Appendix A

# BR SIMPSON Ecological assessment report



December 2022

BRS1-2 EP93\_97\_107\_EMP\_Appendix A

# 1 Introduction

BR Simpson proposes to carry out seismic exploration in the Simpson Desert, across EP93, EP97 and EP107. The project area is in the Southern NT, approximately 150 Kms SE of Alice Springs. Low Ecological Services (LES) has been commissioned to undertake an ecological assessment of the proposed project area. The proposed exploration program includes 11 seismic lines and two temporary camps for which there are multiple proposed locations.

This environmental report incorporates the results of a desktop survey of the area and a field survey of the baseline environmental conditions for the project footprint. The primary aim of this report is to identify and document site conditions prior to activities occurring in the project footprint. Future exploration works will be regulated through the Environmental Management Plan (EMP) approved by the Department of Environment and Natural Resources (DENR).

#### 1.1 Scope

This environmental report is designed to meet the requirements of the EMP. This report does not assess ecological impacts and risks related to any development activities that may follow the exploratory phase of this project. This environmental assessment, presents:

- A review of the environmental context of the project footprint (land use, climate, bioregions, significant areas, surface water, and land systems).
- A desktop assessment of threatened flora and fauna species and plant communities recorded within, or likely to occur within, the project area and a 'likelihood of occurrence' assessment to determine which species have a reasonable likelihood of occurring within the project area.
- The results of a reconnaissance survey to verify desktop assessment of flora and fauna species present and habitat availability for conservation significant species within the project.

# 2 Environmental Context

#### 2.1 Location and access

The proposed seismic activity is located within EP93, EP97 and EP107. These Exploration leases are located approximately 150 km south-east of Alice Springs on a bearing of  $127^{0}$  within the Simpson Desert. The Simpson Desert covers an area of about 200 000 km2 in the region where Queensland, South Australia and the Northern Territory meet. The survey area is dominated by dune fields with some areas of sand plain and avoids rocky plateaus, lateritic domes and clay plains . The proposed access to the site from Alice springs is via the Santa Teresa Andado road past Santa Theresa and via various station and previous exploration tracks. Alternative access from Alice Springs is available via the Stuart Highway to Kulgera, east to Finke and Andado and north to various station and previous exploration tracks.



#### 2.2 Land use

Approximately half of the seismic lines occur within the Andado Station pastoral lease which is dominated by cattle grazing. The remainder of the seismic lines occur within Pmer Ulperre Aboriginal Land Trust and Simpson Desert Crown Land. Numery station and Allambi station lie to the north of the project area and Andado Station and New Crown Station lie to the west. Mineral and petroleum exploration has occurred in the region historically but there is no current mining or petroleum production activity.

#### 2.3 Climate

There is no specific climatic data for the survey area, the closest long-term Bureau of Meteorology weather station is Kulgera (station number 015603) approximately 250 km south-west of the project footprint. This data can be used to draw general conclusions about the climate of the region. Average annual rainfall is 240.9 mm; however, the amount of rainfall in the region is highly variable. 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. If heavy rainfall occurs, it is generally in the summer months from November to March and can result in flash flooding. While winter rainfall depressions can occur and the survey area has recently experienced above average La Nina rains early in the year the BOM predictions are for El Nino dry conditions to begin in late 2023.



Data sourced from the Bureau of Meteorology. Data collected between 1980 and 2022 for temperature and 1969 and 2022 for rainfall.

Figure 2-2. Graph of mean rainfall and mean maximum and minimum temperatures for Kulgera.

#### 2.4 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 largescale geophysical patterns across Australia. These patterns in the landscape are linked to fauna and flora assemblages and processes at the ecosystem scale and provide a useful means for simplifying and reporting on more complex patterns of biodiversity (NSW 2003). The proposed area of exploration is included in the Simpson–Strzelecki Dunefields bioregion which covers an area of 277,800km2 within the boundaries of NT, SA, QLD, and NSW (Baker, Price, Woinarski, Gold, Connors, Fisher and Hempel, 2005). The Northern Territory portion of the Simpson–Strzelecki Dunefields bioregion is 105,900km2 (White, Albrecht, Duguid, Latz, & Hamilton, 2000). The Simpson–Strzelecki Dunefields bioregion has an arid, subtropical climate and includes the driest area of Australia. The area comprises long parallel sand dunes, fringing dunefields, extensive sand plains, ephemeral dry watercourses and palaeochannels, and salt and clay pans (White, Albrecht, Duguid, Latz, & Hamilton, 2000). Vegetation is predominantly spinifex hummock grasslands with sparse acacia shrublands and some narrow river red gum and Coolibah riverine woodlands (White, Albrecht, Duguid, Latz, & Hamilton, 2000). Land use comprises Aboriginal land, conservation reserves, minor tourism and pastoral leases.

#### 2.5 Land systems

Land systems are classified according to recurring patterns of climate, geology, topography, soils and vegetation. These have been mapped across the NT by the government and are at a significantly smaller scale than a bioregion. Within each land system, a set of component land units is defined. In some areas of the NT, mapping has been undertaken to the level of detail of land units. No land unit mapping is available for the survey area but geological mapping provides a surrogate for land units. The geomorphology and land systems of the Alice Springs District including parts of the Simpson Desert area have been mapped and described by Perry et al. (1962) at a scale of 1:1,000,000. Purdie (1984) has mapped the land systems for the central desert region extending from the NT into South Australia. It shows that the project footprint passes across and through six land systems (Table 2-1). There are six different land systems within EP93, EP97 and EP107 which are listed in the table below.

Land system name	Landform description	Soil
McDills	alluvial floodplains, swamps, drainage depressions and alluvial fans	sandy, silty and clay soils on Quaternary alluvium
Peebles	outcrop with shallow stony soils	low hills, hills and stony plateaux on sandstone, siltstone, quartzite and conglomerate (deeply weathered in places);
Rumbalara	Low hills, hills and stony plateaux on sandstone, siltstone, quartzite, and conglomerate (deeply weathered in places)	Outcrop with shallow stony soils
Simpson	Dune fields with parallel linear dunes, reticulate dunes and irregular or aligned short dunes	Red sands
Wilyunpa	low hills, hills and stony plateaux on sandstone, siltstone, quartzite and conglomerate (deeply weathered in places);	outcrop with shallow stony soils
Endinda	Plains and rises associated with deeply weathered profiles (laterite) including sand sheets and other depositional products	Sandy and earth soils

Table 2-1. Land Systems



Figure 2-1. Land systems

#### 2.6 Surface water

The project footprint lies within the Diamantina-Georgina Rivers region and within the Todd and Hale River basins. A all watercourses are ephemeral with flows of short duration following significant rainfall events. There are numerous smaller drainages, tributaries, and drainage gullies across the project footprint. The major watercourse in proximity to the project footprint is the Hale River. There are 6 order one streams that intersect the seismic lines; however, these are ephemeral and are predicted to be dry during the completion of the work. The appropriate buffers and stream crossing practices will be implemented as per the regulations.

#### 2.7 Soils

Northcote and Wright (1983) included the Simpson Desert in the Simpson-Victoria soil landscape province. The provinces, and its associated sand plains, were derived from erosion of deep weathering profiles during the Quaternary arid periods. Sand dunes consisting of red siliceous sands are the distinguishing feature of the province along with swales overlaying laterite, sandy clays, ironstone gravels, sandy clays or other materials. The red siliceous sands are often at depths below 2 m upon which clayey sand or earthy pan zone may be found in the interdunes. Yellow and whitish sands may also occur in some areas where the soil has derived from areas such as drainage ways on the desert margins.

