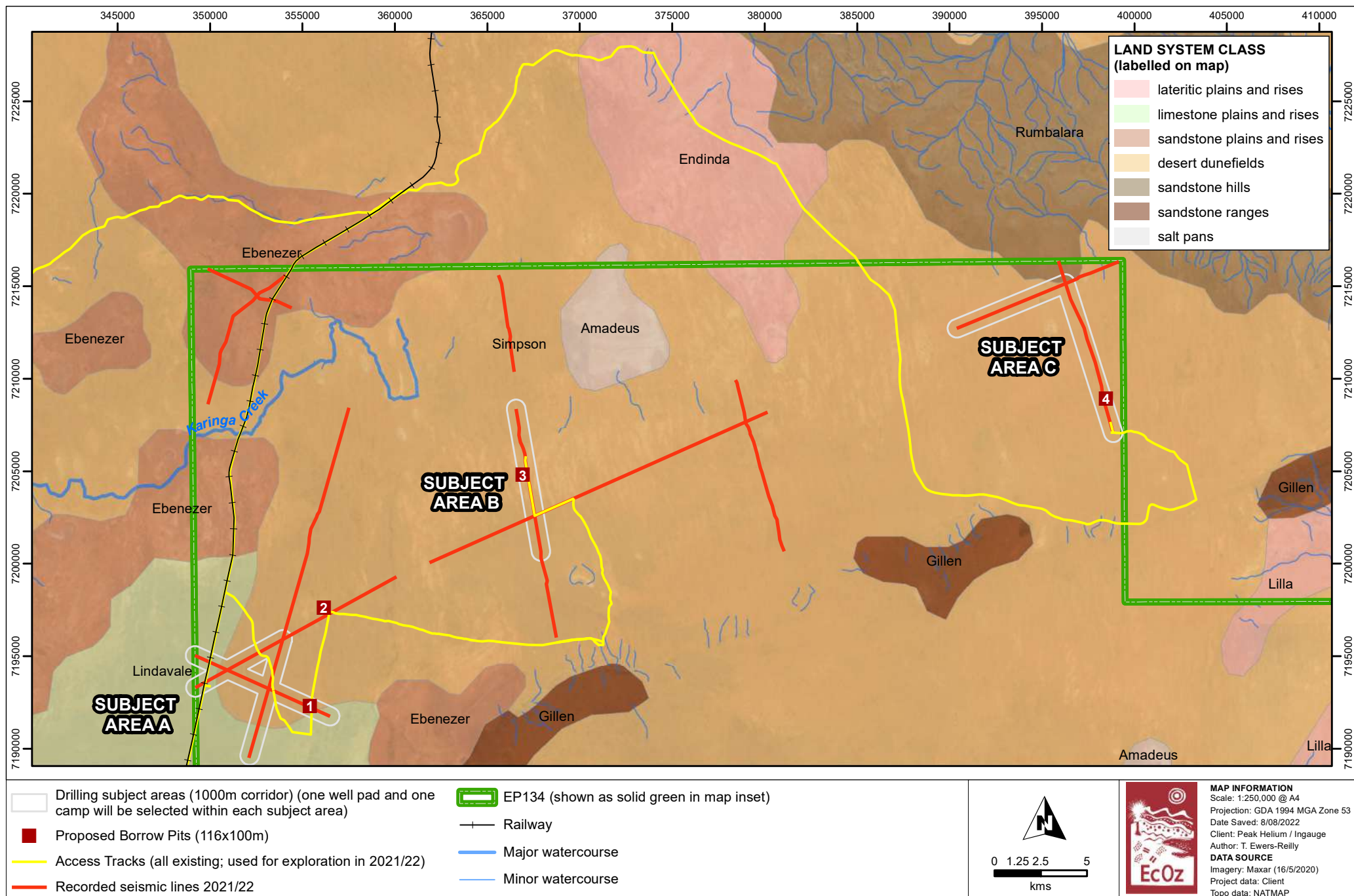
## 2.6 Land systems

Land system mapping of the region was undertaken by Perry et al. (1962) at a scale of 1:1,000,000. It shows that the subject areas pass across and mostly occur within the Simpson land system (desert dunefields) and a small area within Lindavale land system (limestone plains and rises) and Rumbalara land system (sandstone hills) (described in Table 2-1; mapped in Figure 2-2). The surrounding region also supports a salt pan system (Amadeus) (associated with the Karinga SOCS described in Section 2.4), lateritic plains and rises (Endinda), and sandstone ranges (Gillen) – however these land systems are outside of the proposed disturbance area of the drilling program.

It should be noted that land system data and mapping is a large-scale dataset, and more detailed landform and vegetation descriptions were undertaken during field studies in June 2021 (EcOz 2021) – described in Section 2.6.

**Table 2-1. Summary of the land systems relevant to the drilling program**

Land system	Landform	Soil	Vegetation
<b>Desert dunefields</b>			
Simpson	Dunefields with parallel linear dunes, reticulate dunes and irregular or aligned short dunes	Red sands	Typically Desert Cane Grass ( <i>Zygochloa paradoxa</i> ) on dune crests, sparse shrubs, and low trees over spinifex on the flanks, and Mulga ( <i>Acacia aneura</i> ) and Coolibah ( <i>Eucalyptus microtheca</i> ) within the swales.
<b>Limestone plains and rises</b>			
Lindavale	Plains, rises and plateaux on weathered and unweathered Cambrian limestone, dolomite, chalcedony, shale, sandstone and siltstone with associated sand sheets	Sandy and earth soils	Mulga, sparse shrubs and low trees, witchetty bush, bluebush and short grasses and forbs.
<b>Sandstone hills</b>			
Rumbalara	Low hills, hills and stony plateaux on sandstone, siltstone, quartzite, and conglomerate (deeply weathered in places)	Outcrop with shallow stony soils	Absent, sparse shrubs and low trees, mulga, bluebush, saltbush, samphire, witchetty bush, short grasses, and forbs.



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**Figure 2-2. Map of land systems**

## 2.7 Landforms and vegetation (based on field studies)

In June 2021, a field survey was conducted to describe landforms and vegetation types within the region of the seismic program. This included recording the variety of landform types, surface soil types, and dominant flora species at a spatially representative set of survey sites across the subject areas. The field survey also focused on identifying sensitive vegetation/habitat within the 1km corridor, as these areas will require avoidance (or implementation of specific mitigation measures). This involved desktop analysis to determine sensitive habitat types known to occur in the region, followed by a close-up review of aerial imagery within the survey corridors (1km wide) at a scale of 1:5,000 or less. The field survey (in June 2021) visited all locations of sensitive habitat within the survey area and mapped their extent (boundaries) so that suitable buffers, or mitigation measures, can be implemented/applied.

Major landform types within the subject areas are dunes, dune swales, sandplains, plains, loamy depressions and seasonal swamps. The dataset used for this assessment is provided in Appendix A. The following types are considered to be sensitive/important, and impacts should be avoided / minimise where appropriate:

- Swamps
- Dunes
- Desert Oak trees (and other larger trees)
- Thickets or dense patches of vegetation (i.e. patches of shrubs)

### 2.7.1 Dunes

Dunes have a range of orientations from parallel (SE to NW direction), reticulate dunes or irregular dunes. They are stabilized by spinifex, low shrubs (*Acacia* spp., *Grevillea* spp., and *Dodonaea viscosa*) and trees. They have low relief (between 4 and 6 m); with some larger examples in the south eastern part of the project area that may reach up to 10 m (subject area C) (examples from the survey shown in Figure 2-3). They have soft red aeolian sands and support an open shrubland over sparse understory of forbs, tussock grass and occasionally Spinifex. Dune crests within have been mapped (Figure 2-12) and provided as a spatial data.

Dune habitat is used by a range of native species, including the Near Threatened Southern Marsupial Mole – which may occur in the region. The threatened Crest-tailed Mulgara may occur within large dunes; however, it is considered unlikely that this species currently occurs in the area (described further in Section 2.8).



Figure 2-3. Photographs showing typical dunes

## 2.7.2 Swales

Swales are the flat plains between the dunes and have a variable vegetation structure throughout the subject areas; however, in most cases vegetation is open Acacia / Grevillea shrublands with either hummock (spinifex) or tussock grasslands, and slopes are flat to gently sloping.

They occasionally support scattered to patchy Desert Oak (*Allocasuarina decaisneana*) (Desert Oak patches within the subject areas are shown in Figure 2-12). Desert Oak do not hold threatened status (i.e. they are Least Concern under TPWC Act or EPBC Act); however, they are known to provide valuable refuge habitat for a range of native flora and fauna. They may also provide potential roosting sites for the threatened Princess Parrot (although there is no evidence of this occurring in the region; if present very infrequent – Princess Parrot are discussed further in Section 2.8.1).

Loamy depressions can be present within swales (run-on areas within the swale) and have been described as a separate landform.



Figure 2-4. Photograph showing dune and swale



Figure 2-5. Photograph of the broad open swale (this particular swale is where Borrow Pit 3 is proposed within subject area B)

### 2.7.3 Sandplains

Sandplains are flat to gently undulating plains with red sand to sandy red earth soils, which predominately occur in the south part of the project area. They include sandy calcareous plains (with open or patchy Mulga over Kerosene Grass or Oat Grasses and forbs) and spinifex sandplains (with Mulga, mallee or scattered Desert Oak over spinifex). Low dunes and minor limestone/calcrete rises are scattered throughout. Fire has produced floristic differences, and recent drought has resulted in senesced spinifex at the time of survey.



**Figure 2-6. Photograph showing sandplains**

### 2.7.4 Loamy depressions

Shallow minor depressions that have sandy loam soils that support a range of short-lived forbs and tussock grasses. Shrubs are typically absent or present as isolated individuals. These depressions are relatively common in low points within dune swales (or sandplains). These depressions are flat (run-on areas) that are relatively small in size (<1 ha) and are not considered as clay pans or to contain sensitive habitat features.

The proposed (four) borrow pits are located within this landform. By coincidence, Borrow Pit 1 was surveyed as part of the June 2021 field survey (site 8f in Appendix A). Borrow Pits 2, 3 and 4 were not specifically surveyed during field work (as these sites were not known during the seismic exploration phase), however review of aerial imagery coupled with field observations close to the proposed pit locations is enough to make an inference that habitat is similar to that recorded at Borrow Pit 1 (aerial images of each borrow pit is provided in Figure 2-9). Notably, these areas are unlikely to support hollow bearing tree species. However, a ground assessment will be required to confirm inferences, and to ensure that sensitive habitat is suitably avoided.



**Figure 2-7. Photograph (aerial) showing a loamy depression within the subject areas**

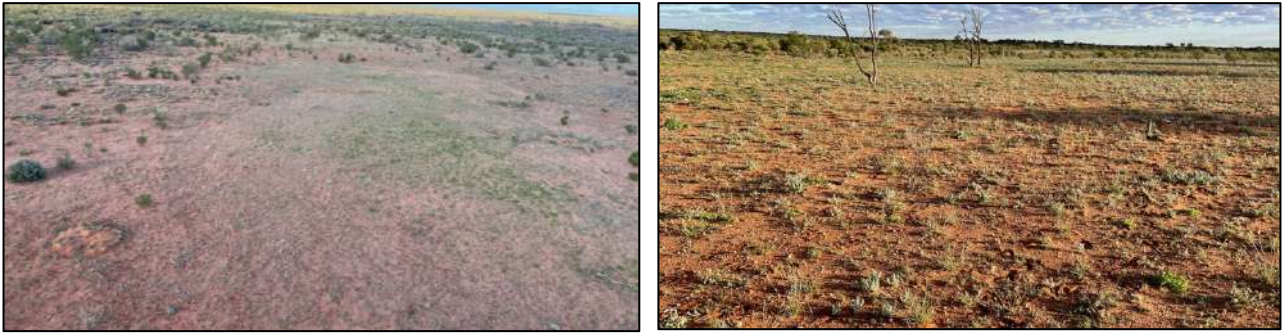
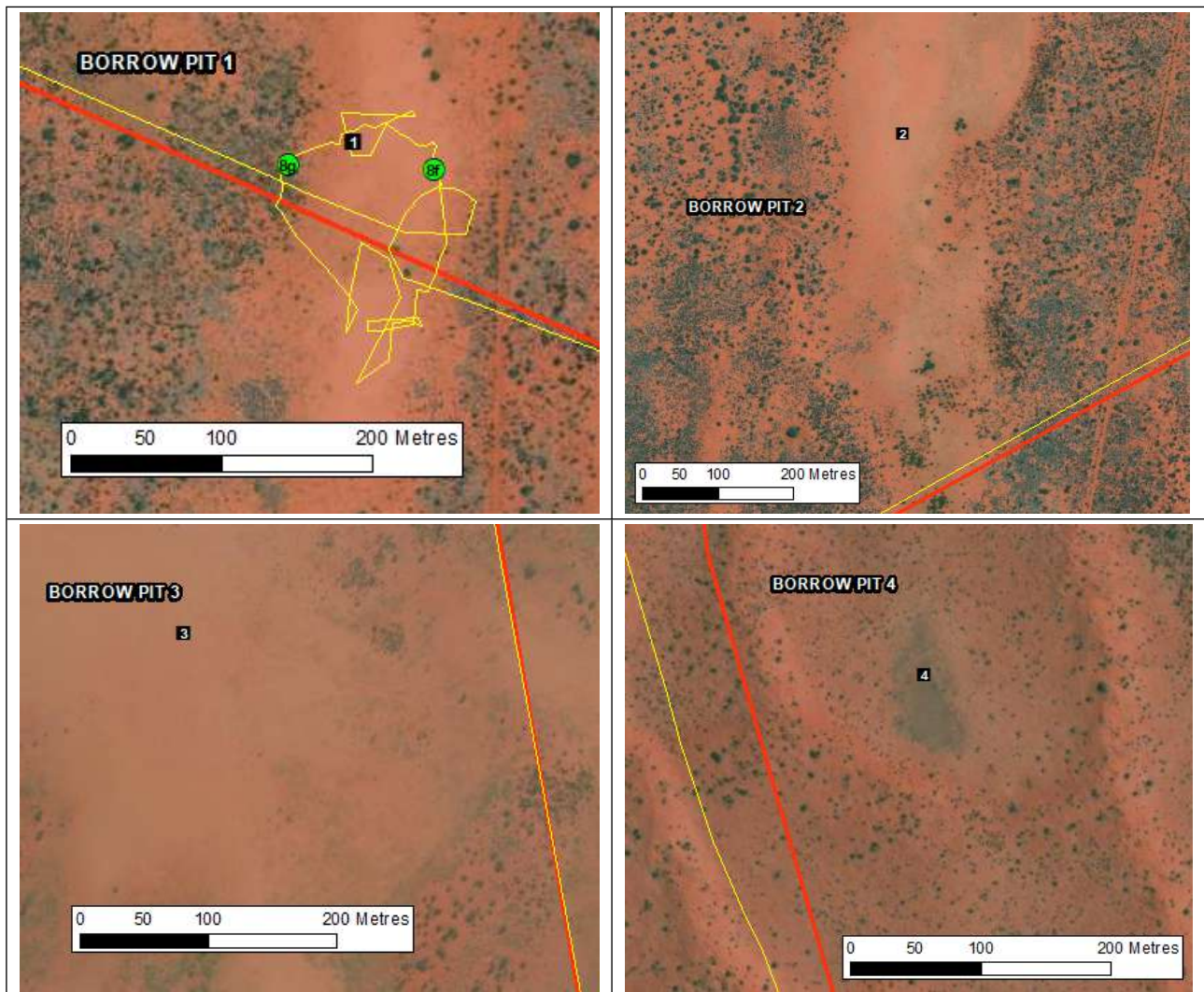


Figure 2-8. Loamy depression where Borrow Pit 1 (within subject area A) is proposed



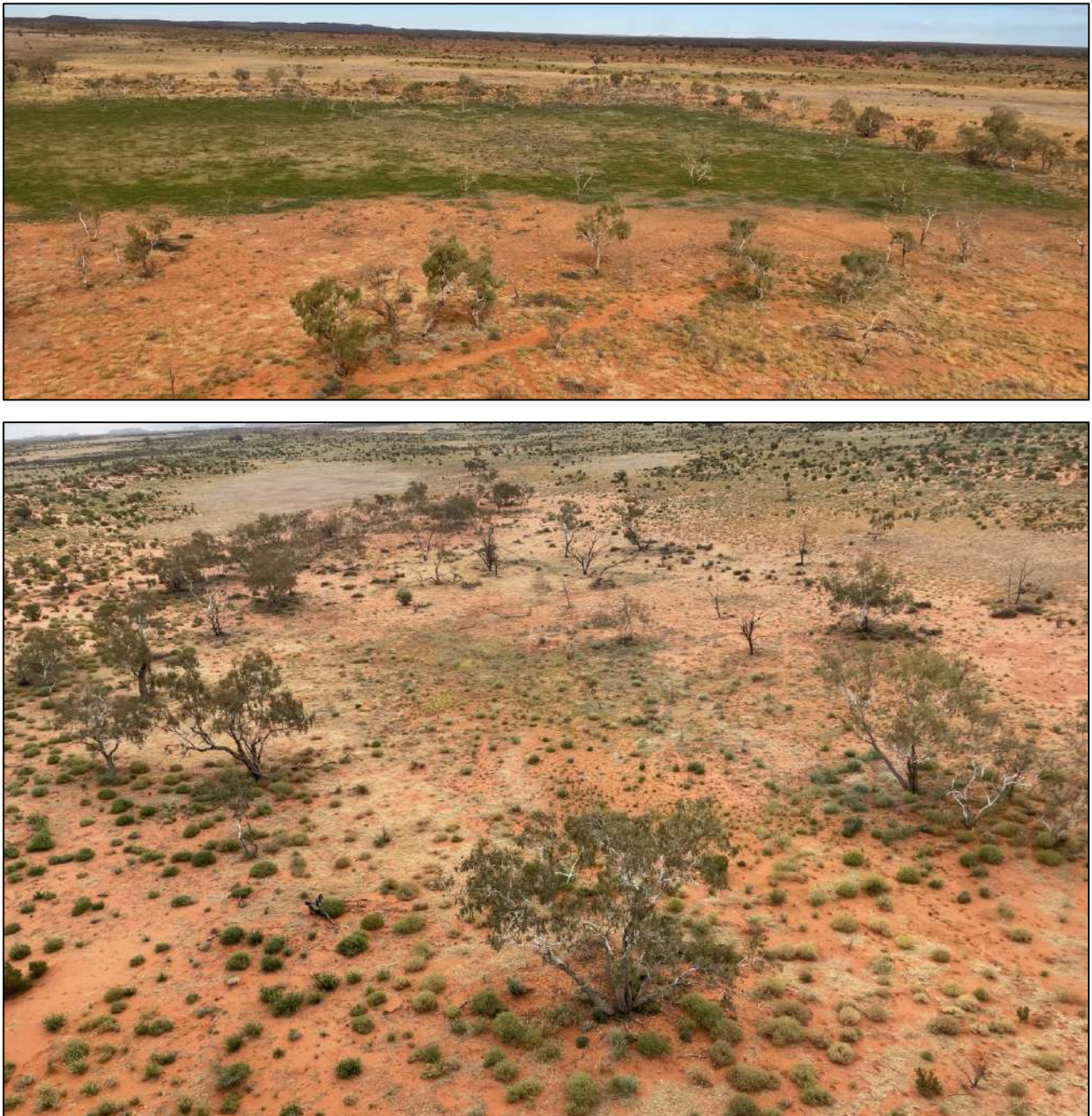
Key: yellow line = field survey GPS tracklog (June 2021); green circles = field survey sites (June 2021); red line = cleared seismic line (existing); black square = proposed borrow pit (indicative area, size 100 x 116m).

Figure 2-9. Aerial images of the (four) proposed Borrow Pit locations

### 2.7.5 Seasonal swamps

There are three seasonal swamps within the subject areas (see Figure 2-12). Seasonal swamps in arid areas provide important regional biodiversity. They are also run-on features similar to clay pan and loamy depressions. They have heavy clay soils (brown) and are occasionally gilgaied. They have a high cover of ephemeral forbs and support large Coolabah trees (*Eucalyptus coolabah* ssp. *arida*). Coolabah are a long-lived tree species which can persist through significant droughts and create a refuge habitat with hollows and leaf litter favourable to a range of species.

These swamps are considered as sensitive habitat under the NT Land Clearing Guidelines.



**Figure 2-10. Photographs showing seasonal swamps**

## 2.7.6 Rocky rises

Rocky rises have a very low relief (i.e. <5m) and are predominately comprised of calcrete / limestone rock type, with some instances of silcrete stones and laterite gravel. Field survey in 2021, and review of aerial imagery, indicates that rocky rises do not occur within the subject areas; however, they are present in the surrounds. If they are encountered, it is advised these areas are avoided for erosion reasons.

Vegetation can vary from a low open chenopod shrubland (*Maireana astrotricha* and *Sclerolaena* spp.) to a low open shrubland of *Senna artemisioides* subsp. *alicia* over forbs, chenopods, and short tussocks. Surface soils are covered by a relatively high cover of rock and sandy loam soils. No outcropping or ridgelines were observed within the subject areas, however these feature do occur in the surrounding landscape.

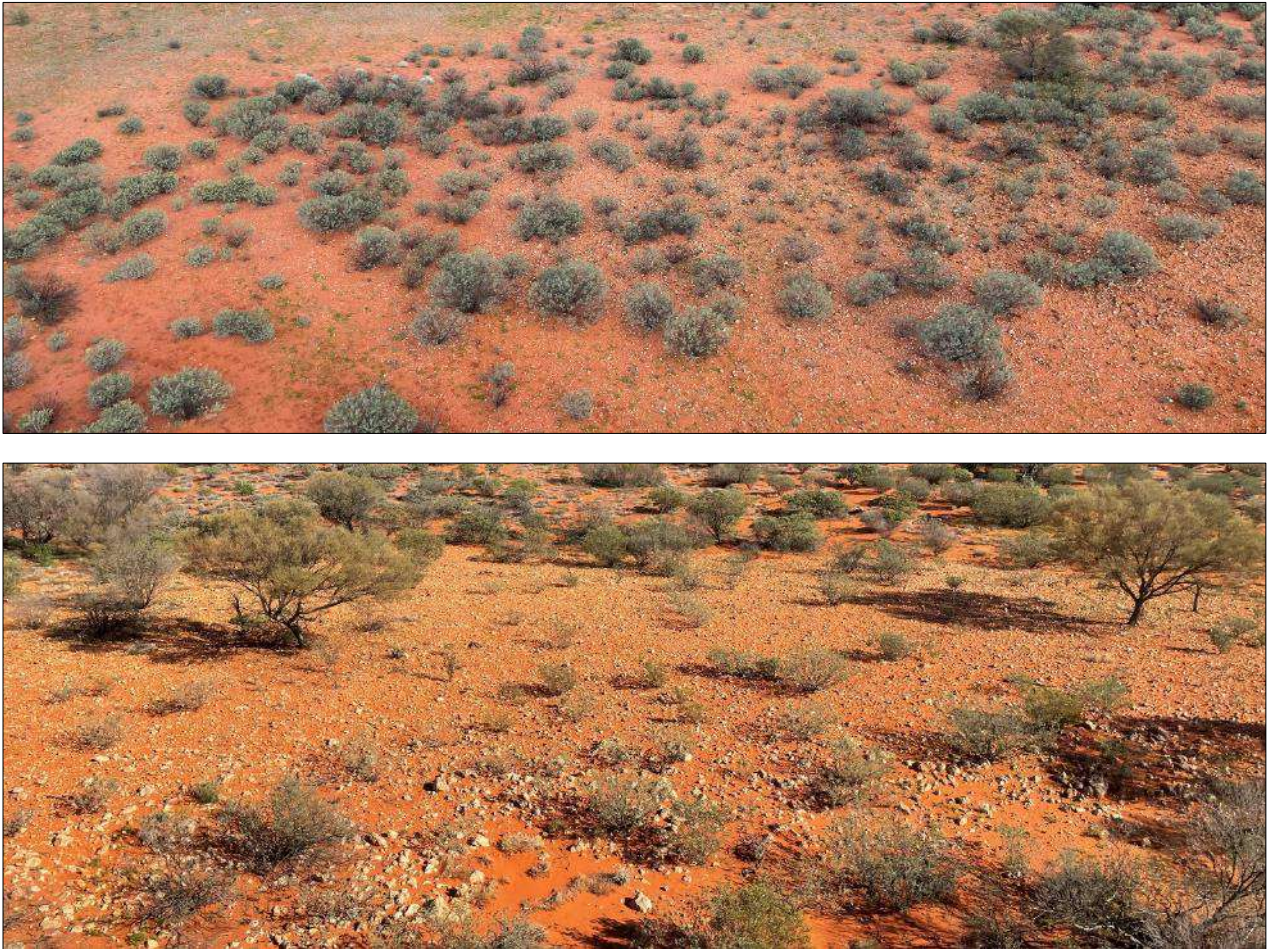
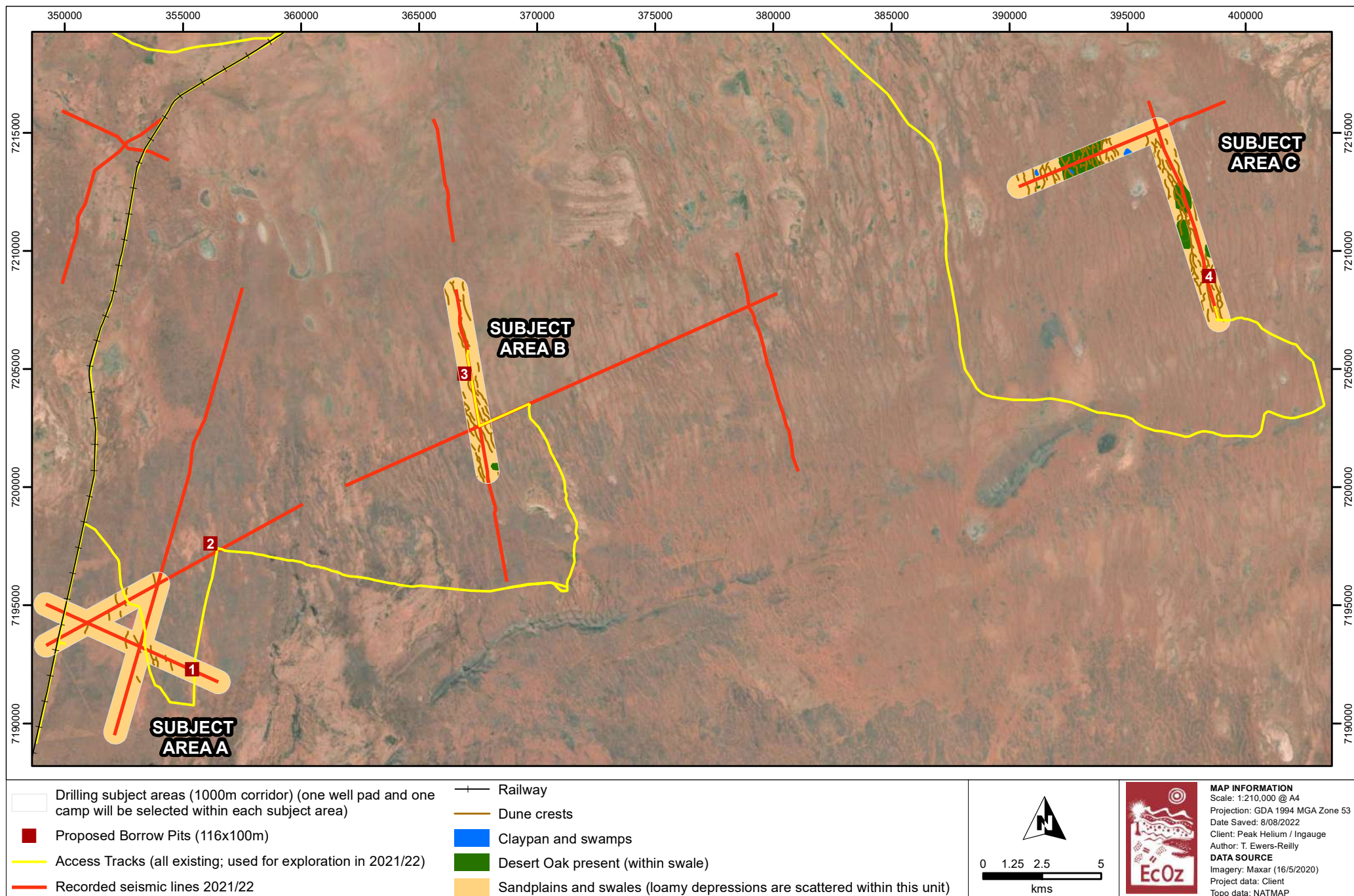


Figure 2-11. Photographs showing rocky rises



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**Figure 2-12. Map of landforms within the subject areas**

## 2.8 Threatened species

A threatened species 'likelihood of occurrence' assessment was conducted for the three subject areas. The assessment was undertaken using available desktop information and incorporated field survey recorded by EcOz in June 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 the subject areas.

A total of 33 threatened species were considered in the 'likelihood of occurrence' assessment (Appendix B). The results from the threatened species 'likelihood of occurrence' desktop assessment are detailed in Appendix C and summarised as follows:

- No threatened species are considered to have a high likelihood of occurrence.
- One species has a medium likelihood of occurrence – Princess Parrot (*Polytelis alexandrae*). This species has been discussed in Section 2.8.1.
- 17 species have a low likelihood of occurrence (species discussed in Table 2-2); and a general low inherent risk of impact from this project.
- 15 species are considered as none (i.e. not expected to occur within the subject areas), and have not been considered further – Malleefowl, Plains-wanderer, Red Goshawk, Central Australian Rock-wallaby, Pale Field-rat, Central Brushtail Possum, Central Rock-rat, Central Rock-rat, Sandhill Dunnart, Slater's Skink, Bronzeback Snake-lizard, Latz's Wattle, Finke Goby, Bednall's Land Snail and *Semotrachia esau* (a land snail). Refer to Appendix C for justifications..

### 2.8.1 Princess Parrot (*Polytelis alexandrae*)

Princess Parrot is listed as Vulnerable under the EPBC Act and TPWC Act. They are found in the swales between sand dunes with a shrub layer and scattered trees (Pavey 2006). They are highly nomadic and, as noted in DoE (2016), they are an irregular visitor (sometimes at intervals of more than 20 years) to most sites within its range and its movements are largely unknown. There are no recent records of Princess Parrot in the region of the subject areas; however, the subject areas do occur within the 'likely' distribution of the species.

The field survey confirmed that nesting potential for Princess Parrot is low within and surrounding the subject areas due to the absence of key tree species – Marble Gum (*Eucalyptus gongylocarpa*) or River Red Gum (*E. camaldulensis*). However, there are a few small stands of Desert Oak (*Allocasuarina decaisneana*) within subject area B and subject area C that may support temporary roosting hollows suitable for Princess Parrot (example photograph in Figure 2-13; patches shown in Figure 2-13). Ground and/or aerial inspections of these stands did not detect any suitable hollows; however, it is noted that a systematic hollow survey was not conducted (because Desert Oaks are rarely used as nest sites by Princess Parrot) and hollow quality and presence can change between seasons.