#### 2.8 Vegetation

There have been several surveys of the flora within the Simpson Desert complex. Gibson and Cole (1988) conducted a biological survey of the northern Simpson Desert, which included sections of the Hale River and Allitra Tableland (north of the project footprint). At the time of Gibson and Coles (1988) survey the Hale River floodout was densely vegetated in Eucalyptus camaldulensis and E. microtheca for much of its length. Floodplains to the south were dominated by Acacia georginae which formed a low open shrubland. A variety of habitat types were found on the lower vegetation layers including grasslands of Astrebla pectinata, shrub lands of Acacia aneura and Atalaya hemiglauca, and dry swamplands of Eucalyptus microtheca. General vegetation descriptions are also provided by Laut et al. (1977), Buckley (1979) and Purdie (1984). Dunefields were the most extensive and dominant of the land zones in this survey area, and their respective vegetation is described in most detail by Purdie (1984). In her description, the dunes contained open Zygochloa hummock grasslands on the crests and Triodia hummock grasslands on the slopes with a mix of shrubs: Acacia dictophleba, A. murrayana, A. ligulata, A. Maitlandii, A. ramulosa, Calotis erinacea, Cassia nemophila, Dodonaea angustissima, Eremophila macdonnellii, Grevillia juncifolia, G. stenobotrya, Hakea eyreana, Pimelea pencilliaris, and Thryptomene maisonneuvei. Other species in the interdune corridors and plains included Acacia jennerae, Acacia kempeana, Adriana hookeri, Atriplex vesicaria, Eremophila willsii, Eucalyptus microtheca, Corymbia opaca, Hakea leucoptera, Halganea cyanea, Phyllanthus fuernrohrii and Rhagodia spinescens.

### 3 METHODS

#### 3.1 Desktop

To assess presence of threatened communities the NT Department of Environment, Parks, and Water Security (DEPWS) list of Sites of Conservation Significance (SOCS) and NT Sites of Botanical Significance (SOBS) was utilised. Sites of Conservation Significance (SOCS) are identified as important sites for biodiversity that need further protecting; in the NT there are 67 SOCS. The 67 areas include sites both of national and of international significance. Sites of Botanical Significance (SOBS) are defined as areas that have botanical features distinguishing them from the surrounding landscape, and that are important in terms of the presence of significant plant communities, the presence of species type localities, the integrity of the ecosystems present and the diversity of plant taxa and plant communities present (White, Albrecht, Duguid, Latz, & Hamilton, 2000).

To assess the possible presence of threatened species the Commonwealth Government Department of Agriculture, Water and Environment Protected Matters Search Tool (PMST) was used to generate a report of the area with a buffer of 50-km radius. This PMST is an online enquiry tool 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, rather than known records.

Species records from the latest version of the NT Atlas were clipped to the Simpson–Strzelecki Dunefields 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. For each threatened species, the likelihood of it occurring within the project footprint 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), and the field survey results.

#### 3.2 Field survey

The field survey was conducted by a team of biologists lead by PhD Zoology, Biology, Ecology. The field survey was conducted by a team of biologists lead by PhD Zoology, Biology, Ecology. The sector of the sector

The field survey was divided into two sections. For the survey outside of Andado station a helicopter was used due to the low number of existing access tracks within the project footprint. The helicopter flight path was centred on the proposed 2D seismic lines and immediate surrounds. Observations were made during the flight and the helicopter stopped approximately every 25 kms to allow for more detailed ground surveys to be conducted. Within Andado Station no helicopters were used at the request of the pastoralists to avoid unnecessary disturbance to cattle. Ground vehicles were used for this section of the survey and observations recorded for each seismic line. For this section of the survey, it was not possible to access the entire length of each seismic line due to a lack of access tracks and difficult driving conditions including sandy dune crossings. Due to these constraints specific survey locations in different land units were used to make generalisations about each of the seismic lines and satellite imagery was used to interpret landscape and vegetation presence and variation.

For both sections of the survey the following data was collected at each survey location.

- Landform/ vegetation. This included a description of general landform, soil type and dominant vegetation structure and species.
- Sensitive or Important habitat. Presence of sensitive vegetation or ecologically important habitat types.
- Threatened species. The presence of threatened species and communities.
- Weeds. Presence of weeds and priority weed infestations.
- Erosion. Presence of existing erosion within the project footprint.
- Pastoral impacts. At each survey site, the current level of pastoral impacts was assessed
- Fire / drought. General observations were made within the project footprint to determine level of impacts from fire and drought.



Figure 3-1. Location of site descriptions

# 4 RESULTS

#### 4.1 Sites Of Conservation Significance

The project footprint surrounds, but does not occur within, the Andado and Snake Creek Site of Conservation Significance which is listed as nationally significant. It encompasses the low hills and rises, gibber plains and other significant habitats on Andado Station, the Snake Creek interdune flood out lakes, and the surrounding sandplains and dune fields. The flood out lakes occur between tall sand dunes in the south of the Site and comprise a network of intermittently flooded freshwater lakes and swamps. Vegetation communities within the Site include acacia and eucalypt open woodland, acacia and saltbush shrubland and spinifex grassland.

The varied habitats of Andado and the Snake Creek lakes support a rich fauna and flora. 11 threatened species are found in the site including three plant species (*Acacia peuce, Acacia pickardii and Eleocharis papillosa*). Eight threatened vertebrate species have been recorded within the Site, including Crest-tailed Mulgara, Brush-tailed Mulgara, Southern Marsupial Mole, Plains Mouse and Dusky Hopping Mouse. The Snake Creek floodout lakes are unusually long-lasting and can support many thousands of waterbirds. The Simpson Desert and the Mac Clark Conservation Reserve are listed on the Register of the National Estate for their natural values (Australian Heritage Council). The Mac Clark (*Acacia peuce*) Conservation Reserve is also listed on the NT Heritage Register (Heritage Advisory Council). Snake Creek Interdune Floodout Lakes are identified as significant for biodiversity conservation by Duguid et al. (2005). The acacia and eucalypt open woodland within the site, especially in the vicinity of Mac Clark Conservation Reserve, provides roosting and breeding opportunities for a variety of bird species, especially raptors and owls (Pavey et al. 2008). The site is in the only region of Australia where the two mulgara species co-occur.

Due to the national significance of the Andado and Snake Creek SOCS specific care has been taken to ensure that the proposed seismic activity does not have any negative impact on the area. Seismic line and camp locations have been selected to avoid interfering with the SOCS area. Where possible existing station tracks have been selected for use within this area to reduce the impact of constructing new tracks. These tracks will be minimally changed to avoid any disruption to the area. Existing tracks occur between Old Andado road, East bore and provide access to the Colson and Blamore tracks along the Madigan line tourist route and are well maintained by the station to allow access to East bore and Bravo bore to the east of the SOCS area. These are formed tracks which may need minimal grading to allow heavy vehicle access however erosion is a minor risk given the lack of significant slope and strategies which do not create windrows.

There are two proposed access tracks which follow old seismic lines and associated access tracks. These are discussed in section 4.3.2 in detail. Assessing ariel photography indicates that these tracks will require clearing of vegetation to re-establish, which can be considered as disturbance within the SOCS area. However the location of these two tracks does not intersect with land units critical for threatened species habitat (cracking clay soils for plains mouse) and are not in the vicinity of any known *Acacia peuce* occurrences. It is considered that re-establishing these access tracks will have significantly less impact than establishing extensive new access tracks which avoid the SOCS area and which would require extensive vegetation clearing and earth works.

#### 4.2 Sites Of Botanical Significance

There are two SOBS within the survey area, the Andado SOBS which is enclosed within the Andado and Snake Creek SOCS and the Old Todd River flood out SOBS out in the northern section of the project footprint. The Andado SOBS is of national significance and the Old Todd River Flood out is of

bioregional significance. No seismic activity is planned within the Andado SOBS due to the national significance of the area.

The Andado and Snake Creek site incorporates the major area for the conservation of Acacia peuce in the Northern Territory. It also supports many interesting disjunctions of plant taxa with aridotemperate distributions, which are more common and widespread in similar land systems in South Australia and also has several disjunctions of plant taxa with arido-tropical distributions. As such, this is an important site for the conservation of species at or near the edge of their continental range. The site also contains several important ephemeral swamps including Indemina Swamp, Indinna Swamp, Andado swamp and Casuarina Swamp. Also of note is a disjunct occurrence of Acacia stowardii dominated shrubland, which is more prevalent in the Channel Country bioregion. This vegetation type is uncommon in both the study area and the NT portion of the Simpson-Strzelecki Dunefields bioregion. See section 5.3 above for a discussion on impacts to the Andado and Snake Creek SOCS and SOBS area.

The Old Todd River Flood out site approximates the extent of an old floodout (presumed) of the Todd River, which now empties into the Simpson Desert to the northeast. The site is primarily recent aeolian sands, alluvium and lenses of river gravels. There are numerous interdune claypans and more extensive systems of playas where past flooding has broken through the NNW oriented parallel dunes. Running through the site roughly oriented NE-SW are a series of low outcrops of sandstone, mudstone and conglomerate, which once impeded the floodwaters of the Todd River from draining to the south. The site still receives some subsurface drainage and supports a diversity of habitats and plant communities. The Old Todd River flood out SOB does intersect with proposed seismic line activity in the northern portion of the project footprint.