Figure 2-13. Photograph of Desert Oak (*Allocasuarina decaisneana*) within dune swales

**Table 2-2. Threatened species with a low likelihood of occurrence'**

Species	EPBC	TPWC	Comment
Grey Falcon ( <i>Falco hypoleucos</i> )	-	VU	<p>This species prefers to nest in tall trees on waterways (and on telecommunication towers) – which are not present within subject areas or associated existing roads/tracks that will be used for transit between drill sites.</p> <p>They could also nest in Coolabah trees within the swamps within subject area C – however would only be present in good seasons when there are high numbers of flocking birds such as dives, finches and budgerigars.</p> <p>Desert Oaks are present within subject areas B and C. It is possible that these trees could be used for nesting; it is considered highly unlikely, unless the Desert Oak is positioned in close proximity to a water sources that would attract target bird prey for Grey Falcon.</p>
Night Parrot ( <i>Pezoporus occidentalis</i> )	EN	CR	<p>Known to nest in mature unburnt patches of Bull Spinifex (<i>Triodia longiceps</i>), which does not occur within or adjacent to subject areas.</p>
Australian Painted Snipe ( <i>Rostratula australis</i> )	EN	EN	<p>Species may occasionally utilise ephemeral swamps present within subject area C (when swamps contain water and suitable food resources).</p> <p>It is uncertain whether the swamps within subject area are suitable habitat (further targeted work would be required for that assessment).</p> <p>Avoidance of swamp habitat would suitably mitigate risk to this species; otherwise targeted survey may be required to adequately assess risk to this species.</p>
Greater Bilby ( <i>Macrotis lagotis</i> )	VU	VU	<p>Field survey did not record any evidence of this species within the subject areas or surrounds (burrows and diggings can be reliably detected via aerial observations). There is no evidence that suggests that this species currently occurs in the region.</p> <p>Surveys did not identify presence of key shrub species that are known to harbour root dwelling grubs that eaten by bilby.</p> <p>However, bilby are highly mobile and may occur if suitable conditions persist and ephemeral food resources become available.</p>
Crest-tailed Mulgara ( <i>Dasycercus cristicauda</i> )	-	VU	<p>There is no current evidence (via field observations or available desktop resources) that suggests that this species occurs within the area. If present, species would most likely occur in larger dunes.</p>
Plains Mouse (NT)/ Plains Rat (Cth) ( <i>Pseudomys australis</i> )	VU	EN	<p>Primary habitat for this species is not present within the subject areas (gibber plains and mid slopes with boulders, small stones and gilgais). Core refuge habitat are thought to be low-lying gilgais and drainages of gibber plains – which are not present within the subject area. As such, a core population is not expected to be present – and significant impact to species is unlikely. If present, species would only occur during boom periods when this species can spread into adjoining sandy plains.</p>
Great Desert Skink ( <i>Liopholis kintorei</i> )	VU	VU	<p>There are no known populations of this species proximate to the subject areas. However, field work in 2021 had limited amount of ground survey which would be required to detect species presence (i.e. burrow systems) the species occurs in tall open shrubland; and because there is suitable habitat present (hummock grasslands and on red sandplains and sand ridges), the species is considered to have potential to occur.</p>
Rainbow Valley Fuchsia Bush ( <i>Eremophila prostrata</i> )	VU	-	<p>This is a restricted range species (only know from a few locations that are 100km to the north of the Project).</p> <p>However, suitable habitat is present within the subject area so possibility of occurrence cannot be totally discounted without systematic survey (sandplains and lower dune slopes that support hummock grasses (<i>Triodia basedowii</i>), and a variety of shrubs and trees including <i>Grevillea</i>, <i>Hakea</i>, <i>Acacia</i>, and Desert Oaks).</p> <p>Ground checks at several sites during 2021 surveys did not detect the species (surveyor is familiar with species).</p>
Desert Quandong ( <i>Santalum acuminatum</i> )	-	VU	<p>Suitable habitat is present within subject areas; however, the species was not observed during surveys in these areas in 2021. It is considered to be unlikely to be present, and if present in the region be limited to mesa country located in the surrounding landscape.</p>

Species	EPBC	TPWC	Comment
Dwarf Desert Spike-rush ( <i>Eleocharis papillosa</i> )	VU	VU	Potentially suitable habitat within Coolabah swamps which are present within the subject areas (Subject Area C only). Field surveys in 2021 did not detect this species; however systematic targeted surveys during suitable conditions would be required to prove absence.
<i>Frankenia plicata</i>	EN	NL	Potentially suitable habitat is present within subject areas (swales and loamy depressions); however, species is not known to occur in the NT. Field surveys in 2021 did not record any Frankenia species. As such, it is considered to be highly unlikely that this species is present; however systematic targeted surveys would be required to prove absence (surveys for this species are not justified based on current data).
Great Knot ( <i>Calidris tenuirostris</i> )	-	VU	All these species are threatened migratory species that may utilise the Karinga Creek paleo-drainage system as migratory stop-over grounds, which falls within the Karinga Creek paleo-drainage system Site of Conservation Significance (SOCS).  No suitable habitat for these species is present within subject areas; they would flyover these areas on transit to preferred wetland habitat.  No drilling or land clearing works are proposed within 2km of migratory species habitat.  Existing access roads and tracks are planned to be used (for transit only) within the SOCS. None of these roads directly traverse migratory species habitat (i.e. ephemeral lakes, salt pans, clay pans); however, some are in close proximity (it is noted that these crossings are on the main Horseshoe Bend Station station road. A road crossing on Karinga creek crossed is also required at one point, which is on the main railway service road (large well established road). Karinga Creek is a major drainage and is linked to migratory species habitat.
Bar-tailed Godwit ( <i>Limosa lapponica</i> )	-	VU	
Eastern Curlew ( <i>Numenius madagascariensis</i> )	-	VU	
Asian Dowitcher ( <i>Limnodromus semipalmatus</i> )	-	VU	
Greater Sand Plover ( <i>Charadrius leschenaultii</i> )	-	VU	
Curlew Sandpiper ( <i>Calidris ferruginea</i> )	-	VU	

CR = Critically Endangered; EN = Endangered; VU = Vulnerable; DD = Data Deficient; NL = Not Listed

## 2.9 Migratory species

The EPBC Protected Matters Search Tool report (50km search radius) identified the possibility of migratory species protected under international agreements occurring within the region (see Table 2-3; EPBC report provided in Appendix B). All of the identified migratory species are considered to have a low likelihood of occurrence within the subject areas. Wetland species would be associated / occur within lake and paleo drainage systems of the Karinga SOCS (see Section 2.4) – which fall outside the subject areas; and the subject areas do not support any important or core habitat for marine and terrestrial species listed in Table 2-3.

No vegetation clearing is planned to occur within (at least) 2km of the migratory species habitat. Existing tracks and roads within the Karinga SOCS will be used for transiting to the subject areas – however, they do not require upgrades (or widening) for this project. As such, potential impacts will be limited to traffic related accidents (such as spills and leaks that could drain into and impact paleo drainage habitat).

**Table 2-3. EPBC listed migratory species that may occur in the region**

Common name	Scientific name	Migratory type	Presence in Australia
Fork-tailed Swift	<i>Apus pacificus</i>	Marine	Unpredictable between Oct to April
Grey Wagtail	<i>Motacilla cinerea</i>	Terrestrial	Outside known area; No suitable habitat
Yellow Wagtail	<i>Motacilla flava</i>	Terrestrial	No suitable habitat
Common Sandpiper	<i>Actitis hypoleucos</i>	Wetlands	Wetlands between June to August
Sharp-tailed Sandpiper	<i>Calidris acuminata</i>	Wetlands	Wetlands between Sept to April
Curlew Sandpiper	<i>Calidris ferruginea</i>	Wetlands	Wetlands between Sept to April
Pectoral Sandpiper	<i>Calidris melanotos</i>	Wetlands	Wetlands likely in summer months
Oriental Plover	<i>Charadrius veredus</i>	Wetlands	Wetlands during winter months
Oriental Pratincole	<i>Glareola maldivarum</i>	Wetlands	Wetlands between October to March

## 2.10 Weeds

The subject areas occur within the *Alice Springs Regional Weeds Strategy 2021-2026* (DEPWS 2021a). This strategy 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)
- *Category 4 – Hygiene and biosecurity weeds* (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* (potential to have a high level of impact 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 2-4.

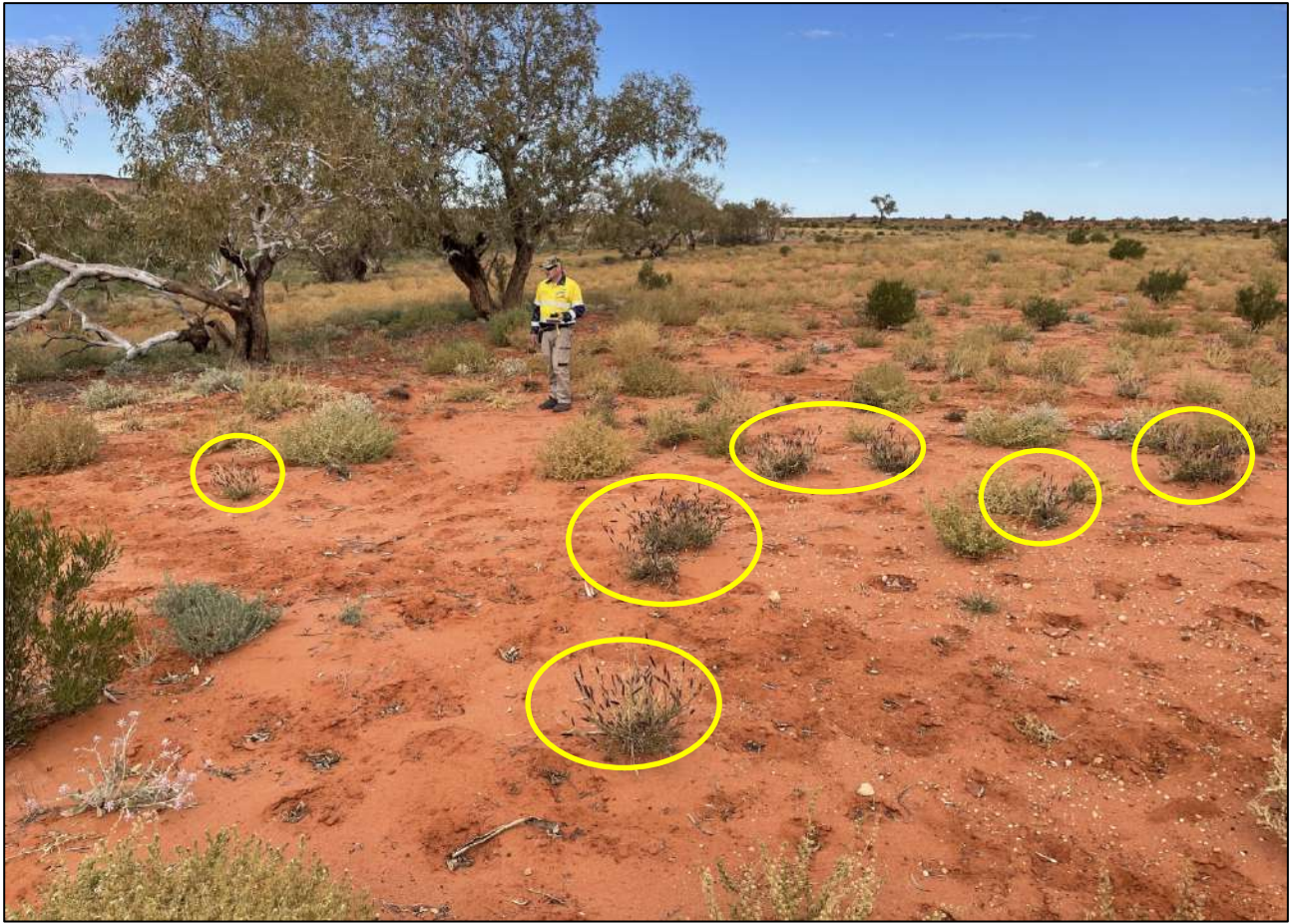
**Table 2-4. Weed species within the region of the subject areas**

Common name	Botanical name	Class	WoNS	Status in management plan
Rope Cactus	<i>Cylindropuntia spp. i</i>	A		Category 1, very high
Prickly Pears	<i>Opuntia spp.</i>	A		Category 1, very high
Athel Pine	<i>Tamarix aphylla</i>	A/B	Yes	Category 2, very high
Parkinsonia	<i>Parkinsonia aculeata</i>	B	Yes	Category 2, very high
Buffel Grass	<i>Cenchrus ciliaris</i>	Not declared		Category 2, very high
African Lovegrasses	<i>Eragrostis cilianensis</i> , <i>E. barreleri</i> , <i>E. cylindriflora</i> , <i>E. minor</i>	Not declared	No	Class 3, *medium
Mexican Poppy	<i>Argemone ochroleuca</i>	B	No	Class 3, medium
Kapok	<i>Aerva javanica</i>	Not declared	No	Class 3, N/A
Ruby Dock	<i>Acetosa vesicaria</i>	Not declared	No	Class 3, low
Saffron Thistle	<i>Carthamus lanatus</i>	B	No	Class 3, medium
Mossman River Grass	<i>Cenchrus echinatus</i>	B	No	Category 4, medium
Caltrop	<i>Tribulus terrestris</i>	B		Category 4, low

\*Only *Eragrostis cylindriflora* has been assessed for weed risk.

The baseline weed survey in June 2021 only identified one weed species at one location within the drilling subject areas – Buffel Grass (*Cenchrus ciliaris*) – which is a small patch on the edge of a Coolabah swamp within subject area C (latitude -25.184159 longitude 133.957304) (photograph of infestation in Figure 2-14; location shown in Figure 2-15). Buffel Grass is not declared under the *Weed Management Act* but it is considered as a Category 2 priority species in the *Alice Springs Regional Weeds Strategy 2021-2026* (DEPWS 2021a). Other weed species noted to occur in the surrounding region are Couch Grass (*Cynodon dactylon*) and Colocynthis (*Citrullus colocynthis*). Kapok (*Aerva javanica*) and Caltrop (*Tribulus terrestris*) are also known to occur in the surrounding region (based on NT Weeds Branch records, shown on Figure 2-15).

Athel Pine (*Tamarix aphylla*) was confirmed as present in existing borrow pits / dams on the western side of the railway, which falls outside but in relatively close proximity to drilling subject area A (location shown on Figure 2-15). The species is a Weed of National Significance and can be easily spread by vegetative growth, and must be avoided to avoid spread.

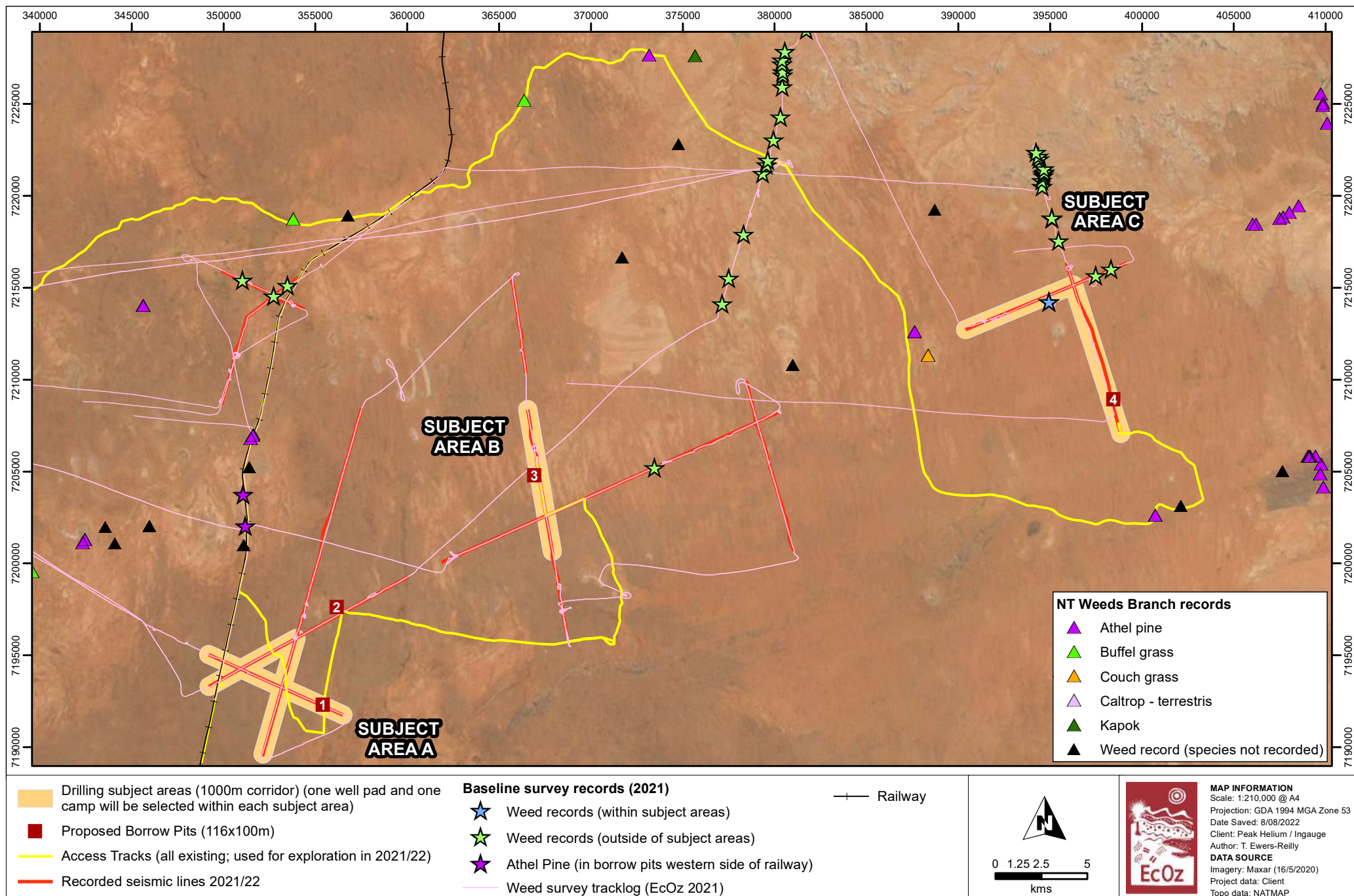


**Figure 2-14. Buffel grass infestation located within subject area C**

It is noted that the access tracks to be used for the drilling have not been ground surveyed, however, as these access roads are already established and will not require upgrades (i.e. widening); subsequently, the chance of weed spread is considered low (if vehicles stay to roads).