#### 4.3 Protected Matters and likelihood of occurrence

The Commonwealth Government Department of the Environment and Energy (DoEE) Protected Matters Search Tool (PMST) results identified 17 listed threatened species and 9 listed migratory species as possibly occurring within the project footprint. This data was integrated with the results of the NT atlas search and desktop information that relates to habitat requirements, distribution, and number of records and the results of the field survey to determine the likelihood of occurrence. Likelihood ratings are as follows.

- High It is expected that this species occurs within the project footprint because there is core habitat and knowledge that the species occurs in the local area.
- Medium Species may occur within the project footprint because there is suitable habitat; however, there is evidence that lowers its likelihood of occurrence.
- Low Species may occur within the project footprint; only marginally suitable habitat is expected.
- None There is strong evidence that this species will not occur within the project footprint.

Scientific name	Common name	Threatened category	Class	Likelihood of occurrence
Amytornis modestus	Thick-billed Grasswren	Vulnerable	Bird	Low
Calidris ferruginea	Curlew Sandpiper	Critically Endangered	Bird	None
Erythrotriorchis radiatus	Red Goshawk	Vulnerable	Bird	Low

#### Table 4-1. Significant Flora and Fauna

Falco hypoleucos	Grey Falcon	Vulnerable	Bird	Medium
Pedionomus torquatus	Plains-wanderer	Critically Endangered	Bird	None
Pezoporus occidentalis	Night Parrot	Endangered	Bird	Low
Polytelis alexandrae	Princess Parrot	Vulnerable	Bird	Low
Rostratula australis	Australian Painted Snipe	Endangered	Bird	Low
Macrotis lagotis	Greater Bilby	Vulnerable	Mammal	Low
Macroderma gigas	Ghost bat	Vulnerable	Mammal	Low
Notomys fuscus	Dusky Hopping-mouse	Vulnerable	Mammal	Low
Pseudomys australis	Plains Mouse	Vulnerable	Mammal	High
Zyzomys pedunculatus	Central Rock-rat	Critically endangered	Mammal	low
Acacia peuce	Waddy, Waddi, Waddywood	Vulnerable	Plant	High
Acacia pickardii	Birds Nest Wattle	Vulnerable	Plant	High
Eleocharis papillosa	Dwarf Desert Spike-rush	Vulnerable	Plant	None
Frankenia plicata		Endangered	Plant	Low
Minuria tridens	Minnie daisy	Vulnerable	Plant	Low
Liopholis kintorei	Great Desert Skink, Tjakura, Warrarna	Vulnerable	Reptile	Low
Liopholis slateri slateri	Slater's Skink, Floodplai Skink	Endangered	Reptile	Low
Ophidiocephalus taeniatus	Bronzeback Snake-lizard	Vulnerable	Reptile	Low

#### 4.3.1 Species likely to occur within the project footprint.

#### 4.3.1.1 Acacia peuce

*Acacia peuce* is a long lived, tall tree to c. 15-18 m with short horizontal branches, pendulous branchlets and Sheoak-like phyllodes. *Acacia peuce* is known from three disjunct sites on the western and eastern edges of the Simpson Desert in arid inland Australia: Andado Station (230 km south-east of Alice Springs) in the Northern Territory (NT); and Birdsville and Boulia in Queensland. Acacia peuce is listed as endangered under the TPWC Act and is known to occur within and outside the fenced areas of the Mac Clark Conservation Reserve. At Andado and Birdsville, *A. peuce* is associated with shallow sand aprons overlaying clayey and gibber slopes and plains. No seismic acquisition and no new access routes are proposed within the vicinity of the Mac Clark Conservation Reserve. Hence, there will be no disturbance to *Acacia peuce* on a local scale.

#### 4.3.1.2 Acacia pickardii

Acacia pickardii is a shrub or small tree 3-5 m high. The stipules are spinose and the inflorescence globular. It is distinguishable from other species of the *A. victoriae* group by its sharp cylindrical foliage (phyllodes). Acacia pickardii typically grows on gibber-covered sandplains and stony rises and low hills, including mesas and tablelands, and adjacent flats. In the Northern Territory (NT), Acacia pickardii is known from two small, and one larger, populations on the edge of the Simpson Desert. Acacia pickardii is listed as vulnerable under the TPWC Act and is known to occur in the

Allitra Tableland and in north-eastern Andado Station. The species usually forms a shrubland or low openwoodland with an understorey of sparse chenopod subshrubs or tussock grasses. *Acacia pickardii* typically grows on gibber-covered sandplains and stony rises and low hills, including mesas and tablelands, and adjacent flats.

#### 4.3.1.3 Plains Mouse

The Plains Mouse is a moderately sized rodent, with a stocky build, rounded snout, and long ears. It is one of the largest rodents still present in the arid zone with a body mass up to 50 g. Once widespread across arid and semi-arid Australia, *P. australis* is now known only from the stony deserts of South Australia, the southern Northern Territory (NT) and was recently recorded in western New South Wales. The plains mouse (*Pseudomys australis*) is listed as endangered under the TPWC Act and has been recorded within a 50 km radius of the proposed seismic lines. The Plains Mouse lives on plains, especially stony plains (gibber), and prefers areas of cracking clay soil associated with minor drainage features. These run-on areas are generally more productive than the surrounding landscape because they receive water and nutrients even after relatively minor rainfall events. It occurs in colonies that are usually small in size and difficult to locate. However, numbers increase dramatically following rainfall. Rainfall triggers an increase in available resources in the animal's habitat that results in high levels of reproduction. They are known to occur on gibber pains at two locations within the NT, one of which is within the eastern section of Andado Station including the Mac Clark Conservation Reserve. It is very likely that the Plains mouse currently occupies the cracking clay soils present within the Andado and Snake Creek SOCS area.

The Plains Mouse occupies the cracking clay soils present within the Andado and Snake Creek SOCS area. There are current records of the species in this area, spatial data shown in Appendix A. A Plains Mouse Protection Area was supplied by the NT Department of Environment, Parks and Water Security. As communicated by DEPWS (April 2023), no work will be undertaken within the Plains Mouse Protection Area. The road through the Plains Mouse Protection Area will be used for daytime travel only. No set-downs, turning circles, or off-track driving will be undertaken within the Plains Mouse Protection Area.

The two proposed new or re-established access tracks - within the Plains Mouse Protection Area – have been selected to avoid these critical cracking clay habitat areas wherever possible. However it is possible that these tracks overlap with Plains Mouse refuge habitat (burrow systems). The potential impact of track construction includes immediate destruction of burrows, noise disturbance, water runoff and an increase in feral animal predation due to increased human activity and food availability.

To minimize the potential impact to the Plains Mouse the following measures will be implemented:

- adherence to the no work protection area shown in the maps of the seismic program and discussed further in appendix A to avoid impacts on important habitat for a significant Plains Mouse population. A buffer of 3km has been placed around the known habitat area.
- Access through this area will be during daytime hours only at reduced speeds to minimize the likelihood of traffic encounters. No set-downs, turning circles or off-track driving will be permitted.
- Retaining key habitat requirements for the species. Land units which contain cracking clay soils will be avoided.
- Indirect impacts such as weed invasion and feral predators will be mitigated by strict adherence to the waste management plan and adherence to the weed management plan.
- Staging the timing of works to avoid impact to habitat during times at which there is a higher likelihood of occupancy. In this case populations are likely to increase following rainfall events. Work will cease if there is a significant rainfall event (>25 mm)

#### 4.3.1.4 Thick billed grass wren

This thick-billed grass-wren is a small bird (length 15-20 cm) with a long tail. The upperparts are dull brown in colour with the underparts being paler fawn. Feathers are streaked with white. The north-western subspecies of the thick billed grass wren inhabits the chenopod shrublands of inland Australia, particularly those dominated by saltbush Atriplex and bluebush Maireana. The subspecies is sedentary, and pairs usually occupy a home range of 20-40 ha. Birds feed on the ground where seeds and invertebrates are obtained. Breeding takes place in spring or summer. During the survey of seismic lines, the required habitat for the species was not identified, with most seismic lines occurring within spinifex dominated dune systems. While possible habitat may occur within the Andado and Snake creek SOCS this area will be disturbed as minimally as possible, and no seismic activity occurs within the SOCS. If suitable vegetation is encountered during seismic line establishment the following measures will be implemented.

- Buffer of 300 metres around any suitable vegetation identified during seismic line construction.
- Avoidance of construction during the breeding season
- Construction restricted to daytime hours.
- If the species is identified seismic activity will be redirected.
- Adherence to the weed and waste management plans to mitigate the potential increase in feral animals such as cats.

#### 4.3.1.5 Bronzeback

The Bronzeback is a small species of legless lizard with a snout-vent length of up to 102 mm and an even longer tail. The upper body is bronze or rich fawn, which contrasts with the pale grey head and a broad dark-brown lateral band that runs from the snout to the tail tip. The Bronzeback typically occurs in Acacia dominated open woodlands with a low open shrub understory. In the NT, the species is closely associated with ephemeral drainage channels that dissect stony gibber plains, areas of shale and siltstone mesas. Bronzebacks are fossorial and inhabit deep leaf litter underlain with loose sandy loam soil at the base of a tree or shrub. In the NT, the species has been recorded under the litter mats of four shrub species: Acacia aneura, *A. cambagei, A. latzii* and *A. sibirica*. Recent and historical records for the species all occur to the west (between 30 to 130 km) of the tenements. Review of satellite imagery indicates that this habitat type may occur across the southern extent of the tenements. Assessment of seismic line placement indicates that this habitat is unlikely to be encountered however if it does intersect seismic line establishment the following measures will be implemented.

- Buffer of 300 metres around any suitable vegetation identified during seismic line construction.
- Diversion of seismic line to avoid any of the preferred acacia species and associated leaf litter.
- Construction restricted to daytime hours.
- If the species is identified seismic activity will be redirected.

#### 4.3.1.5.1 Grey Falcon

The Grey Falcon is a medium-sized, compact, pale falcon. The head and upperparts are light blue grey. The cheeks and chin are whitish, except for a faint grey 'tear mark' under each eye, and the underparts are pale grey with fine darker streaks. The wingtips are blackish above and the flight and tail feathers are barred. Grey Falcons live in areas of sparsely timbered lowland plains, typically on inland drainage systems, where the average annual rainfall is less than 500 mm. The species occurs in low densities and usually only one or two individuals are seen. Grey Falcons use nests built by other bird species and prefer those in the tallest trees along watercourses. Nesting has been recorded from June to November, but in any one area may occur only in years with above-

average rainfall. Grey Falcon was not observed during the survey, however there are several areas of potential nesting habitat associated with drainage lines and watercourses. Watercourses have been avoided in the survey apart from small ephemeral stream bed which are not associated with large trees. If encountered these trees are scattered to sparse and can be easily avoided by the 2D seismic line establishment. As such, none of these trees will be removed so minimal impacts to this species are expected from the 2D seismic program. The following mitigation measures will be implemented throughout the project to reduce the risk of impacting the species.

- If any active nests are detected near the seismic exploration area, then a 300 m radius no work zone should be applied to reduce disturbance to the nest.
- Seismic lines have been designed to avoid areas with large trees such as riparian zones.
- Construction restricted to daytime hours.

#### 4.3.1.6 Brush Tail Mulgara

The Brush tail Mulgara is a medium sized carnivorous Australian marsupial species weighing approximately 100 g. Their body length is 12 to 17 cm and tail length is 6–10 cm with a distinctive fin-like crest of black hairs on the tail. The coat is tan to ginger above and creamy white on the belly. The Brush Tail Mulgara is widely distributed having been observed in the north-western, central, and south-western areas of the arid zone of Australia. Populations often occur as scattered with relatively low population densities while still being locally abundant. Populations decline consistently during the winter and spring, possibly due to decreased food during the winter season, reducing available food for potentially pregnant females that would need to feed their young, and reduction of available males due to aggressive competition for access to females earlier in the year. Notably, dramatic increases in population can be observed after large rainfall events, which are thought to come from competition with small rodent population explosions following such events. Their primary habitat is associated with spinifex grasses. The Brush tail Mulgara dig deep burrows up to 0.5m deep. The diet is an opportunistic one consisting of a wide range of invertebrates including frogs, reptiles and small mammals as well as beetles. it is a mostly nocturnal marsupial and during the day it shelters in complicated extensive burrow systems which are typically located at the base of large clumps of spinifex grasses occupying sand and gibber plains. Scats of this species are readily identifiable. The distribution of this species is not known to overlap with any EPBC Act-listed threatened ecological community so minimal impacts to this species are expected from the 2D seismic program. The species is highly mobile and will quickly leave the area if disturbed by the action of graders, bulldozers or Vibroseis trucks. The species is also known to be very inquisitive therefore individuals may get closer to the machinery or the cleared lines without risk of harm to them. The following mitigation measures will be implemented throughout the project to reduce the risk of impacting the species.

- Blade up clearing in proximity to identified habitats
- Construction restricted to daytime hours.
- If the species is identified by burrow or scat presence, seismic activity will be redirected.
- Adherence to the weed and waste management plans to mitigate the potential increase in feral animals such as cats.

# 5 FIELD SURVEY RESULTS

#### 5.1 Level of confidence

The results of this survey retuned a high level of confidence that, given the specific ecological needs of flora and fauna species of concern, if recommendations are adhered to the impacts to species of ecological significance have been well quantified and can be controlled.

#### 5.2 Vegetation

Overall, none of the species identified within this survey were listed under the Commonwealth Environment Protection and Biodiversity Act 1999 (EPBC Act 1999) (amended 2004) and Territory Parks and Wildlife Conservation Act (2000) (TPWC Act 2000). There were minor differences in species composition throughout each of the surveyed areas, mainly because of rainfall and fire patterns, but in general all flora identified within the survey sites are similar and are widespread throughout the Simpson Desert dune complex.

#### 5.3 Landform descriptions and assessment

The project footprint is predominately comprised of dune systems in the southern and northern section with rocky rises and plains interspersed in the middle section. The following section outlines the different landforms present during the seismic line surveys.

#### 5.3.1 Dune fields

Dunes within the project footprint have a range of orientations from parallel (SE to NW direction), reticulate dunes or irregular dunes. Some are vegetated with mixed shrubs and kerosene grass whilst spinifex dominated dune fields, typical of the Simpson Desert, occur in the southern part of the project area. Dunes have high relief (between 5 - 15 metres). Dune crests are susceptible to erosion when vegetation is removed, and vehicle tracks established in these areas. This landform is widely spread across the bioregion and does not contain significant habitat or sensitive vegetation, it is therefore unlikely that seismic activity in this landform will have ongoing negative impacts.

#### 5.3.2 Swales

Interdunal swales, the flat plains and depressions between dunes have a varied vegetation structure throughout the study area. In the southern part of the project footprint swales are dominated by spinifex and with some sparse trees including patches of grevilleas and coolabahs. In the northern area Swales are broader with Mulga shrubland over low grassland present. Interdunal swales are easily trafficable and present few erosion risks. This landform is widely spread across the bioregion and does not contain significant habitat or sensitive vegetation, it is therefore unlikely that seismic activity in this landform will have ongoing negative impacts.

#### 5.3.3 Plains

Broad undulating plains with either sandy or clay dominated compositions occur within the project area. These areas support isolated shrubs and Mulga stands over short grass fore communities. Widely spaced drainage lines may support isolated Coolibah over shrubs and annual grasses. Soils are typically clays to clay loams with a relatively high surface gravel content, but large expanses of sandy loams with low to no rocks are also present. The topsoil is easily eroded if bare of vegetation or if stockpads or roads concentrate water flow. Long slopes, whilst gentle, have the potential to channel large volumes of water. These features increase the risk of water erosion and run off, graded tracks with winrows can concentrate sheet flow leading to gully erosion. Maintaining vegetation cover and constructing well drained roads without wind rows can help minimise soil erosion in these areas.

#### 5.3.4 Drainage lines

There are relatively few drainage lines within the project footprint, and many that occur are small ephemeral watercourses that only fill periodically. There are six drainage lines that intersect the northern most seismic line in the project (EP107 line 2). These are all non-perennial stream order 1 drainage lines. These drainage lines are considered easily trafficable that will either require no or very minor cuts in the instance that earthworks are required at crossing points specific controls to minimise disturbance from the movement of the exploration vehicles (i.e. deeper depressions,

minor gully erosion or lined with vegetation) will be implemented as per the ESCP. The locations of drainage line crossings are shown in Figure 5-1 and attached as spatial data.