A Weed Management Plan has been developed for the drilling program and contains specific weed management control and mitigation measures, including the need for all vehicles, equipment and machinery to have a weed inspection prior to arriving on site.

Management of weeds is important, and when any new weed infestation is recorded, immediate control actions should be undertaken - ideally when plants are in growth phase.



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**Figure 2-15. Map showing baseline weed records within the drilling subject areas and surrounds (EcOz 2021), as well as records from the NT Weed Branch**

## 2.11 Land condition

As part of the previous ecological assessment, land condition as evaluated by ranking the level of impact of each survey sites based on condition rating described in Table 2-5. If a site was considered to align with two or more of the criteria within a row, it was assigned that value.

Of the nine sites surveyed within the subject areas, eight sites were rated as being in good condition and one site was rated to be in average condition (due to minor weed infestation described in Section 2.10). It is expected that the land condition will be impacted by cattle in some localised areas; however, the general condition of the sandplains and dunes (that are the most dominant landform group within the subject areas) currently has a low level of pastoral impacts.

The dataset used for this assessment is provided in Appendix A.

**Table 2-5. Ratings for the land condition assessment**

Condition	Vegetation	Erosion	Weeds	Cattle
<b>GOOD</b>	Vegetation structure intact, all expected layers present	No erosion	No weeds	Negligible impact
<b>AVERAGE</b>	Vegetation structure altered, basic vegetation structure present	Some erosion	Few weeds (including Buffel Grass)	Some impact
<b>POOR</b>	Vegetation structure severely impacted, some strata are absent	Significant erosion	Many weeds (including Buffel Grass)	Significant impact

## 3 CONCLUSION

### 3.1 Main findings

Summary maps that show the key ecological features within each subject areas are provided in Figure 3-1 (subject area A), Figure 3-2 (subject area B) and Figure 3-3 (subject area C). The main findings are as follows:

- Princess Parrot (Vulnerable TPWC Act and EPBC Act) may be present occasionally and could use Desert Oaks in the area for temporary nesting/roosting purposes. A few open stands of Desert Oak are present within subject areas B and C.
- There are several threatened species that are considered to have a low likelihood of occurrence; however survey evidence indicates that essential/critical habitat for these species is not present within the subject areas and it is unlikely that these species occupy these areas for breeding / roosting purposes – Grey Falcon, Night Parrot, Australian Painted Snipe, Greater Bilby, Crest-tailed Mulgara, Plains Mouse, Great Desert Skink, Rainbow Valley Fuchsia Bush, Desert Quandong, Dwarf-Desert Spike-rush, *Frankenia plicata*, Great Knot, Bar-tailed Godwit, Eastern Curlew, Asian Dowitcher, Greater Sand Plover and Curlew Sandpiper.
- No migratory species habitat is present within the subject areas; however, existing roads and tracks that are planned to be used for access traverse habitat that is linked to migratory habitat associated with the Karinga Creek palaeo drainage SOCS. This area may occasionally support EPBC listed migratory species Common Sandpiper, Sharp-tailed Sandpiper, Curlew Sandpiper, Pectoral Sandpiper, Oriental Plover and Oriental Pratincole. There are no plans for any land or vegetation clearing in these areas.
- Swamp habitat is present within Subject Area C, this is considered as sensitive habitat in the Northern Territory (i.e. wetlands). There are no other sensitive vegetation types (or habitat) present within the subject areas (according to the NT Land Clearing Guidelines, DEPWS 2021b).
- Sandplains, swales and loamy depressions do not hold special ecological value; however areas of denser vegetation (i.e. shrub thickets) and older (large) spinifex are expected to have local refugial values for a range of species.
- There are no drainage lines, creeks or rivers present within the subject areas. However, access to the subject areas do traverse drainages and creeks (including Karinga Creek) – these are all on existing roads that will not require any widening or vegetation clearing.
- The subject areas have a low incidence of weeds. No declared weeds were recorded within the subject areas. However, Buffel Grass (*Cenchrus ciliaris*) is present on the edge of a Coolabah swamp within subject area C and is considered as a priority species in the *Alice Springs Regional Weed Strategy 2021-26* (DEPWS 2021a). Buffel Grass is also present in the surrounding region.
- Several other priority weed species are known to occur in the region and controls should be in place to ensure these species are not accidentally introduced/spread by the project.
- Small sections of Subject Areas A, B and C intersect the Karinga Creek SOCS buffer areas. The subject areas do not intersect any SOBS.
- The proposed (four) borrow pits are located in flat loamy depressions situated within dune swales. These sites typically support an ephemeral forbland with absent to sparse shrubs, or occasional open Mulga (low probability of hollow bearing trees). This landform is not considered as sensitive habitat (as defined in the NT Land Clearing Guidelines 2021).

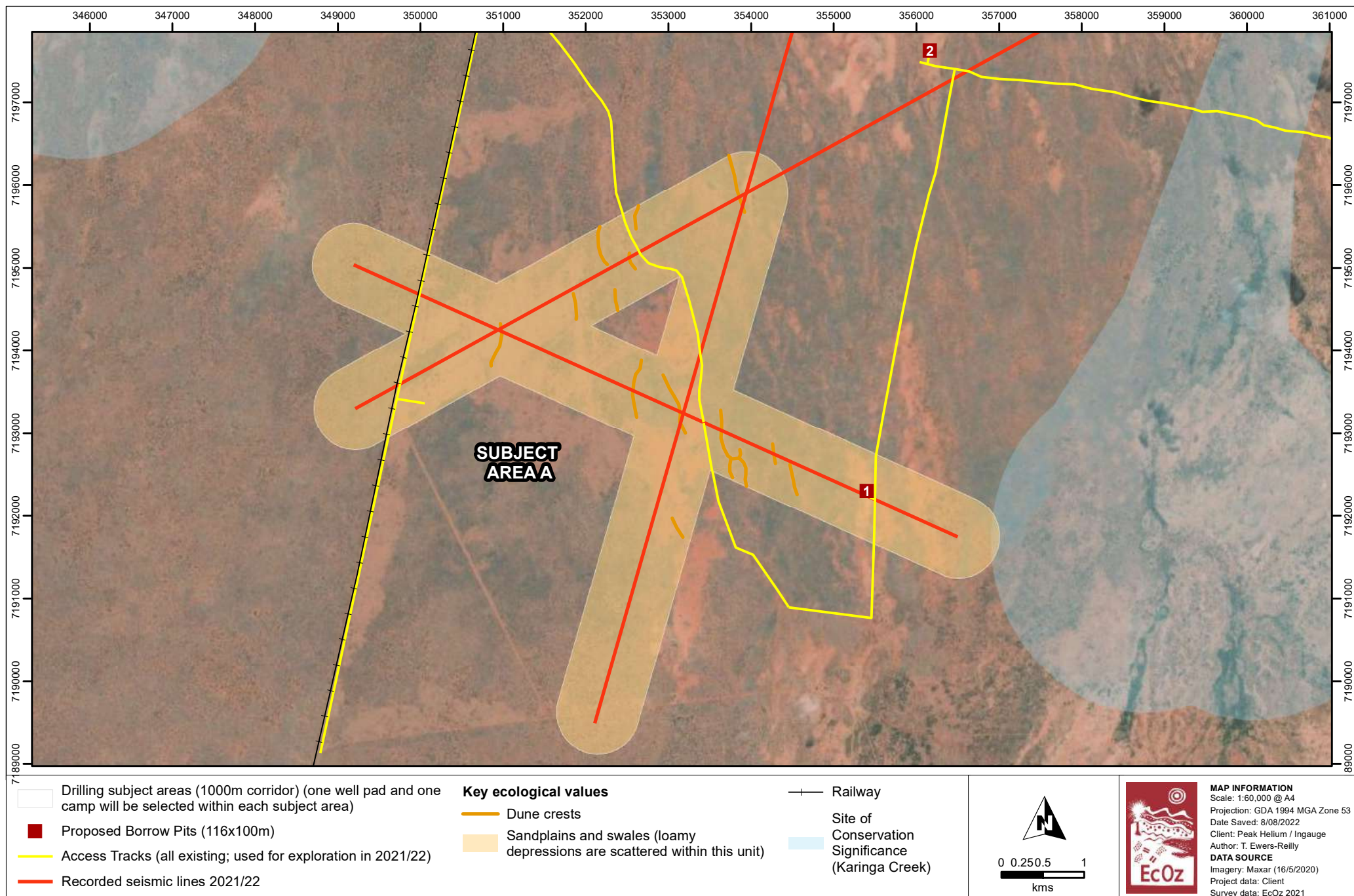
## 3.2 Recommendations

The following recommendations should be implemented to achieve minimum potential impact to key ecological values identified in this assessment:

- Do not conduct vegetation clearing or drilling within 2km of waterways or paleo drainage habitat associated with the Karinga Creek palaeo drainage SOCS.
- When using existing tracks and roads for transit through the SOCS; do not conduct any vegetation clearing or road widening activities and implement strict traffic controls to minimise chance of accidents that may lead to accidental contamination of significant habitat. This may involve reduced speed limits, signage, staff awareness via inductions, and appropriate spill control plan in the case of an incident.
- Do not impact any essential or important habitat for threatened species considered to potentially occur within the subject areas (species listed in Section 3.1). This should be confirmed by an ecologist during a pre-clearing survey. If threatened species are identified during pre clearing surveys, a general protection buffer of 300m will be applied from the burrow/nest/roost site.
- Avoid clearing or disturbance of large Desert Oak trees, or any large hollow bearing tree. This will minimise potential impacts to Princess Parrot nesting/roosting that may occasionally occur with the region. If a Princess Parrot nest/roost site is present, drilling activities should not occur within 300m. This should be confirmed by an ecologist during a pre-clearing survey.
- Drilling activities should avoid ephemeral swamps by at least 200m (only relevant to subject area C). This should be confirmed by an ecologist during a pre-clearing survey.
- Avoid disturbance of sand dunes (for biodiversity and general erosion reasons). This should be confirmed by an ecologist during a pre-clearing survey.
- Location of well pads, borrow pits, camps and associated connecting access tracks should be selected in swales, sandplains or open plains with lower vegetation cover (i.e. avoid patches of shrubs, small trees where possible). This will minimise overall impacts to ecological values in the area and will also likely result in more rapid rehabilitation success). This should be confirmed by an ecologist during a pre-clearing survey.
- Implement the project specific Weed Management Plan, specifically in relation to minimising spread of Buffel Grass and introducing other priority weeds to the area. This should involve a pre clearing survey to record existing weed infestations so that any infestation can either be avoided, or washdown / hygiene protocols implemented to minimise chance of spread. This should be undertaken by an ecologist during a pre-clearing survey.
- Implement a waste and Wastewater Management Plan to prevent attracting pest species that may prey on threatened fauna and alter habitat through grazing.

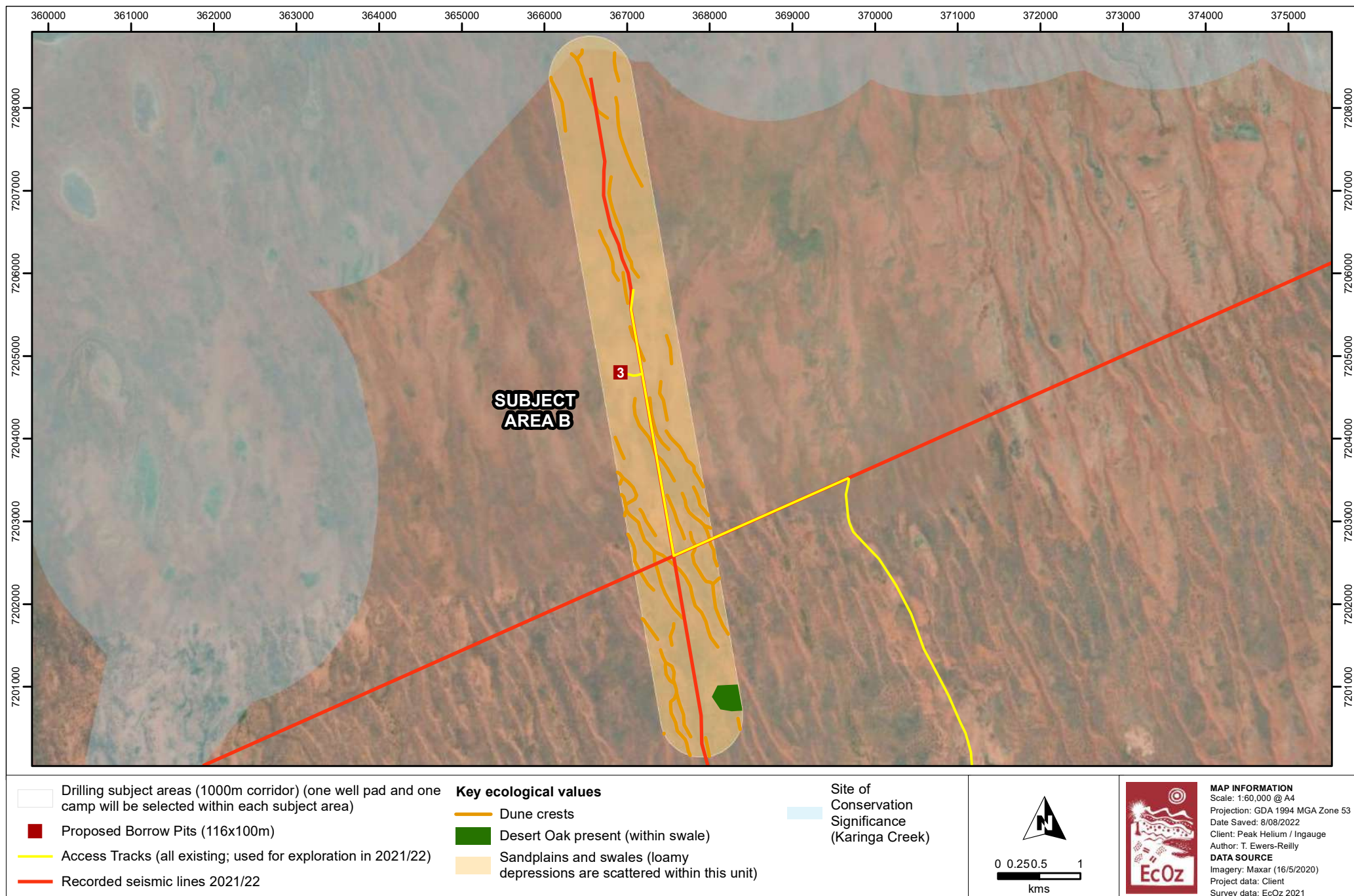
As mentioned in above recommendations, it is advised that pre-clearing surveys are conducted by a suitably qualified ecologist (at the site selection phase prior to land disturbance) to ensure that drilling program does impact threatened species, sensitive habitat or any other key ecological values that may occur in the area.

If the above recommendations cannot be achieved, the EMP will be required to provide reasoning why, and what measures will be in place to minimise impacts.



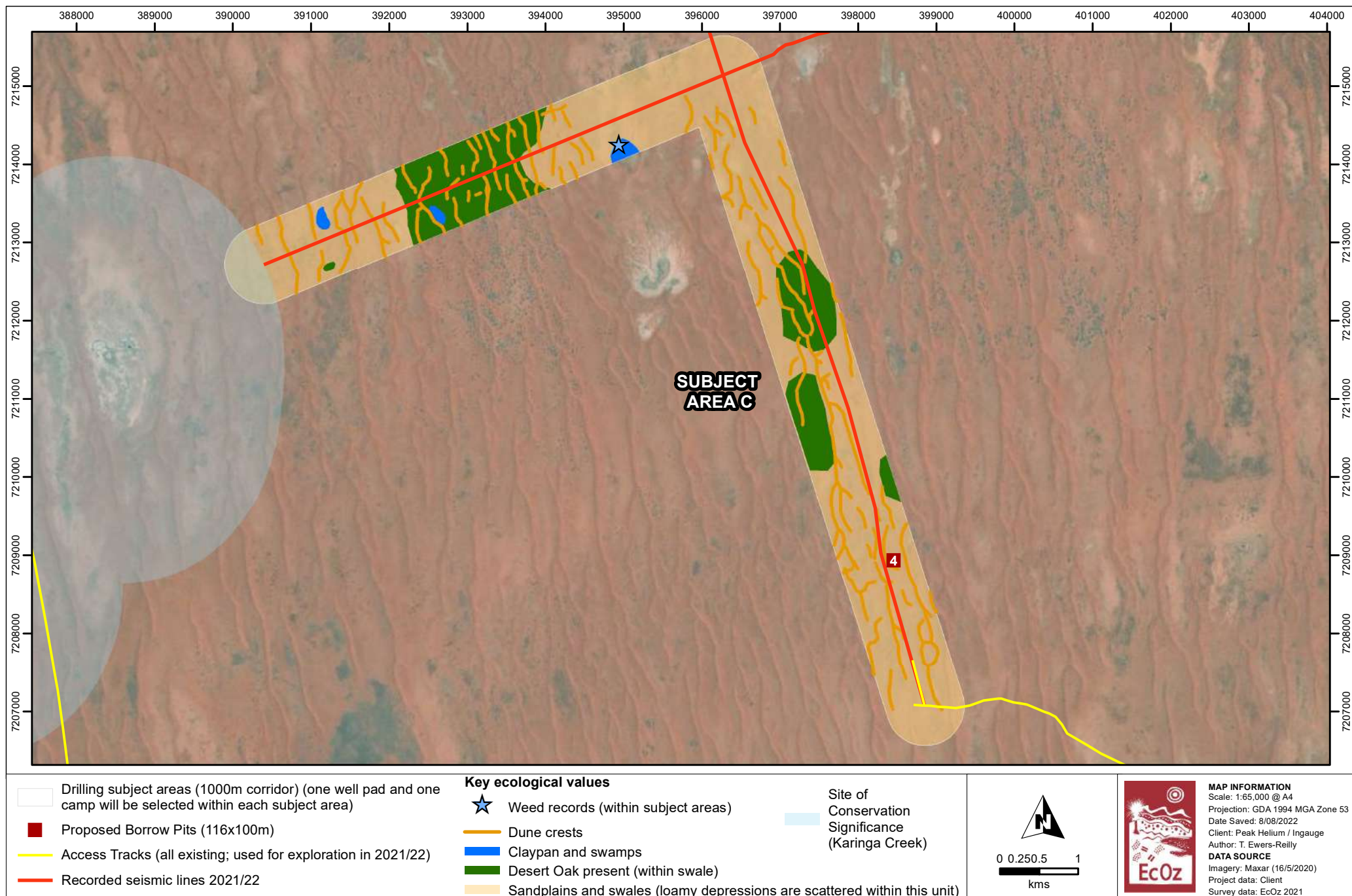
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**Figure 3-1. Map of key ecological values for Subject Area A**



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**Figure 3-2. Map of key ecological values for Subject Area B**



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**Figure 3-3. Map of key ecological values for Subject Area C**

## 4 REFERENCES

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## **APPENDIX A    FIELD SURVEY DATASET (JULY 2021) FOR SITES RELEVANT TO THE DRILLING SUBJECT AREAS**

**ECOLOGICAL SITES DATA FROM ECOZ 2021 (ONLY INCLUDING SITES WITHIN DRILLING SUBJECT AREAS)**

Site	Landform	Landform notes	Soil type	Surface rock	Vegetation structure	Species data	Weeds	Erosion	Cattle	Fuel load	Land condition	Other comments
1a	Swale	Some tall dunes nearby (10m)	red sand	None	Desert oak over Ptilotus polystachyus	<i>Allocasuarina decasneana</i> , <i>Ptilotus polystachyus</i> , <i>Calandrinia balonensis</i> , <i>Salsola tragus</i> , <i>Atalaya hemiglaucula</i> (isolated patch on adjacent steep dune)	None	None	Low	Low	Good	Avoid steep dunes where possible
2.3a	Seasonal swamp	Flat	Heavy clay	None	Coolabah on edge; forbs and daisies in swamp	<i>Eucalyptus coolabah</i> , <i>Rhodanthe charsleyae</i> , <i>Rhodanthe floribunda</i> , <i>Muehlenbeckia florulenta</i> , <i>Einadia nutans</i> , <i>Roepera</i> sp.	<i>Cenchrus ciliaris</i> (low; patchy on edge).	None	Low	Very low	Good, average on edge due to Buffel	Swamp is avoided. Important not to clear Coolabah trees
4.2a	Loamy depression	Flat	Clay loam	Scattered calcrete fragments	Forbs and tussocks	<i>Dissocarpus paradoxus</i> , <i>Roepera</i> sp., <i>Tragus australianus</i> , <i>Enneapogon cylindricus</i> , numerous other small forbs and daisies	None	None	Low	Very low	Good	
4.2b	Dune	low dune - 3m high	Sandy red earth	None	Open shrubland over sparse hummock grass	<i>Acacia ramulosa</i> , <i>Dodonaea viscosa</i> subsp. <i>angustissima</i> , <i>Acacia ligulata</i> , <i>Ptilotus polystachyus</i> , <i>Salsola tragus</i> , <i>Triodia basedowii</i> , <i>Calandrinia balonensis</i>	None	None	Low	Low	Good	
4.2c	Clay pan	Flat, run-on.	Clay, cracking, hard	None	High cover of forbs, and scattered tussocks and Mulga	<i>Acacia aneura</i> (4 - 7m, scattered), <i>Portulaca oleracea</i> , <i>Tribulus eichlerianus</i> (dom), <i>Swainsona</i> sp., <i>Cleome viscosa</i> , <i>Leucochrysum stipitatum</i>	None	None	Low	Very low	Good	
5a	Loamy depression	Flat	Sandy loam	Calcrete fragments	Forblands and tussocks	<i>Sclerolaena</i> sp. (dom) <i>Salsola tragus</i> , <i>Portulaca oleracea</i> , <i>Roepera</i> sp., daisies and forbs	None	None	Low	Very low	Good	

**ECOLOGICAL SITES DATA FROM ECOZ 2021 (ONLY INCLUDING SITES WITHIN DRILLING SUBJECT AREAS)**

Site	Landform	Landform notes	Soil type	Surface rock	Vegetation structure	Species data	Weeds	Erosion	Cattle	Fuel load	Land condition	Other comments
8e	Sandplain	Gently undulating	Sandy red earth	None	Open shrubland over hummock grass (recovering from fire)	<i>Acacia aneura</i> (<2m), <i>Dodonaea viscosa</i> subsp. <i>angustissima</i> , <i>Acacia ramulosa</i> , <i>Ptilotus polystachyus</i> (dominant). <i>Triodia basedowii</i> normally dominant but currently rare due to fire. Other species – <i>Abutilon</i> sp., <i>Eragrostis</i> , <i>Aristida holathera</i> , <i>Newcastelia spodioptricha</i> , <i>Calandrinia balonensis</i> , <i>Sida</i> sp., <i>Euphorbia tannensis</i> , <i>Eremophila longifolia</i> , <i>Monachather paradoxus</i>	None	None	Low	Very low	Good	Recovering from fire
8f	Loamy depression	Gentle; <2%	Clay loam	Calcrete fragments / gravel	Forblands and tussocks; scattered <i>Acacia aneura</i> (4 - 5m)	<i>Roepera</i> sp., <i>Abutilon</i> sp., <i>Sclerolaena</i> sp. (dom), <i>Eriachne aristidea</i> , <i>Enneapogon avenaceus</i> , <i>Ptilotus sessilifolius</i> , <i>Solanum</i> sp., <i>Swainsona</i> sp., small tussock grasses (maybe <i>Triraphis molle</i> )	None	None	Low	Very low	Good	
8g	Sandplain	Gently undulating	Sandy red earth	None	Low open shrubland over sparse hummock grass, tussocks and forbs	<i>Senna artemisioides</i> subsp. <i>filifolia</i> (1 - 1.5m), <i>Dodonaea viscosa</i> subsp. <i>angustissima</i> (2-3m), <i>Acacia ligulata</i> (2m), <i>Triodia basedowii</i> , <i>Calandrinia balonensis</i>	None	None	Low	Low	Good	

## **APPENDIX B   EPBC PROTECTED MATTERS SEARCH TOOL REPORT**



# 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. Please see the caveat for interpretation of information provided here.

Report created: 23-Nov-2022

[Summary](#)

[Details](#)

[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)

# Summary

## Matters of National Environment Significance

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

<a href="#">World Heritage Properties:</a>	None
<a href="#">National Heritage Places:</a>	None
<a href="#">Wetlands of International Importance (Ramsar</a>	None
<a href="#">Great Barrier Reef Marine Park:</a>	None
<a href="#">Commonwealth Marine Area:</a>	None
<a href="#">Listed Threatened Ecological Communities:</a>	None
<a href="#">Listed Threatened Species:</a>	16
<a href="#">Listed Migratory Species:</a>	9

## Other Matters Protected by the EPBC Act

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

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

A [permit](#) 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.

<a href="#">Commonwealth Lands:</a>	None
<a href="#">Commonwealth Heritage Places:</a>	None
<a href="#">Listed Marine Species:</a>	14
<a href="#">Whales and Other Cetaceans:</a>	None
<a href="#">Critical Habitats:</a>	None
<a href="#">Commonwealth Reserves Terrestrial:</a>	None
<a href="#">Australian Marine Parks:</a>	None
<a href="#">Habitat Critical to the Survival of Marine Turtles:</a>	None

## Extra Information

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

<a href="#">State and Territory Reserves:</a>	1
<a href="#">Regional Forest Agreements:</a>	None
<a href="#">Nationally Important Wetlands:</a>	None
<a href="#">EPBC Act Referrals:</a>	3
<a href="#">Key Ecological Features (Marine):</a>	None
<a href="#">Biologically Important Areas:</a>	None
<a href="#">Bioregional Assessments:</a>	1
<a href="#">Geological and Bioregional Assessments:</a>	None

# Details

## Matters of National Environmental Significance

Listed Threatened Species

[ Resource Information ]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.  
Number is the current name ID.

Scientific Name

Threatened Category

Presence Text

Buffer Status

BIRD

[Amytornis modestus](#)

Thick-billed Grasswren [84121]

Vulnerable

Species or species habitat likely to occur within area

In feature area

[Calidris ferruginea](#)

Curlew Sandpiper [856]

Critically Endangered

Species or species habitat may occur within area

In feature area

[Falco hypoleucos](#)

Grey Falcon [929]

Vulnerable

Species or species habitat known to occur within area

In feature area

[Pedionomus torquatus](#)

Plains-wanderer [906]

Critically Endangered

Species or species habitat may occur within area

In buffer area only

[Pezoporus occidentalis](#)

Night Parrot [59350]

Endangered

Species or species habitat may occur within area

In feature area

[Polytelis alexandrae](#)

Princess Parrot, Alexandra's Parrot [758]

Vulnerable

Species or species habitat known to occur within area

In feature area

[Rostratula australis](#)

Australian Painted Snipe [77037]

Endangered

Species or species habitat may occur within area

In feature area

MAMMAL

[Petrogale lateralis centralis](#)

Warru, Central Australian Rock-wallaby [90831]

Vulnerable

Species or species habitat may occur within area

In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
<a href="#">Pseudomys australis</a> Plains Rat, Palyoora, Plains Mouse [108]	Vulnerable	Species or species habitat known to occur within area	In feature area
<a href="#">Sminthopsis psammophila</a> Sandhill Dunnart [291]	Endangered	Species or species habitat may occur within area	In feature area
<a href="#">Zyzomys pedunculatus</a> Central Rock-rat, Antina [68]	Critically Endangered	Species or species habitat may occur within area	In buffer area only

PLANT			
<a href="#">Acacia latzii</a> Latz's Wattle [14275]	Vulnerable	Species or species habitat known to occur within area	In feature area
<a href="#">Frankenia plicata</a> [4225]	Endangered	Species or species habitat likely to occur within area	In feature area

REPTILE			
<a href="#">Liopholis kintorei</a> Great Desert Skink, Tjakura, Warrarna, Mulyamiji [83160]	Vulnerable	Species or species habitat may occur within area	In feature area
<a href="#">Liopholis slateri slateri</a> Slater's Skink, Floodplain Skink [83163]	Endangered	Species or species habitat may occur within area	In feature area
<a href="#">Ophidiocephalus taeniatus</a> Bronzeback Snake-lizard [1630]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only

Listed Migratory Species [ <a href="#">Resource Information</a> ]			
Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Migratory Terrestrial Species			
<a href="#">Motacilla cinerea</a> Grey Wagtail [642]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
<a href="#">Motacilla flava</a> Yellow Wagtail [644]		Species or species habitat may occur within area	In feature area
Migratory Wetlands Species			
<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
<a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
<a href="#">Charadrius veredus</a> Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area	In feature area
<a href="#">Glareola maldivarum</a> Oriental Pratincole [840]		Species or species habitat may occur within area	In feature area

### Other Matters Protected by the EPBC Act

Listed Marine Species	[ Resource Information ]		
Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
<a href="#">Bubulcus ibis as Ardea ibis</a> Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In buffer area only
<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area
<a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
<a href="#">Chalcites osculans as Chrysococcyx osculans</a> Black-eared Cuckoo [83425]		Species or species habitat known to occur within area overfly marine area	In feature area
<a href="#">Charadrius veredus</a> Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area overfly marine area	In feature area
<a href="#">Glareola maldivarum</a> Oriental Pratincole [840]		Species or species habitat may occur within area overfly marine area	In feature area
<a href="#">Merops ornatus</a> Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
<a href="#">Motacilla cinerea</a> Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
<a href="#">Motacilla flava</a> Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area	In feature area
<a href="#">Neophema chrysostoma</a> Blue-winged Parrot [726]		Species or species habitat may occur within area overfly marine area	In buffer area only
<a href="#">Rostratula australis as Rostratula benghalensis (sensu lato)</a> Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area overfly marine area	In feature area

### Extra Information

State and Territory Reserves			<a href="#">[ Resource Information ]</a>
Protected Area Name	Reserve Type	State	Buffer Status
Chamber's Pillar	Historical Reserve	NT	In buffer area only

EPBC Act Referrals			<a href="#">[ Resource Information ]</a>	
Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Controlled action				
<a href="#">Tellus Chandler Salt Mine Project</a>	2012/6684	Controlled Action	Post-Approval	In buffer area only
Not controlled action				
<a href="#">Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia</a>	2015/7522	Not Controlled Action	Completed	In feature area
Not controlled action (particular manner)				
<a href="#">Waterhouse Range seismic survey</a>	2006/3130	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only

Bioregional Assessments			
SubRegion	BioRegion	Website	Buffer Status
Pedirka	Lake Eyre Basin	<a href="#">BA website</a>	In buffer area only

# Caveat

## 1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

## 2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

## 3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and 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

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

Where little information is available for a 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 detailed distribution mapping methods are used to update these distributions

## 4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

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

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

# Acknowledgements

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

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

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Please feel free to provide feedback via the [Contact us](#) page.