Drainage lines are prone to weed infestation (predominantly Buffel Grass *Cenchrus ciliaris*) and erosion. During infrequent heavy rainfall events water will generally disperse across the landscape and pool in drainage depressions. The movement of sediment along drainage lines is unlikely to be of major concern if vegetation cover is retained and vehicle disturbance is minimised. Roads and tracks must be graded to ground level and any excess soil, or windrows along the roadside edges must be flattened to prevent water concentration and enable water to move freely across the landscape in an unaltered direction. This will prevent further erosion and sediment transport into drainage lines and ensure that water is able to follow its natural course.



Figure 7-1

Figure 5-1 Location of drainage line crossings and claypans

#### 5.3.5 Clay pans

Clay pans have a scattered occurrence throughout the project footprint. They support very little vegetation, and the edges are generally lined with species typical of the surrounding landform. Clay pan areas are sensitive to impacts – particularly if crossed when wet, with heavy plant, vehicles, and equipment. Being so flat the claypan has little erosion hazard, although the margins can be quite fragile due to sheet flow entering the depression. Clay pans are often found to have a high probability of artefact occurrence – further information can be found in the projects Archaeological Survey Report. There are 27 small clay pans within the project footprint. These have been mapped (Figure 5-1) and provided as a spatial data layer. This information is valuable to assist with identifying areas to avoid, therefore minimising impacts of erosion and preserve biodiversity within the region. The clay pan identified during the field survey were all small and can be easily avoided by diverting seismic lines slightly skirt around clay pans. In general clay pans in the area were typically recorded between 20 – 70 metres wide.

#### 5.3.6 Low rocky rises

Low rocky rises have a very low relief (i.e. <5m). These features are scattered throughout the project footprint, particularly within the sandplains and dune fields. Vegetation can vary from 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 soil.

#### 5.3.7 Hills

Most of the hills in the project footprint are formed on deeply weathered Rumbalara Shale and dip to the south-east where they pass under the sand plains. The gravelly rises in the central and northeastern parts of the property consist of deeply weathered 'breakaways' featuring a silcrete duricrust capping. Water channelled on the road, along windrows and wheel ruts, often leads to gully erosion. Avoiding windrows and using 'whoaboys' and spoon drains can help prevent erosion occurring. Coarse textured surface soils overlie clayey subsoils and support a low grassland of annual grasses and copper burrs.

#### 5.4 Weeds

During the field survey all weed sightings were recorded (Figure 5-2). There are several different categories for weeds within the Northern Territory. Some species of introduced flora are declared weeds under the NT Weeds Management Act because of the environmental and/or economic harm they can cause. Class A weeds are to be eradicated by landowners and occupiers. Class B weeds must have their growth and spread controlled by landowners and occupiers. The remaining introduced flora species are referred to as environmental weeds. The Commonwealth Government has also categorised some species as Weeds of National Significance (WoNS). The main weed of concern within the project footprint is Buffel Grass (*Cenchrus ciliaris*), which is not a declared species but is listed as a category 2 species in the Alice Springs Regional Weeds Strategy 2021- 2026 (DEPWS 2021) due to its potential impacts on biodiversity and fire risk. Bitter Paddymelon (*Citrullus colocynthis*) was also present at many sites however this is a lower impact environmental weed.



Figure 5-2 Weeds recorded in the project area

#### 5.5 Introduced fauna

Six introduced species were reported as either present, or likely to occur in the proposed project area in state and commonwealth databases for the project area. These include Dromedary Camels, Horses, Dogs, Cats, Foxes and House Mice. The project area also occurs on a pastoral lease, therefore commercial herds of cattle are presumed to be present. Tracks and scats of feral cats were observed in several areas throughout the project area. Cat tracks were observed following vehicle tracks and dry ephemeral creek beds, indicating that cats utilise these clear areas to move around in the landscape.

#### 5.6 Erosion

A large part of the proposed project area is situated on vegetation characterised by low sand dunes interspersed with swales. The orientation of seismic lines crossing sand dunes is likely to influence the erosion potential in this area. Repeated access to seismic lines across the project area by heavy vehicles during seismic surveys is also likely to cause topsoil compaction and disturbance which could lead to erosion. With the project area situated on commercial cattle grazing operation, cattle are likely to use seismic lines, especially where these lines are prepared in proximity to troughs and dams. This will increase the time for vegetation to recover post-survey. Generally, drainages and watercourses are typically more prone / susceptible to erosion when disturbed and erosion controls will need to be installed to minimise chance of erosion development along the 2D seismic lines. However, soils in all other land types within the project footprint can also erode if track establishment / rehabilitation works are not carried out appropriately. The project specific Erosion and Sediment Control Plan (ESCP) describes how erosion will be managed.

#### 5.7 Pastoralism

A significant portion of the project footprint is covered by Andado station. There was minimal evidence of grazing and trampling impacts from cattle with strong vegetation growth across the property. Localised areas of more significant impacts occurred close to bores and stock watering points, along cattle tracks and in drainage areas. Due to higher volumes of cattle movement these areas had more signs of trampling, grazing and minor erosion.

#### 5.8 Fire

Fires are a frequent occurrence in the Simpson desert and are often related to periods of above annual rainfall. According to fire history and fire scar data in Northern Australia and Rangelands Fire Information, a significant portion of the project area burnt in 2011 in fires which covered much of the Simpson desert Figure 5-3). The most recent fires occurred in the Northern section of EP107 in 2020 and 2021, although these fires were significantly smaller than the fires which occurred in 2011. Fuel loads across the region were moderate to high during the field survey. Fuel loads were higher in areas with perennial vegetation, while areas of annual vegetation were less significant.



Figure 5-3 Fire history of the project area

# 6 Recommendations

To avoid impacts to threatened species and to the biodiversity values of the project area in general, LES makes the following recommendations:

- In general, the proposed seismic acquisition program is not likely to have significant impact on the flora, fauna, or landscape if existing tracks are used where available, best practice techniques are followed and sensitive areas avoided.
- Travel between project footprint sites using existing tracks, roads, and trails.
- Exploration and movement of plant and equipment within Sites of Conservation Significance and Sites of Botanical Significance should be avoided or limited to existing tracks and roads.
- No major changes to seismic line alignment are recommended, however best practice line establishment methods should be always used. The blade should be kept above ground level where possible.
- To reduce likelihood of erosion in sand dune habitat, wherever possible crossings of sand dunes should be orientated to reduce slope of crossing (i.e. cross on an angle rather than perpendicular to the dune).
- If dune crests need to be crossed to gain access to the adjacent swale, the dune crest should be scouted on foot or quad bike prior to vegetation clearing for passage to choose area of minimum impact (i.e. low point and/or existing cattle pass-over points to minimise impact to pristine locations).
- Strict weed hygiene management practices, including vehicle wash pre entry to site and blow down should be implemented during the proposed operations when traversing areas of known weed infestations to prevent the introduction of weeds, spread of weeds in the area, and transport of weeds off site.
- Avoid Coolabah swamps and clay pans to preserve the biodiversity within the region.
- Avoid large trees and use techniques such as blade up clearing to reduce damage to vegetation across the project area.

# 7 Seismic line details and recommendations

#### 7.1 EP93 line 1

- EP93 line 1 is approximately 135.6 kilometres long and predominately intersects dune and dune swales associated with the Simpson desert dune fields.
- There are seven claypans which intersect this seismic line (spatial data provided) shown in the map (Figure 7.1). It is suggested that these claypans can be easily avoided by diverting the seismic line 20 70 metres to the north or the south in these locations.
- Appendix B Cultural Heritage Assessment Report identifies several claypans as Cultural Heritage Risk Areas (CHRA) having low-medium risk of isolated stone artefacts and low-density scatters of stone artefacts (EP93 Line 1 CHRA01, appendix B, Table 8). Claypans are to be blade up traversed during construction as per recommendations in appendix B.
- There are three drainage lines which intersect the seismic line. The most easterly line is associated with the Hale river flood out and the recorded claypans. This site was inspected during the survey. It is recommended to avoid large trees associated with clay pans and drainage systems. The two western drainage lines are stream order three and four respectively. These streams were surveyed and do not present erosion issues as they are non-perennial and are associated with broad dune swales and clay pans. Clay pans can be skirted around, and large trees avoided.

- The drainage lines are non-perennial and are predicted to be dry during the completion of the survey.
- The following measures are recommended for crossing these areas during the survey.
  - Existing topography to remain unaltered.
  - Blade up 'walk over' of drainage lines and riparian buffers (25 meters) with no use of grader or dozers.
  - Temporary stockpiling of soil, equipment, and materials within watercourses, or on adjacent banks and floodplains, is to be avoided (unless integral to drainage control requirements).
  - Select crossing where bank is lowest, avoiding trees and dense vegetation (if possible).
  - Where possible, crossings should be constructed at right angles in locations where the stream is straight.
  - Seismic line runoff is to be prevented from directly entering the watercourse by construction of flow diversion banks (rollovers) immediately upslope to divert flow.
  - Monitoring points at each drainage line to detect any signs of erosion.
  - Vehicles utilised for surveying should be customised for sandy off-road driving (i.e. broad sand terrain tyres, low tyre pressure, high clearance etc.)
- At the western end of the line there are several Coolabah (*Eucalyptus coolabah*) stands, these mature trees will be avoided as they are uncommon in the area and provide important habitat for species in this land system. The seismic line can easily skirt around these stands of trees. Spatial data for locations of large trees provided and shown in Appendix A
- At the western end of the line there are several Coolabah (*Eucalyptus coolabah*) stands, these mature trees will be avoided as they are uncommon in the area and provide important habitat for species in this land system. The seismic line can easily skirt around these stands of trees. Locations are shown in the map (Figure 7.1) and provided as a spatial data file.

#### 7.2 EP93 Line 2

- EP93 line 2 is approximately 68.5 kilometres long and predominately intersects dune and dune swales associated with the Simpson desert dune fields.
- The clay pans and drainage channels associated with the Hale River flood-out contain several stands of large Coolabah trees (*Eucalyptus coolabah*) and is considered a sensitive vegetation community. This seismic line has been shortened to avoid intersecting with the southern end of the Hale River flood-out and associated clay pans and Coolabah trees.
- There are 4 claypans which intersect this seismic line (spatial data provided) shown in the map (Figure 7.1). It is suggested that these claypans can be easily avoided by diverting the seismic line 20 70 metres to the north or the south in these locations. These locations can be avoided by diverting the line slightly to the south. The use of cordless geophones allows for such features to be avoided.
- In the middle section of the line several stands of White wood (*Atalaya hemiglauca*) occur on dune slopes and crests. These stands of mature tree will be avoided to reduce disturbance to the site. Shown in the map and associated spatial data provided (Figure 7.1).
- Dunes are larger in the Eastern section of the line and may present some challenges for vehicle access.
- One drainage line associated with the Hale river flood out intersects the western end of the line. This area was surveyed and was deemed to be a low-risk area due to the non-perennial nature of the flood out. The flood out occupies a wide dune swale with low erosion risk and any large trees or clay pans can be avoided during seismic line construction.

- The drainage lines are non-perennial and works will be paused following rain events of 25mm or over insuring the drainage will be dry during the completion of the survey.
- Appendix B Cultural Heritage Assessment Report identified a water course as a CHRA (EP93 Line 2 CHRA01, appendix B, Table 8). Watercourse to be blade up traversed during construction as per recommendations in appendix B.
- The following measures are recommended for crossing these areas during the survey.
  - Existing topography to remain unaltered.
  - Blade up 'walk over' of drainage lines and riparian buffers (25 meters) with no use of grader or dozers.
  - Temporary stockpiling of soil, equipment, and materials within watercourses, or on adjacent banks and floodplains, is to be avoided (unless integral to drainage control requirements).
  - Select crossing where bank is lowest, avoiding trees and dense vegetation (if possible).
  - Where possible, crossings should be constructed at right angles in locations where the stream is straight.
  - Seismic line runoff is to be prevented from directly entering the watercourse by construction of flow diversion banks (rollovers) immediately upslope to divert flow.
  - $\circ$   $\;$  Monitoring points at each drainage line to detect any signs of erosion.
  - Vehicles utilised for surveying should be customised for sandy off-road driving (i.e. broad sand terrain tyres, low tyre pressure, high clearance etc.)

#### 7.3 EP93 Line 3

- EP93 line 3 is approximately 57.4 kilometres long and predominately intersects dune and dune swales associated with the Simpson desert dune fields.
- Weeds (paddy melon) were identified at one location along the line.
- Local erosion was noted at one site along the line in an area with low dunes.
- Patches of *Grevillea juncifolia* occur in some interdunal swales and on dune flanks. These larger trees will be avoided during line construction. The seismic line can easily skirt around these trees. These locations are shown in the map (Figure 7.1). and attached as a spatial data file.
- No drainage crossings on this line

#### 7.4 EP93 line 4

- EP93 line 4 is approximately 36.6 kilometres long and predominately intersects dune and dune swales associated with the Simpson desert dune fields.
- The Hale River flood out-area is a sensitive land unit which provides important habitat and may present increased erosion risks. The previous extent of this line has been modified to avoid this area and associated vegetation and habitat for threatened species.
- No drainage lines or clay pans were recorded on this line.

#### 7.5 EP93 Line 5

- EP93 line 5 is approximately 27.7 kilometres long and predominately intersects dune and dune swales associated with the Simpson desert dune fields. This seismic line runs along an interdunal swale, minimising the amount of clearing and track development required to allow access. This also reduces erosion risk and damage to vegetation.
- This line partially intersects with Andado station. The helicopter could therefore not be used to survey the entire length of the seismic line. The land system classification remains the

same for the entire line, so the surveyed portion has been used to generalise for the entire length.

- Some stands of *Grevilea juncifolia* occur and these will be avoided by the use of cordless geophones negating the need for straight line traverse, shown on the map (Figure 7.1). and spatial data provided. The dune swale is wide with a relatively flat base so this will not present difficulties.
- No drainage crossings on this line

#### 7.6 EP97 Line 1

- Seismic line 1 in EP97 is approximately 115.3 kilometres long and predominately intersects dune and dune swales associated with the Simpson desert dune fields.
- Nine clay pans were noted during the survey of this line and three artefacts were identified adjacent to the seismic line in one of these areas, shown in map (Figure 7.1).
- Appendix B Cultural Heritage Assessment Report identifies several clay pans as CHRA (EP97 Line 1 CHRA01-03, appendix B, Table 8). Clay pans are to be blade up traversed during construction as per recommendations in appendix B.
- Weeds (Paddy Melon) were identified at two locations along the line and camels were sited at one location with dropping and tracks located at other sites, both records are presented in the map (Figure 7.1) and in the accompanying spatial data.
- The dunes in the east section of these line are very steep and high (up to ten to 15 metres). Line could be moved either north or south to optimise areas where dune crossings are lower. Ideally, dune crossing points should aim to occur a low point, or break, in the dune to minimise cut requirement on its crest. The 300m AAPA approved easement width allows for this movement if required.
- No drainage crossings on this line.

#### 7.7 EP107 line 1

- EP07 line 1 is approximately 38 kilometres long intersecting dunes and open sand plains in the north.
- This seismic line has been removed from the proposed seismic survey to avoid potential impact on cultural heritage values.
- This decision was made after the completion of the field survey and reviewing recommendations of Cultural Heritage Assessment Report (appendix B).

#### 7.8 EP107 line 2

- EL107 line 2 is approximately 59.8 kms long and intersects low sprawling hills and gravelly foot slopes as well as open sandy dune fields.
- The far eastern end the line has been shortened to avoid intersecting the alluvial plains and drainage systems associated with the Todd River flood out which provides critical habitat and can be considered as sensitive vegetation.
- In the western section of the line on the southwestern side of the Old Andado road there is a rocky outcrop which should be avoided, the line could be moved either south or north. See the archaeological report for further details and realignment.
- There are 9 drainage lines which intersect the seismic line. 8 are stream order 1 and one is stream order 4 and all are listed as non-perennial. The protocol for work carried out is for work to only occur when these areas are dry. It is predicted there will be minimal impacts associated with drainage line crossings if this occurs.