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## APPENDIX C THREATENED SPECIES LIKELIHOOD OF OCCURRENCE ASSESSMENT

The threatened species 'likelihood of occurrence' assessment was undertaken using available desktop information and field survey data by EcOz in June 2021 for the three subject areas related to the proposed drilling program. 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 the subject areas. *This is not a risk assessment as it does not take into account project activities and potential impacts (this will be covered in the project specific EMP).*

### Categories

This assessment focuses on species that are listed as Vulnerable, Endangered or Critically Endangered under either the *Territory Parks and Wildlife Conservation Act (TPWC Act)* or the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*. The *EPBC Act* also protects important habitat for, and significant occurrences of, migratory species.

### Procedure

The following procedure was used to determine which species have the potential to occur in the region:

- Species records from the latest version of the [NT Atlas](#) were clipped to the Finke bioregion. 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.
- [EPBC Protected Matters Search Tool](#) (PMST) was used to generate a report using a 50 km buffer from the subject areas. This PMST is an online enquiry tool managed by the Commonwealth Department of the Environment and Energy 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 was generated on 9 June 2022 (Appendix B).
- For each threatened species, the likelihood of it occurring within the subject areas was then assessed based on desktop information that relates to habitat requirements, distribution, number and dates of proximate records (obtained from NT Atlas and/or [Atlas of Living Australia](#)), the ecological information described in Section 2, and the field survey results presented in EcOz 2021. Likelihood ratings are defined in Table 4-1.

**Ratings for the desktop threatened species likelihood of occurrence assessment**

Likelihood	Definition
HIGH	It is expected that this species occurs within the subject areas because there is core habitat and recent (post-2000) proximate records or knowledge that the species occurs in the local area.
MEDIUM	Species may occur within the subject areas 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 within or close to the subject areas, substantial loss of habitat within the subject areas since previous records, species is naturally-rare or occurs at a low density etc.).
LOW	Species may occur, as a vagrant, within the subject areas; only marginally-suitable habitat is expected.
NONE	There is strong evidence that this species will not occur within the subject areas (i.e. there is no suitable habitat and/or the species is considered to be regionally-extinct).

# DESKTOP THREATENED SPECIES LIKELIHOOD OF OCCURRENCE

Name	Status		Summary	Likelihood of occurrence
	Cth	NT		
BIRDS				
Thick-billed Grasswren (north-west subspecies) <i>Amytornis modestus indulkana</i>	-	CR	<b>Habitat:</b> Chenopod shrublands dominated by <i>Atriplex</i> saltbush and <i>Maireana</i> bluebush. The Charlotte Waters' population is located along drainage lines dominated by <i>Atriplex nummularia</i> (Pavey & Ward 2002). <b>Distribution:</b> West of Lake Eyre and Lake Torrens near the border of SA and the NT (Black 2011). In 1994, recorded south of Charlotte Waters in the southern NT. <i>Amytornis modestus</i> was formerly present in the Finke River system but is now considered extinct (Pavey & Ward 2002).	<b>NONE</b> <ul style="list-style-type: none"><li>Species considered extinct within the region.</li></ul>
			Black, A.B. (2011). <i>Subspecies of the Thick-billed Grasswren Amytornis modestus (Aves-Maluridae)</i> . Transactions of the Royal Society of South Australia 135, 26–38. Pavey, C. and Ward, S. (2012). <i>Threatened Species of the Northern Territory - Thick-Billed Grasswren (north-western subspecies) - Amytornis modestus indulkana</i> . Northern Territory Department of Environment and Natural Resources. [online] Available at: <a href="https://nt.gov.au/_data/assets/pdf_file/0004/206338/thick-billed-grasswren-north-western-subspecies.pdf">https://nt.gov.au/_data/assets/pdf_file/0004/206338/thick-billed-grasswren-north-western-subspecies.pdf</a> [Accessed 1 May 2018].	
Grey Falcon <i>Falco hypoleucos</i>	-	VU	<b>Habitat:</b> 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). <b>Distribution:</b> 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).	<b>LOW</b> <ul style="list-style-type: none"><li>Limited habitat present within subject areas.</li><li>Recent records within bioregion.</li><li>If present, would only be expected to be flyover / hunting; not nesting.</li><li>Larger trees that are preferred by the species (often on the banks of major watercourses and creeks) are not present within the subject areas.</li></ul>
			Schoenjahn, J. (2013), A hot environment and one type of prey: investigating why the Grey Falcon ( <i>Falco hypoleucos</i> ) 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: <a href="https://nt.gov.au/_data/assets/pdf_file/0020/206354/grey-falcon.pdf">https://nt.gov.au/_data/assets/pdf_file/0020/206354/grey-falcon.pdf</a> [Accessed 1 May 2018].	
Malleefowl <i>Leipoa ocellata</i>	VU	CR	<b>Habitat:</b> Occupies woodland, shrubland and scrub and favours areas with shrubby understorey. Strongly associated with mallee in most parts of its range. In arid Australia, occupies mulga scrub, either pure stands or mixed with mallee (Pavey 2006). <b>Distribution:</b> In the NT, has been recorded mostly west of the Stuart Highway and south of the Tanami Desert, with no records since the early 1960's (Benshemesh 2000). Storr (1977) located nine records from the	<b>NONE</b> <ul style="list-style-type: none"><li>Only historical records within close proximity to subject areas.</li><li>Resumed to be existing in the region.</li><li>Limited suitable habitat present within subject areas.</li></ul>

**DESKTOP THREATENED SPECIES LIKELIHOOD OF OCCURRENCE**

Name	Status		Summary	Likelihood of occurrence
	Cth	NT		
			<p>south-west corner of the NT, from the Petermann Range in the extreme south-west, north across the MacDonnell Ranges as far as Central Mount Wedge.</p> <p>Benshemesh, J. (2000). <i>National Recovery Plan for the Malleefowl</i>. National Parks and Wildlife South Australia, Adelaide.</p> <p>Pavey, C. (2006). <i>Threatened Species of the Northern Territory – Malleefowl - Leipoa ocellata</i>. Northern Territory Department of Environment and Natural Resources. [online] Available at: <a href="https://nt.gov.au/_data/assets/pdf_file/0005/206339/malleefowl.pdf">https://nt.gov.au/_data/assets/pdf_file/0005/206339/malleefowl.pdf</a> [Accessed 1 May 2018].</p> <p>Storr, G.M. (1977). <i>Birds of the Northern Territory</i>. Western Australian Museum, Perth.</p>	
<b>Plains-wanderer</b> <i>Pedionomus torquatus</i>	CR	-	<p><b>Habitat:</b> Sparse and treeless lowland native grasslands, supported by hard red-brown clay soils that do not support dense pasture growth. Records from amongst crops of cereal grasses, stubble and chenopod shrublands (DoE 2016).</p> <p><b>Distribution:</b> Population is highly fragmented within south-eastern Australia. No confirmed records in the NT (DoE 2016).</p>	<b>NONE</b> <ul style="list-style-type: none"> <li>• No suitable habitat present within subject areas.</li> <li>• No confirmed records within region.</li> </ul>
			<p>Department of the Environment (2016). <i>Pedionomus torquatus</i>. Species Profile and Threats Database, Department of the Environment, Australian Government, Canberra. [online] Available at: <a href="http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=906">http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=906</a> [Accessed 1 May 2018].</p>	
<b>Night Parrot</b> <i>Pezoporus occidentalis</i>	EN	CR	<p><b>Habitat:</b> Flat spinifex (<i>Triodia</i> spp.) grasslands in stony or sandy environments; and samphire and chenopod shrublands – including genera such as <i>Atriplex</i>, <i>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).</p> <p><b>Distribution:</b> 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.</p>	<b>LOW</b> <ul style="list-style-type: none"> <li>• Limited suitable nesting and feeding habitat present within subject areas. There are no large patches of spinifex hummocks within subject areas, and spinifex grasslands are under stress and in poor condition due to drought. Additional, the spinifex species (<i>Triodia basedowii</i>) present is not the same species where Night Parrot nesting is typically present (<i>Triodia longiceps</i>).</li> <li>• Two records within the greater bioregion, one within close proximity to the subject areas – however, records are historic (1929).</li> </ul>
			<p>Department of the Environment (2017). <i>Pezoporus occidentalis</i>. Species Profile and Threats Database. Department of the Environment, Canberra. [online] Available at: <a href="http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=59350">http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=59350</a> [Accessed 1 May 2018].</p> <p>Whitlock, F.L. (1924). Journey to central Australia in search of the night parrot. <i>Emu</i>, Vol. 23, pp. 248-281.</p>	

# DESKTOP THREATENED SPECIES LIKELIHOOD OF OCCURRENCE

Name	Status		Summary	Likelihood of occurrence
	Cth	NT		
<b>Princess Parrot</b> <i>Polytelis alexandrae</i>	VU	VU	<p><b>Habitat:</b> Swales between desert sand dunes with a shrub layer and scattered trees (Pavey 2006). The Princess Parrot nests in hollows or holes in Eucalyptus trees (including <i>E. gongylocarpa</i>, <i>E. camaldulensis</i>), or occasionally in <i>Allocasuarina decasneana</i> trees away from water.</p> <p><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.'</p>	<p><b>MEDIUM</b></p> <ul style="list-style-type: none"> <li>Some suitable habitat present within subject areas.</li> <li>Recent records found within the bioregion, including nearby to the subject areas.</li> <li>Subject areas are in proximity to mapped 'likely' habitat (as mapped by SPRAT).</li> <li>Desert Oak are present in some areas (these trees can provide suitable nesting habitat but are widespread across the region). These trees are can be easily avoided as they are widely spaced (i.e. sparse woodland).</li> </ul>
			<p>Barrett, G. Silcocks, A. Barry, S. Cunningham, R. and Poulter, R. (2003). <i>The New Atlas of Australian Birds</i>, Birds Australia, Melbourne, Victoria.</p> <p>Blakers, M. Davies S.J.J.F. and Reilly P.N. (1984). <i>The Atlas of Australian Birds</i>. Melbourne, Victoria: Melbourne University Press.</p> <p>Britton, P.L. (1992). The Queensland Ornithological Society Bird Report, <i>Sunbird</i>, 22:51-83.</p> <p>Department of the Environment (2017). <i>Polytelis alexandrae</i>. Species Profile and Threats Database. Department of the Environment, Canberra. [online] Available at: <a href="http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=758">http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=758</a> [Accessed 1 May 2018].</p> <p>Higgins, P.J. (ed.) (1999). <i>Handbook of Australian, New Zealand and Antarctic Birds</i>. Volume 4: Parrots to Dollarbird, Oxford University Press, Melbourne, Victoria.</p> <p>Pavey, C. (2006). <i>Threatened Species of the Northern Territory - Princess Parrot - Polytelis alexandrae</i>. Northern Territory Department of Environment and Natural Resources. [online] Available at: <a href="https://nt.gov.au/data/assets/pdf_file/0017/206360/princess-parrot.pdf">https://nt.gov.au/data/assets/pdf_file/0017/206360/princess-parrot.pdf</a> [Accessed 1 May 2018].</p>	
<b>Red Goshawk</b> <i>Erythrorhynchus radiatus</i>	VU	VU	<p><b>Habitat:</b> 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).</p> <p><b>Distribution:</b> 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).</p>	<p><b>NONE</b></p> <ul style="list-style-type: none"> <li>Outside of currently known distribution.</li> <li>Records in central Australia are rarely encountered and likely to be only vagrants.</li> <li>Field survey confirmed there is no nesting habitat present within the subject areas that would be specifically targeted/utilised by Red Goshawk.</li> <li>If present within the region, only expected to be a vagrant and there is no indication that habitat within the subject areas would be specifically important to this species.</li> </ul>
			<p>Aumann, T. and Baker-Gabb, D. (1991). A Management Plan for the Red Goshawk. RAOU Report 75, Royal Australasian Ornithologists Union, Melbourne.</p>	

# DESKTOP THREATENED SPECIES LIKELIHOOD OF OCCURRENCE

Name	Status		Summary	Likelihood of occurrence
	Cth	NT		
			<p>Czechura G.V. and Hobson R.G. (2000). The Red Goshawk <i>Erythrotriorchis radiatus</i> in northern Queensland: status and distribution. Report to Queensland Parks and Wildlife Service.</p> <p>Czechura G.V. (2001). The status and distribution of the Red Goshawk <i>Erythrotriorchis radiatus</i> on Cape York Peninsula, Queensland. Unpublished report to Birds Australia.</p> <p>Debus, S. and Czechura, G. (1988). Field identification of the Red Goshawk <i>Erythrotriorchis radiatus</i>. Australian Bird Watcher, Vol. 12, pp. 154-159.</p> <p>Debus, S. (1998). The Birds of Prey of Australia. Oxford University Press, Melbourne.</p> <p>Department of the Environment (2022). <i>Erythrotriorchis radiatus</i> in Species Profile and Threats Database, Department of the Environment, Canberra. Available at: <a href="http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=942">http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=942</a> [Accessed 27 Jan 2022]</p> <p>Woinarski, J. (2006). Threatened Species of the Northern Territory - Red Goshawk - <i>Erythrotriorchis radiatus</i>. Northern Territory Department of Environment and Natural Resources. [online] Available at: <a href="https://nt.gov.au/_data/assets/pdf_file/0018/206352/red-goshawk.pdf">https://nt.gov.au/_data/assets/pdf_file/0018/206352/red-goshawk.pdf</a> [Accessed 1 May 2018].</p>	
<b>Australian Painted-snipe</b> <i>Rostratula australis</i>	EN	EN	<p><b>Habitat:</b> Fringes of permanent and temporary wetlands, swamps and inundated grasslands (Taylor et al. 2013).</p> <p><b>Distribution:</b> 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).</p>	<p><b>LOW</b></p> <ul style="list-style-type: none"> <li>Potentially suitable habitat within Coolabah swamps that occur within the subject areas; however, swamps will be avoided by the drilling program by at least 200m.</li> <li>No previous records of the species in the region.</li> </ul>
			<p>Garnett, S.T., Szabo, J.K. and Dutson, G. (2011). <i>The Action Plan for Australian Birds 2010</i>. CSIRO Publishing. Collingwood, Australia.</p> <p>Rogers, D. (2001). Painted Snipe. <i>Wingspan</i>, Vol. 11 (No. 4), pp. 6-7.</p> <p>Taylor, R., Chatto, R. and Woinarski, J.C.Z. (2013). <i>Threatened Species of the Northern Territory - Australian painted snipe - Rostratula australis</i>. Northern Territory Department of Environment and Natural Resources. [online] Available at: <a href="https://nt.gov.au/_data/assets/pdf_file/0018/206361/australian-painted-snipe.pdf">https://nt.gov.au/_data/assets/pdf_file/0018/206361/australian-painted-snipe.pdf</a> [Accessed 1 May 2018].</p>	
<b>Great Knot</b>  <b>Bar-tailed Godwit</b>  <b>Eastern Curlew</b>  <b>Asian Dowitcher</b>  <b>Greater Sand Plover</b>	-	VU	<p><b>Habitat:</b> Coastal and estuarine areas with tidal mudflats. May roost during high tide on nearby beaches. May also be found at near-coastal swamps and lakes (apart from Red and Great Knot)</p> <p><b>Distribution:</b> Mostly widespread around the northern Australian coast, less common in the south, with few inland records. Eastern Curlew is uncommon across Australia while Asian Dowitcher is rare. Every year these species breed in the northern hemisphere in the summer, and migrate to Australia for the southern hemisphere (austral) summer. Some birds, primarily juveniles, remain in Australia during the winter.</p> <p>[Information above summarised from Chatto (2003), DoE (2015) and Garnett et al. (2011)].</p>	<p><b>LOW</b></p> <ul style="list-style-type: none"> <li>No suitable habitat present within subject areas.</li> <li>All species prefer a coastal habitat to an inland regions but may utilise the Karinga Creek paleo-drainage system as migratory stop-over grounds.</li> <li>No drilling or land clearing works are proposed within 2km of this paleo-drainage system. However, existing access roads and tracks are planned to be used (for transit only) within the SOCS which the paleo-drainage system occurs.</li> <li>Limited historical records of all species.</li> <li>Low records for Greater Sand Plover and Curlew Sandpiper.</li> </ul>

# DESKTOP THREATENED SPECIES LIKELIHOOD OF OCCURRENCE

Name	Status		Summary	Likelihood of occurrence
	Cth	NT		
<b>Curlew Sandpiper</b>			<p>Chatto, R. (2003). <i>The distribution and status of shorebirds around the coast and coastal wetlands of the Northern Territory</i>. Technical Report 73, Parks and Wildlife Commission of the Northern Territory, Darwin. [online] Available at: <a href="https://dtc.nt.gov.au/_data/assets/pdf_file/0008/279917/2003_shorebirds_rpt76.pdf">https://dtc.nt.gov.au/_data/assets/pdf_file/0008/279917/2003_shorebirds_rpt76.pdf</a> [Accessed 1 May 2018].</p> <p>Department of the Environment (2015). <i>EPBC Act Policy Statement 3.21 - Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species</i>. Commonwealth of Australia, Canberra, ACT. <a href="http://www.environment.gov.au/epbc/publications/shorebirds-guidelines">http://www.environment.gov.au/epbc/publications/shorebirds-guidelines</a> [Accessed 1 May 2018].</p> <p>Garnett, S.T., Szabo, J.K. and Dutson, G. (2011). <i>The Action Plan for Australian Birds 2010</i>. CSIRO Publishing. Collingwood, Australia.</p>	
<b>MAMMALS (TERRESTRIAL)</b>				
<b>Crest-tailed Mulgara</b> <i>Dasycercus cristicauda</i>	-	VU	<p><b>Habitat:</b> Prefers sand dune habitats that are vegetated with cane grass and spinifex (Masters 1997).</p> <p><b>Distribution:</b> Due to considerable taxonomic confusion the exact distribution of this species and <i>D. blythi</i> is not well known in the NT. The majority of the records are from the southern Simpson Desert with confirmed historical records from Charlotte Waters and Crown Point in the NT (Pavey et al. 2006).</p>	<p><b>LOW</b></p> <ul style="list-style-type: none"> <li>• Suitable habitat present within subject area; however, preferred habitat (i.e. dunes) will be avoided,</li> <li>• Recorded sightings nearby to the subject area.</li> <li>• Most sightings are to the south-east of the subject area.</li> <li>• Ground surveys 2021 did not find any suspected burrows, tracks or scats for this species.</li> </ul>
			<p>Masters, P. (1997). <i>Interim recovery plan for Ampurta Dasycercus hillieri</i>. Report to ANCA Endangered Species Program.</p> <p>Pavey, C., Cole, J. and Woinarski, J.C.Z. (2006). <i>Threatened Species of the Northern Territory - Crest-tailed Mulgara - Dasycercus cristicauda</i>. Northern Territory Department of Environment and Natural Resources. [online] Available at: <a href="https://nt.gov.au/_data/assets/pdf_file/0015/205512/crest-tailed-mulgara.pdf">https://nt.gov.au/_data/assets/pdf_file/0015/205512/crest-tailed-mulgara.pdf</a> [Accessed 1 May 2018].</p>	
<b>Greater Bilby</b> <i>Macrotis lagotis</i>	VU	VU	<p><b>Habitat:</b> In the NT, occurs in hummock grasslands on sandy soils with a preference for paleo-drainage lines (Southgate 1990). Has large foraging area and will move home range in search for food (Johnson 2008).</p> <p><b>Distribution:</b> Historically widespread in arid Australia. Currently confined to arid WA, the Tanami Desert in the NT and south-western Qld (Woinarski et al. 2014).</p>	<p><b>LOW</b></p> <ul style="list-style-type: none"> <li>• Suitable habitat present within subject areas.</li> <li>• Recent and historical records of presence of species within the bioregion, surrounding the subject areas.</li> <li>• Population range is located within the west of the bioregion, not in close proximity to subject areas.</li> </ul>
			<p>Johnson, K.A. (2008). Bilby <i>Macrotis lagotis</i>. In: Van Dyck, S. and Strahan, R. (eds.). <i>Mammals of Australia</i>. Third Edition. Reed New Holland, Queensland Government, Queensland Museum: pp. 191-193.</p> <p>Southgate, R. (1990). Habitat and diet of the greater bilby <i>Macrotis lagotis</i> Reid (Marsupalia: Peramelidae). In: Seebeck et al. (eds.). <i>Bandicoots and Bilbies</i>. Surrey Beatty &amp; Sons, Sydney, NSW.</p> <p>Woinarski, J., Burbidge, A. and Harrison, P. (2014). <i>The Action Plan for Australian Mammals 2012</i>. CSIRO Publishing: pp. 203-205.</p>	

# DESKTOP THREATENED SPECIES LIKELIHOOD OF OCCURRENCE

Name	Status		Summary	Likelihood of occurrence
	Cth	NT		
<b>Black-footed Rock-wallaby (McDonnell Ranges race)</b> <i>Petrogale lateralis</i>	VU	-	<p><b>Habitat:</b> 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).</p> <p><b>Distribution:</b> 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.</p>	<p><b>NONE</b></p> <ul style="list-style-type: none"> <li>No suitable habitat present within subject areas.</li> </ul>
<p>Pavey, C. (2006). <i>Threatened Species of the Northern Territory - Black-footed Rock-Wallaby - Petrogale lateralis</i>. Northern Territory Department of Environment and Natural Resources. [online] Available at: <a href="https://nt.gov.au/data/assets/pdf_file/0003/376122/black-footed-rock-wallaby.pdf">https://nt.gov.au/data/assets/pdf_file/0003/376122/black-footed-rock-wallaby.pdf</a> [Accessed 1 May 2018].</p> <p>Woinarski, J., Burbidge, A. and Harrison, P. (2014). <i>The Action Plan for Australian Mammals 2012</i>. CSIRO Publishing: pp. 403-405.</p>				
<b>Plains Mouse (NT)</b> <b>Plains Rat (Cth)</b> <i>Pseudomys australis</i>	VU	EN	<p><b>Habitat:</b> Open plains especially stone-covered plains. Prefers areas associated with minor drainage features and cracking soil (clay) (Pavey &amp; Cole 2012). Most commonly found in areas that are regularly inundated (DoE 2017).</p> <p><b>Distribution:</b> Formerly throughout arid and semi- arid Australia, now restricted to northern SA and the extreme south of the NT – nearby to Charlotte Waters and to the south-east of Andado station (including the Mac Clark Conservation Reserve) (Pavey &amp; Cole 2012).</p>	<p><b>LOW</b></p> <ul style="list-style-type: none"> <li>Suitable habitat may be present within subject areas.</li> <li>Recent and historical recorded sightings nearby to the subject areas.</li> <li>Species is noted to be restricted outside of subject areas.</li> <li>Refugial habitat was not observed within the subject areas (cracking clay soils in open stone-covered plains), as such a core population is not expected to be present. Only expected to be present during period of population booms.</li> </ul>
<p>Department of the Environment (2017). <i>Pseudomys australis</i>. Species Profile and Threats Database, Department of the Environment, Canberra. [online] Available at: <a href="http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=108">http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=108</a> [Accessed 1 May 2018].</p> <p>Pavey, C. and Cole, J. (2012). <i>Threatened Species of the Northern Territory - Plains Mouse - Pseudomys australis</i>. Northern Territory Department of Environment and Natural Resources. [online] Available at: <a href="https://nt.gov.au/data/assets/pdf_file/0019/205507/plains-mouse.pdf">https://nt.gov.au/data/assets/pdf_file/0019/205507/plains-mouse.pdf</a> [Accessed 1 May 2018].</p>				
<b>Pale Field-rat</b> <i>Rattus tunneyi</i>	-	VU	<p><b>Habitat:</b> Historically occurred in a wide range of habitats, but now primarily in dense vegetation along creeks (Aplin et al. 2008). Fire regime seems to have little effect on population numbers; instead, the level of groundwater irrigating the riparian system and, to a lesser extent, current rainfall have a much stronger influence (Braithwaite &amp; Griffiths 1996).</p> <p><b>Distribution:</b> Higher rainfall areas of northern Australia, extending from Kimberley in WA to south-eastern Qld, including the Top End of the NT (Cole &amp; Woinarski 2002, Braithwaite &amp; Griffiths 1996). Previously widespread and</p>	<p><b>NONE</b></p> <ul style="list-style-type: none"> <li>No suitable habitat present within subject areas due to range contraction.</li> <li>Records within the bioregion are all historic, considered to be regionally extinct.</li> </ul>

# DESKTOP THREATENED SPECIES LIKELIHOOD OF OCCURRENCE

Name	Status		Summary	Likelihood of occurrence
	Cth	NT		
			<p>patchily abundant, particularly in the north-west of the Top End, the Pale Field-rat appears to have declined in lower rainfall areas (Woinarski 2000).</p> <p>Aplin, K., Braithwaite, R. and Baverstock, P. (2008). Pale Field-rat: <i>Rattus tunneyi</i>. In: Van Dyck, S. and Strahan, R. (eds.). <i>The Mammals of Australia (3rd Edition)</i>. Reed New Holland, Sydney, NSW.</p> <p>Braithwaite, R. and Griffiths, A. (1996). The paradox of <i>Rattus tunneyi</i>: endangerment of a native pest. <i>Wildlife Research</i>, Vol. 23, pp. 1-21.</p> <p>Cole, J. and Woinarski, J. (2002). <i>Field Guide to the Rodents and Dasyurids of the Northern Territory</i>. Surrey Beatty &amp; Sons, Chipping Norton, NSW.</p> <p>Woinarski, J.C.Z. (2000). The conservation status of rodents in the monsoonal tropics of the Northern Territory. <i>Wildlife Research</i>, Vol. 27, pp. 421-435.</p>	
<p><b>Common Brushtail Possum (Central Australian subspecies)</b></p> <p><i>Trichosurus vulpecula</i></p>	-	EN	<p><b>Habitat:</b> In Central Australia, riverine habitat that is close to rocky outcrops and moist gullies within the ranges or rocky slopes (Kerle et al. 1992). Habitat occurs on various geological substrates but is characterised by a diverse association of fire-sensitive plant species (Pavey and Ward 2012).</p> <p><b>Distribution:</b> Occurs in isolated populations in southern NT. Most common in the southern NT within the MacDonald Ranges (Pavey and Ward 2012). Formerly had a much more extensive distribution in the NT. Common throughout much of the continent, including SA, Victoria, NSW, southern and south-western Qld, and much of WA (Pavey &amp; Ward 2012).</p>	<p><b>NONE</b></p> <ul style="list-style-type: none"> <li>• No suitable habitat present within subject areas.</li> </ul>
			<p>Kerle, J., Foulkes, J., Kimber, R. and Papenfus, D. (1992). The decline of the brushtail possum, <i>Trichosurus vulpecula</i> (Kerr 1798), in arid Australia. <i>Rangelands Journal</i>, Vol. 14, pp. 107-127.</p> <p>Pavey, C. and Ward, S. (2012). <i>Threatened Species of the Northern Territory - Common Brushtail Possum - Trichosurus vulpecula</i>. Northern Territory Department of Environment and Natural Resources. [online] Available at: <a href="https://nt.gov.au/_data/assets/pdf_file/0019/205525/common-brushtail-possum.pdf">https://nt.gov.au/_data/assets/pdf_file/0019/205525/common-brushtail-possum.pdf</a> [Accessed 1 May 2018].</p> <p>Woinarski, J.C.Z. (2004). In a land with few possums, even the common are rare: ecology, conservation and management of possums in the Northern Territory. In: Goldingay, R. and Jackson, S. (eds.). <i>The biology of Australian possums and gliding possums</i>. Surrey Beatty &amp; Sons, Sydney: pp.51- 62.</p>	
<p><b>Central Rock-rat</b></p> <p><i>Zyzomys pedunculatus</i></p>	EN	EN	<p><b>Habitat:</b> Range of grasslands and woodlands in the MacDonnell Ranges (McDonald 2012).</p> <p><b>Distribution:</b> Historically widespread in the arid regions of the NT and WA (Baynes &amp; Johnson 1996). Rediscovered in the MacDonnell Ranges at a few sites (McDonald 2012).</p>	<p><b>NONE</b></p> <ul style="list-style-type: none"> <li>• No suitable habitat present within subject areas.</li> </ul>
			<p>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.). <i>Exploring Central Australia: Society, the Environment and the 1894 Horn Expedition</i>. Surrey Beatty and Sons, Sydney: pp. 168-186.</p> <p>McDonald, P. (2012). <i>Threatened Species of the Northern Territory - Central Rock Rat - Zyzomys pedunculatus</i>. Northern Territory Department of Environment and Natural Resources. [online] Available at: <a href="https://nt.gov.au/_data/assets/pdf_file/0013/205510/central-rock-rat.pdf">https://nt.gov.au/_data/assets/pdf_file/0013/205510/central-rock-rat.pdf</a> [Accessed 1 May 2018].</p>	

# DESKTOP THREATENED SPECIES LIKELIHOOD OF OCCURRENCE

Name	Status		Summary	Likelihood of occurrence
	Cth	NT		
<b>Sandhill Dunnart</b> <i>Sminthopsis psammophila</i>	EN	EN	<p><b>Habitat:</b> Occurs in semi-arid sand dune country covered by spinifex hummocks with swales consisting of desert oaks (DoE 2017).</p> <p><b>Distribution:</b> First identified in 1894 near Lake Amadeus between Kurtitina Well and Uluru. Not sighted since; however, remains have been discovered in owl pellets in Uluru and Kata-Tjuta National Park (Pavey 2006). Recorded on the Eyre Peninsula SA and in the Great Victoria Desert (SA and WA) (Pearson &amp; Robinson 1990).</p>	<p><b>NONE</b></p> <ul style="list-style-type: none"><li>• Potentially suitable habitat within subject areas</li><li>• No previous records of the species in the region.</li><li>• Species has not been recorded in the NT for approximate 100 years.</li></ul>
	Department of the Environment (2017). <i>Sminthopsis psammophila</i> . Species Profile and Threats Database, Department of the Environment, Australian Government, Canberra. [online] Available at: <a href="http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=291">http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=291</a> [Accessed 1 May 2018].			
Pavey, C. (2006). <i>Threatened Species of the Northern Territory - Sandhill Dunnart - Sminthopsis psammophila</i> . Northern Territory Department of Environment and Natural Resources. [online] Available at: <a href="https://nt.gov.au/_data/assets/pdf_file/0004/376159/sandhill-dunnart.pdf">https://nt.gov.au/_data/assets/pdf_file/0004/376159/sandhill-dunnart.pdf</a> [Accessed 1 May 2018].				
Pearson, D.J. and Robinson, A.C. (1990). New records of the sandhill dunnart, <i>Sminthopsis psammophila</i> (Marsupialia: Dasyuridae) in South and Western Australia. <i>Australian Mammalogy</i> , Vol. 13, pp. 57-59.				
REPTILES (TERRESTRIAL)				
<b>Great Desert Skink</b> <i>Liopholis kintorei</i>	VU	VU	<p><b>Habitat:</b> Generally occurs in tall open shrubland, hummock grasslands and on red sandplains and sand ridges (Cogger et al. 1993). However, in some locations (e.g. the Gibson Desert) found on sandplains with fine gravel.</p> <p><b>Distribution:</b> Originally within a broad range extending from the desert parts of south-western NT, eastern interior of WA and north-western SA (Cogger et al. 1993). Currently known from seven populations (McAlpin 2001), three of which occur in the NT –the Tanami Desert, Uluru-Kata Tjuta National Park and the Yulara lease lands.</p>	<p><b>LOW</b></p> <ul style="list-style-type: none"><li>• Suitable habitat present within subject areas.</li><li>• Records within bioregion are not recent.</li><li>• Known populations are not nearby to the subject areas.</li><li>• No evidence of burrows during field surveys within the subject areas (or surrounds) in 2021.</li></ul>
	Cogger, H., Cameron, E., Sadlier, R. and Egglar, P. (1993). <i>The Action Plan for Australian Reptiles</i> . Australian Nature Conservancy Agency, Canberra.			
McAlpin, S. (2001). <i>The Recovery Plan for the Great Desert Skink (Egernia kintorei) 2001-2011</i> . Arid Lands Environment Centre. [online] Available at: <a href="http://www.environment.gov.au/system/files/resources/2e5e895a-e176-409e-80c3-34d63a80fac5/files/great-desert-skink.pdf">http://www.environment.gov.au/system/files/resources/2e5e895a-e176-409e-80c3-34d63a80fac5/files/great-desert-skink.pdf</a> [Accessed 1 May 2018].				
<b>Bronzeback Snake-lizard</b> <i>Ophidiocephalus taeniatus</i>	EN	EN	<p><b>Habitat:</b> Occurs along drainage lines on dissected tablelands. Vegetation consists of low open woodland dominated by Gidgee, Mulga or Dead Finish. Requires deep, matted leaf litter and plant debris overlying deep crackibg clays – often near the bases of trees and shrubs.</p>	<p><b>NONE</b></p> <ul style="list-style-type: none"><li>• No suitable habitat present within subject areas.</li><li>• If present in area, most likely to be associated with tabletop mesas to the north – which occur outside Project area.</li></ul>