- There are five claypans on this seismic line. Clay pans shall be diverted around during seismic construction. The drainage lines are non-perennial and are predicted to be dry during the completion of the survey. The use of cordless geophones will allow these features to be bypassed.
- In the western section of the line on the southwestern side of the Old Andado road there is a rocky outcrop which should be avoided, the line could be moved either south or north. See the archaeological report for further details and realignment.
- This area is likely to contain vegetation suitable for threatened species habitat such as the Grey falcon and would require extensive land clearing and earth works to allow access. The eastern section of the line has been shortened to avoid intersecting with the drainage systems, alluvial plains, large trees and clay pans associated with the Todd River flood out to avoid this area.
- Appendix B Cultural Heritage Assessment Report identified the Todd River palaeo-drainage system in the east of the original line as a CHRA (EP107 Line 2 CHRA07, appendix B, Table 8). The eastern section of the line has been shortened to avoid this CHRA as per recommendations in appendix B.
- The following measures are recommended for crossing these areas during the survey.
  - Existing topography to remain unaltered.
  - Blade up 'walk over' of drainage lines and riparian buffers (25 meters) with no use of grader or dozers.
  - Temporary stockpiling of soil, equipment and materials within watercourses, or on adjacent banks and floodplains, is to be avoided (unless integral to drainage control requirements).
  - Select crossing where bank is lowest, avoiding trees and dense vegetation (if possible).
  - Where possible, crossings should be constructed at right angles in locations where the stream is straight.
  - Seismic line runoff is to be prevented from directly entering the watercourse by construction of flow diversion banks (rollovers) immediately upslope to divert flow.
  - Monitoring points at each drainage line to detect any signs of erosion.
  - Vehicles utilised for surveying should be customised for sandy off-road driving (i.e. broad sand terrain tyres, low tyre pressure, high clearance etc.)
  - $\circ$   $\;$  Dust suppression if needed to avoid the potential of wind erosion.
  - Minimise the number of vehicle crossings wherever possible.
  - Reduce speed when crossing drainage lines.

#### 7.9 EP107 line 3

- EL107 line 3 is approximately 30.6 kms long and predominately intersects with wide interdunal fields and sand plains. The line follows a wide interdunal swale with relatively dense shrubs and few trees. The interdunal swale presents few erosion risks. Several ephemeral clay pans occur along the line in the dune swale and are shown in map 7.1 and associated spatial data.
- This seismic line has been significantly shortened from previous proposed work. This will reduce the risk of erosion and impact to vegetation in the old Todd River flood-out site of botanical significance which occurs in this northern section of EP107.
- Drainage depressions, claypans and stony rises in the north of original EP107 line 3 identified in Appendix B Cultural Heritage Assessment Report as CHRA (EP107 Line 3 CHRA01-03, appendix B, Table 8). All CHRAs avoided by shortening of seismic line.

- This seismic line has been carefully selected to avoid the Andado and Snake creek SoBS and SOCS which lie to the south of the line and contain nationally significant flora and fauna.
- Cattle tracking in the area is relatively high.
- No drainage crossings on this line
- A large unoccupied eagle's nest was identified along this line during the survey (shown on the map and in associated spatial data) a three hundred metre buffer is recommended around this area to ensure no impact to potential habitat.

#### 7.10 EP107 line 4

- EP107 line 4 is approximately 50.5 kms long and is entirely within Andado station.
- The line predominately intersects with sandy dune fields with tall sparse shrubland. In the North the line crosses a broad alluvial plain area.
- The access track to the southern end of the seismic line follows an existing pastoral track across an alluvial plain. This alluvial plain is associated with run off from the nearby plains and contains several localised drainage lines however the access track does not intersect with these. Care will be taken to ensure that this area is only traversed during dry conditions.
- This seismic line has been shortened to avoid the rocky escarpment in the southern section of the previously proposed line. This land system has been avoided to minimise risk of erosion and avoid potential habitat of localised populations of *Acacia peuce*. Several clustered groups of artefacts were also found in the hill and rocky rise land unit.
- Shortening southern section of the proposed line avoids drainage and landforms identified as CHRA (EP107 Line 4 CHRA03, appendix B, Table 8) in Appendix B Cultural Heritage Assessment Report, as per recommendation. As per Appendix B recommendations cultural monitors have been appointed by the CLC to assess this area and sacred site clearance has been given.
- Blade up traverse will be used in construction in claypan and drainage depression identified as CHRA (EP107 Line 4 CHRA01-02, appendix B, Table 8) as per recommendations in Appendix B Cultural Heritage Assessment Report.
- No drainage crossings on this line

#### 7.11 EP107 line 5

- EL107 line 5 is approximately 61.8 kms long. The Southern section of the line begins in the open sand plain before following a wide interdunal swale for much of its length.
- There is one clay pan in the Northern section of the line which can be easily avoided by diverting slightly to the east or west within the dune swale.
- This seismic line has been shortened to avoid the low hills and gravelly slopes in the north of the previously proposed line.
- Drainage depressions in north of previously proposed line identified as CHRA (EP107 Line 5 CHRA01-03, appendix B, Table 8) in Cultural Heritage Assessment Report has been avoided with line shortening.
- A single stone axe artefact was found the southern part of the line in the interdunal swale.
- The southern section of the line is easily traversable, the wide stable dune swale does not present any challenges and is easily trafficable. Large trees in the dune swale should be avoided by the use of cordless geophones.
- No drainage crossings on this line



Figure 7-1. Drainage-line crossings, clay pans and significant trees to avoid.

# 8 Access track details and recommendations

#### 8.1 Old Andado road

- This is a formed and well used road that is regularly maintained for pastoral use in the region and will not require upgrades to allow site access and mobile camp movement.
- The road crosses a large section of the Andado and Snake Creek SOCS, however impacts will be minimal because this road will only be used for site access and all vehicle movement will be kept to the existing road. These factors coupled with vehicle weed inspections mean that potential risks are ALARP.

#### 8.2 Colson Track

- Relatively good condition throughout
- Follows broad interdunal swales through sandy dune fields with rare crossing of low anastimosing dunes. This alignment reduces risk of erosion and sheet flow runoff.
- May require some grading for heavy vehicle access, particularly in the southern area of the access track.
- This track is rarely used with infrequent tourist 4WD adventure traffic, seismic activity is unlikely to impact other road users.

#### 8.3 Blamore track

- Existing access track which follows broad interdunal swales with rare crossing of low anastimosing dunes. This alignment reduces risk of erosion and sheet flow runoff. Some areas in the south may require grading and patching.
- This track is rarely used with very little traffic, seismic activity is unlikely to impact other road users. Slightly increased road activity near Bravo bore with occasional tourist activity (Madigan line tourist route) and pastoral use (bore monitoring and cattle). In frequent access by seismic activity is unlikely to impact other users.

#### 8.4 Station tracks within Andado and Snake Creek SOCS

- Station tracks in this area are well formed and established.
- The total length of access tracks which occur within the Andado and Snake Creek SOCS is approximately 102 kms.
- No track widening will occur in this area to reduce possible negative impacts to the Andado and Snake Creek SOCs which overlies this section of the EP.
- Station tracks used for site access have been selected to avoid the Mac Clark Conservation reserve and the *Acacia peuce* that occur there.

#### 8.5 Northern access for EP107 line 5

- The northerly east west access route also follows an existing access created by Santos in mid 2010s for seismic, currently unmaintained. This section of track traverses dune swales, sandplains and low dune ridges
- A review of aerial imagery indicates that the track has moderate to high levels of vegetation regrowth, so it is expected that track maintenance may require some removal of regrown shrubs and small trees.
- Small section of the access track intersects the SOCS area. Assessment of this area shows that the initial 1.2 kms follows an existing pastoral fence line. There are two land units within this section neither of which contain the cracking clay soils preferred by the plains mouse. After leaving the fence line the access track returns to the widely distributed sand dune land

units. While this area is still contained within the SOCS these land units are not considered to be rare or threatened and the impact of the access track is therefore considered low.

• The western 16 km of this track occurs within dune fields, which are not considered to hold special ecological significance. Dune crossings at the westerly end of the route may require earth works to stabilise dune crests and allow access for heavy vehicles. There are 12 dune crossings in this route.

#### 8.6 Access from East bore to EP107 seismic line 4.

- This access route follows existing station tracks from east bore north to Andado stock bore and then towards Bravo bore (RN015819).
- This access route is 30 kms long and follows an old Central Petroleum access route for previous seismic work.
- These tracks are well established and will not require widening or substantial earthworks. Grading and patching may be required in some areas to reduce the risk of erosion.
- No track widening will occur within the SOCS and only work to reduce erosion risk will be carried out in these areas.