## DESKTOP THREATENED SPECIES LIKELIHOOD OF OCCURRENCE

Name	Status		Summary	Likelihood of occurrence
	Cth	NT		
			<b>Distribution:</b> In the NT, it is only currently known from the Beddome Ranges and some westerly outliers on New Crown and Umbeara pastoral stations. The are also some anecdotal records from the George Gill Ranges.  McDonald, P. & G. Fyfe (2008). <i>A survey for the Bronzeback Snake-lizard (Ophidiocephalus taeniatus), New Crown and Umbeara Pastoral Leases, Northern Territory</i> . Unpublished Report. Northern Territory Government.	
<b>Slater's Skink</b> <i>Liopholis slateri</i> <i>(slateri)</i>	EN	EN	<b>Habitat:</b> Little known about ecology. Generally, on alluvial soils close to drainage lines. Although all historical sites have been in open floodplain type situations, a number of the more recently located populations, including Loves Creek, occur on minor drainages among stony hills (McDonald 2012)  <b>Distribution:</b> Four locations in the Finke and MacDonnell Ranges bioregions centred on Alice Springs. In the 1960's, appears to have been abundant around Alice Springs (McDonald 2012).  McDonald, P. (2012). <i>Threatened Species of the Northern Territory - Slater's Skink - Liopholis slateri</i> . Northern Territory Department of Environment and Natural Resources. [online] Available at: <a href="https://nt.gov.au/_data/assets/pdf_file/0006/206457/slaters-skink.pdf">https://nt.gov.au/_data/assets/pdf_file/0006/206457/slaters-skink.pdf</a> [Accessed 1 May 2018].	<b>NONE</b> <ul style="list-style-type: none"> <li>• No suitable habitat present within subject areas.</li> <li>• Outside of known species distribution (according to EPBC listed distribution map); all occurrence of this species within the Finke bioregion are 100km (approx.) to the north and north west of the subject areas.</li> </ul>
<b>FISH</b>				
<b>Finke Goby</b> <i>Chlamydogobius</i> <i>japalpa</i>	-	VU	<b>Habitat:</b> Similar in ecology to the Desert Goby ( <i>Chlamydogobius eremius</i> ). Rests on the bottom amongst detritus in shallow pools with rock, sand or gravel bottoms (Stirrat & Larson 2006).  <b>Distribution:</b> Limited distribution in the upper reaches of the Finke River system (Stirrat & Larson 2006).  Stirrat, S. and Larson, H. (2006). <i>Threatened Species of the Northern Territory - Finke Goby - Chlamydogobius japalpa</i> . Northern Territory Department of Environment and Natural Resources. [online] Available at: <a href="https://nt.gov.au/_data/assets/pdf_file/0008/206387/finke-goby.pdf">https://nt.gov.au/_data/assets/pdf_file/0008/206387/finke-goby.pdf</a> [Accessed 1 May 2018].	<b>NONE</b> <ul style="list-style-type: none"> <li>• No suitable habitat present within subject areas.</li> </ul>
<b>INVERTEBRATES</b>				
<b>Land Snail</b> <i>Semotrachia esau</i>	-	VU	<b>Habitat:</b> No published information on ecology, other than those specimens have been collected under figs (mostly) or under spinifex (Wilson et al. 2006).  <b>Distribution:</b> Only known from a small area along the Finke River and Palm Creek in the Krichauff Ranges west of Alice Springs. Also a single isolated	<b>NONE</b> <ul style="list-style-type: none"> <li>• No suitable habitat present within subject areas.</li> <li>• Highly restricted range that is remote from the subject areas.</li> </ul>

# DESKTOP THREATENED SPECIES LIKELIHOOD OF OCCURRENCE

Name	Status		Summary	Likelihood of occurrence
	Cth	NT		
			colony in the Palmer River drainage 78 km to the southeast. This disjunct occurrence in the Palmer River may have resulted from accidental transport of snails during flooding of the Finke River system. Some more recent museum collections extend this known range marginally (Wilson et al. 2006). No direct evidence that any factors have caused a decline in numbers or distribution.	
Wilson, C., Woinarski, J., Kessner, V. and Braby, M. (2006). <i>Threatened Species of the Northern Territory - Land Snail - Semotrachia esau</i> . Northern Territory Department of Environment and Natural Resources. [online] Available at: <a href="https://nt.gov.au/_data/assets/pdf_file/0016/206530/semotrachia-esau.pdf">https://nt.gov.au/_data/assets/pdf_file/0016/206530/semotrachia-esau.pdf</a> [Accessed 1 May 2018].				
Bednall's Land Snail <i>Sinumelon bednalli</i>	EN	-	<b>Habitat:</b> Restricted to areas around fig trees. Adults aestivate in loose litter under the trees and are only active after heavy rain (Palmer et al. 2012). <b>Distribution:</b> Endemic to the NT. Collected at several sites in the ranges of central Australia, from Wattarka National Park in the west to Trephina Gorge, 50 km east of Alice Springs. It is likely that other populations in the southern NT remain to be discovered (Palmer et al. 2012).	<b>LOW</b> <ul style="list-style-type: none"><li>• Limited suitable habitat present within subject areas (i.e. no fig trees present as confirmed by field surveys in 2021 (EcOz 2021).</li><li>• Highly restricted range that is remote from the subject areas.</li><li>• This species was given a low likelihood due to largely unknown distribution and limited knowledge of species ecology and habitat requirements. However, it is highly unlikely to be found in habitat within subject areas.</li></ul>
	Palmer, C., Ward, S., Kessner, V., Braby, M. and Woinarski, J. (2012). <i>Threatened Species of the Northern Territory - Bednall's Land Snail - Sinumelon bednalli</i> . Northern Territory Department of Environment and Natural Resources. [online] Available at: <a href="https://nt.gov.au/_data/assets/pdf_file/0020/206516/sinumelon-bednalli.pdf">https://nt.gov.au/_data/assets/pdf_file/0020/206516/sinumelon-bednalli.pdf</a> [Accessed 1 May 2018].			
FLORA				
Latz's Wattle <i>Acacia latzii</i>	VU	VU	<b>Habitat:</b> Silcrete-capped mesas and low stony hills of shale and siltstone. Often concentrated along minor creek-lines and on low hill slopes. Known to occur on highly alkaline sandy clay-loams (Nano et al. 2012). <b>Distribution:</b> Southern NT to far northern SA (DoE 2017). Endemic to the Finke Bioregion of the NT, where restricted to two areas 200 km apart (DoE 2017). Further survey effort will likely increase known distribution (Nano et al. 2006).	<b>NONE</b> <ul style="list-style-type: none"><li>• Suitable habitat does not occur within the subject areas.</li><li>• Species is endemic to the bioregion, but not within subject areas.</li><li>• Species has a restricted range and which does not occur within or adjacent to the subject areas.</li><li>• Field surveys in 2021 did not detect presence of this species within or surrounding the subject areas.</li></ul>

# DESKTOP THREATENED SPECIES LIKELIHOOD OF OCCURRENCE

Name	Status		Summary	Likelihood of occurrence
	Cth	NT		
			<p>Department of the Environment (2017). <i>Acacia latzii</i> — <i>Latz's Wattle</i>. <i>Species Profile and Threats Database</i>. Department of the Environment, Australian Government, Canberra. [online] Available at: <a href="http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=14275">www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=14275</a> [Accessed 1 May 2018].</p> <p>Nano, C., Kerrigan, R., Albrecht, D. and Pavey, C. (2012). <i>Threatened Species of the Northern Territory - Acacia latzii Maslin (Mimosaceae) - Tjilpi Wattle Peter Latz Wattle</i>. Northern Territory Department of Environment and Natural Resources. [online] Available at: <a href="https://nt.gov.au/data/assets/pdf_file/0016/208402/acacia-latzii.pdf">https://nt.gov.au/data/assets/pdf_file/0016/208402/acacia-latzii.pdf</a> [Accessed 1 May 2018].</p>	
<b>Dwarf Desert Spike-rush</b> <i>Eleocharis papillosa</i>	VU	VU	<p><b>Habitat:</b> Ephemeral wetlands in freshwater and semi-saline swamps. In the NT, recorded growing amongst Coolabah (<i>Eucalyptus coolabah</i>), Samphire (<i>Halosarcia spp.</i>), Northern Bluebush (<i>Chenopodium auricomum</i>) and <i>Eragrostis spp.</i> including Swamp Cane grass (<i>E. australasica</i>) (DoE 2017).</p> <p><b>Distribution:</b> WA, SA and NT. Known from eight locations in the NT ranging from the Tanami Desert to the Southern Finke bioregion across to the edge of the Simpson Desert. These sites occur on Aboriginal free hold land (Lander River, Rabbit Flat, Lake Mackay); pastoral lease (three stations); and crown land (Ilparpa swamp) (Duguid et al. 2006). Likely to be naturally rare. An extensive survey of wetlands in 2000 and 2001, in apparently ideal conditions, only found one new population (Duguid et al. 2002).</p>	<p><b>LOW</b></p> <ul style="list-style-type: none"> <li>• Potentially suitable habitat within Coolabah swamps which are present within the subject areas (Subject Area C only).</li> <li>• Field surveys in 2021 did not detect this species; however it is noted that systematic targeted surveys for this species was not conducted due to unsuitable climatic conditions and the fact that the exploration program would clearly avoid this area so potential impacts would be low (if indeed present).</li> </ul>
			<p>Department of the Environment (2017). <i>Eleocharis papillosa</i>. <i>Species Profile and Threats Database</i>. Department of the Environment, Australian Government, Canberra. [online] Available at: <a href="http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=2519">http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=2519</a> [Accessed 1 May 2018].</p> <p>Duguid, A., Kerrigan, R. and Albrecht, D. (2006). <i>Threatened Species of the Northern Territory - Dwarf Desert Spike-rush - Eleocharis papillosa</i>. Northern Territory Department of Environment and Natural Resources. <a href="https://nt.gov.au/data/assets/pdf_file/0020/208433/eleocharis-papillosa.pdf">https://nt.gov.au/data/assets/pdf_file/0020/208433/eleocharis-papillosa.pdf</a> [Accessed 1 May 2018].</p>	
<b>Rainbow Valley Fuschia Bush</b> <i>Eremophila prostrata</i>	VU	-	<p><b>Habitat:</b> Sandplains and lower dune slopes that characteristically support hummock grasses (<i>Triodia basedowii</i>), and a variety of shrubs and trees including <i>Grevillea</i>, <i>Hakea</i>, <i>Acacia</i>, and Desert Oaks (Kerrigan et al. 2012).</p> <p><b>Distribution:</b> Endemic to southern NT. Known from seven populations: two from the Mt Ooraminna area, four from between Deep Well and Mt Ooraminna, and another from the Rainbow Valley area (Kerrigan et al. 2012).</p>	<p><b>LOW</b></p> <ul style="list-style-type: none"> <li>• Limited suitable habitat present within subject areas.</li> <li>• Recent and historical records within bioregion to the north of the subject areas.</li> <li>• Restricted range that is remote from the subject areas.</li> <li>• Field surveys in 2021 by EcOz ecologist Tom Reilly did not detect this species.</li> </ul>
			<p>Kerrigan, R., Albrecht, D., Duguid, A. and Nano, C. (2012). <i>Threatened Species of the Northern Territory - Rainbow Valley Fuschia Bush - Eremophila prostrata</i>. Northern Territory Department of Environment and Natural Resources. <a href="https://nt.gov.au/data/assets/word_doc/0003/376266/eremophila-prostrata.docx">https://nt.gov.au/data/assets/word_doc/0003/376266/eremophila-prostrata.docx</a> [Accessed 1 May 2018].</p>	

# DESKTOP THREATENED SPECIES LIKELIHOOD OF OCCURRENCE

Name	Status		Summary	Likelihood of occurrence
	Cth	NT		
Desert Quandong <i>Santalum acuminatum</i>	-	VU	<b>Habitat:</b> Dune swales, along creeks, on plains and low rises, and rarely on hills. Typically occurs where the soils are sandy or loamy, sometimes with limestone or sandstone shallowly below the soil surface (Nano et al. 2012). <b>Distribution:</b> Known from all Australian mainland areas. In the NT, occurs west and south-west of Alice Springs (Nano et al. 2012).	<b>LOW</b> <ul style="list-style-type: none"><li>• Suitable habitat present within subject areas.</li><li>• Recent and historical records nearby to the subject areas.</li><li>• One record found during 2021 field survey in the mesa landforms to the north of the seismic program. However, field surveys did not observed the species within the subject areas.</li><li>• It is considered to be unlikely to be present, and if present in the region be limited to mesa country located in the surrounding landscape.</li></ul>
			Nano, C., Kerrigan, R., Albrecht, D. and Latz, P. (2012). <i>Threatened Species of the Northern Territory - Santalum acuminatum</i> . Northern Territory Department of Environment and Natural Resources. <a href="https://nt.gov.au/data/assets/pdf_file/0004/208489/santalum-acuminatum.pdf">https://nt.gov.au/data/assets/pdf_file/0004/208489/santalum-acuminatum.pdf</a> [Accessed 1 May 2018].	
Frankenia plicata			<b>Habitat:</b> Occurs in a range of habitats, including on small hillside channels, which take the first run-off after rain (Leigh et al., 1985). In the Simpson Desert, the species has been found predominantly from swales of loamy sands to clay (Neagle, 2002). This species is found in a wide range of vegetation communities that have good drainage (Neagle, 2002). <b>Distribution:</b> No records within NT. Occurs in South Australia, from north of Port Augusta along the Stuart Highway to the Northern Territory border and from Port Augusta north-east to Maree (Barker et al., 2005; State Herbarium of South Australia, 2007).	<b>LOW</b> <ul style="list-style-type: none"><li>• Species is not known to occur within the NT</li><li>• Potentially suitable habitat within subject areas, swales and loamy depressions.</li><li>• Field surveys in 2021 did not record any Frankenia species. It is considered to be highly unlikely that this species is present but as systematic surveys were not conducted for this species (as they are not justified based on current data) this species has been given a low likelihood rather than 'none'.</li></ul>
			Barker, WR, Barker, RM, Jessop, JP & Vonow, HP 2005, 'Census of South Australian vascular plants; 5 <sup>th</sup> Edition', Journal of the Adelaide Botanic Gardens, Supplement 1. Leigh, J, Boden, R & Briggs, J 1984, Extinct and Endangered Plants of Australia, Macmillan, Melbourne. Neagle, N 2002, National Land and Water Audit Conservation Strategy Case Study Dieri subregion South Australia, National Parks and Wildlife (SA), viewed 21 April 2008, <a href="http://www.anra.gov.au/topics/vegetation/pubs/case_studies/ssd_casestudy.pdf">http://www.anra.gov.au/topics/vegetation/pubs/case_studies/ssd_casestudy.pdf</a> State Herbarium of South Australia 2007, Frankenia plicata fact sheet, viewed 21 April 2008, <a href="http://www.flora.sa.gov.au/cgi-bin/texhtml.cgi?form=speciesfacts&amp;family=&amp;genus=frankeniania&amp;species=plicata&amp;iname=&amp;submit=Search">http://www.flora.sa.gov.au/cgi-bin/texhtml.cgi?form=speciesfacts&amp;family=&amp;genus=frankeniania&amp;species=plicata&amp;iname=&amp;submit=Search</a>	



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