#### 8.7 Access from EP107 seismic line 4 to 3BB access line (3P) continuing to J line.

This path was proposed to eliminate passage through SOCS from east bore to the north of the J line. This track was assessed and found to traverse an escarpment as well as requiring some clearing in the initial section. It is strongly believed that the use of the Madigan track from East bore to the J line (discussed below) will result in significant less environmental ecological damage than any other path.

#### 8.8 J line access

- This access route follows an existing Station track and historical access track south from East bore.
- The northern section of this track was established at least 24 years ago to check and service bore RN017396 and heard cattle. The southern sections, below the SOCS area was established by Central Petroleum approximately 15 years ago and is currently maintained as a station track, viewable from aerial imagery.
- Use of this track has been shortened to the first 33.8kms to avoid the need to create new access or upgrade the existing track. This track will provide accesses to BR Simpson EP93 seismic lines which can then be used to access EP97 seismic lines via EP93 Line 5 and the Blamore and Colson tracks.
- The existing track follows and, in places, crosses a non-perennial stream bed which does not contain water unless a large rain event occurs. It is believed the use of this track will result in the least ecological impact to the area due to the use of a current track and will require no blade down clearing or manipulation of stream banks.
- This water course is characterised by very flat areas of washout where crossings can occur without risking further erosion.
- The elevation profile of this created drainage shows high points where sand dunes would have obstructed the natural flow and diverted the water south underground. These areas would be ideal to use Whoa boys and encourage the historical natural action of the drainage water.
- Risk to the SOCS values is negligible due to large absence of clay pans, cracking clay soil land units and no predicted populations of listed threatened species in the immediate vicinity. It is considered that re-establishing this track with a small section in the SOCS area will have a

less significant impact than establishing a new access track which avoids the SOCS, but which would involve significantly longer routes, more vegetation clearing, and significant earth works.

• This access route predominately follows the wide interdunal swale and will not require vegetation clearing as this area is relatively flat with minimal vegetation in the swale. The access track can easily avoid any large trees that do occur within the interdunal area.

#### 8.9 The Simpson access track

- This access route follows an existing access track.
- 19.6 kms of this route will be used for access to seismic lines in EP93.
- This route has not been maintained and work will be required to re-establish the route and allow for heavy vehicle movement.
- This access route predominately follows the wide interdunal swale and will not require significant levels of vegetation clearing as this area is relatively flat with minimal vegetation in the swale. The access track can avoid any large trees that do occur within the interdunal area.

#### 8.10 Simpson Bore to EP97 line 1.

- An historical access was established to the Simpson bore however this will need to be reestablished during the proposed seismic program.
- This access route is 24.3 kms long.
- This access route follows a dune swale and will not require land clearing to reform.

# 9 Camp location descriptions and locations

Three temporary accommodation camps will be established during the project. The three locations for the mobile camps have been selected with consideration given to existing vegetation, level of ground, proximity to re-supply and access routes in/out and location of water courses/sources and or sensitive ecological environments. The following section outlines the locations and descriptions of each of the selected camps. Note that camp locations have been changed significantly since the initial environmental survey was conducted in 2022 hence the final sites were not closely surveyed in 2022. However Low Ecological has worked extensively in the area and has previously surveyed the Blamore track, Colson track and Old Andado road for various projects and is very familiar with the area, associated land units and potential risk factors. Satellite imagery and aerial photographs were used to verify interpretations.

#### 9.1 Camp Blamore

Camp Blamore is located within a wide interdunal swale dominated by Spinifex (*Triodia pungens*) and other short grass forb community species. There are relatively few shrubs and no large trees in the immediate vicinity of the proposed camp location. The wide dune swale with red sands poses a low erosion risk with minor slope. This land system is unsuitable habitat for the plains mouse and threatened plant species in the region (*Acacia peuce and Acacia pickardii*). This is the dominant land system and vegetation community within the region and is therefore unlikely to pose significant risks to other listed threatened or migratory species.

#### 9.2 Camp Andado

Camp Andado is located in the north of the project area on a sandy plain with low open grassland. Scattered Mulga (*acacia aneura*) occur across the area. These sandy plains present low erosion risk and will not require significant clearing of vegetation or earth works. Note this camp location has been moved from its previous location with the Andado and Snake creek SOCs. Open plains with sandy soils are unlikely to provide critical habitat for threatened species such as the plains mouse which prefers the cracking clay soils present within the SOCS area.

#### 9.3 Camp Colson

Camp Colson is located within a wide interdunal swale dominated by Spinifex (*Triodia pungens*) and other short grass forb community species. Scattered *Acacia ligulata* and other small shrubs with no large trees. The wide dune swale with red sands poses a low erosion risk with minor slope. This land system is unsuitable habitat for the plains mouse and threatened plant species in the region (*Acacia peuce and Acacia pickardii*). This is the dominant land system and vegetation community within the region and is therefore unlikely to pose significant risks to other listed threatened or migratory species.

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# **Cultural Heritage Assessment Report BR Simpson Seismic Exploration Project** (EP107, EP97 & EP93, Simpson Desert, NT) Prepared for: BR Simpson Pty Ltd SMK
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## Cultural Heritage Assessment Report: BR Simpson Seismic Exploration Project (EP107, EP97 & EP93, Simpson Desert, NT) (Final Report) 12 September 2022

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### Acknowledgements

BMK Co would like to acknowledge the assistance of the NT Heritage Branch (Department of Tourism, Sport and Culture) with providing background heritage information for this Project.

BMK Co would also like to acknowledge the assistance of the Central Land Council and Traditional Owners in facilitating field teams. Similarly, BMK Co wishes to extend sincere gratitude to Low Ecological Services and KAG Enterprises for organising logistics and field supplies.

## 1 Introduction

Remote Heritage Services (BMK Co Pty Ltd) has been engaged by BR Simpson Pty Ltd, to undertake a Cultural Heritage Assessment (CHA) of their proposed 2D seismic exploration program, located within the Simpson Desert, Northern Territory. The planned seismic acquisition is being plotted to assess the area within the Eromanga-Pedirka-Warburton Basin complex to delineate the depocentres of the Eringa and Madigan Troughs.

The Project Areas subject to this this heritage study are wholly located within petroleum exploration leases EP107, EP97 and EP93 and comprise the following proposed components:

- EP107 construction of five seismic lines, totalling 341km.
- EP97 construction of one seismic line, totalling 115 km.
- EP93 construction of five seismic lines, totalling 357 km.

BR Simpson intends to employ cordless geophones for the seismic acquisition, which aims to minimise the need for ground disturbance. As such, this Project plans to predominantly use a blade up approach to clear and degrass the 4 m wide seismic lines. Heritage and significant vegetation features are aimed to be avoided during the seismic program.

An archaeological field assessment, coupled with a desktop study, was used to inform this CHA report of any potential risks to archaeological resources and areas of cultural heritage significance within the proposed Project Areas outlined above. Archaeologist **Constant and Constant and Cons** 

### 1.1 Scope of the Study

This study and CHA report centred on assessing the significance and potential impacts to archaeological sites of Aboriginal origin and historical features associated with the post-contact to modern period. Sacred Sites, mandated as sites of significance in the Aboriginal Tradition by the Commonwealth *Aboriginal Land Rights (Northern Territory) Act 1976* (ALRA) and Northern Territory *Aboriginal Sacred Sites Act 1989*, have been assessed through the Aboriginal Areas Protection Authority (AAPA) Authority Certificate process (see Appendix 1: AAPA Authority Certificates).

In brief, the following objectives were used to complete this CHA:

- 1. Identify archaeological, cultural heritage features and other areas of cultural significance within or proximal to the Project Areas.
- 2. Identify and describe any archaeological research gaps relevant to the Project.
- 3. Identify any archaeological or cultural heritage constraints, potential impacts, and risks within the proposed Project Areas.
- 4. Consult with the relevant stakeholders throughout the Project, including Traditional Owner site custodians and Northern Territory Government Heritage Branch.<sup>1</sup>
- 5. Detail the Cultural and scientific significance of each feature identified.

<sup>&</sup>lt;sup>1</sup> Principally to establish the location of previously recorded archaeological sites of Aboriginal or historical origin.

6. Develop recommendations to minimise harm to Aboriginal and historic cultural heritage features and other areas of cultural significance.

### 1.2 Project Location and Land Tenure

The Project Areas are located within the Simpson Desert, approximately 300 km southeast of Alice Springs in the Northern Territory. As presented in Table 1, the seismic lines fall across varied land tenure, which include pastoral leases, Vacant Crown Land, Native Title and Aboriginal Land Trusts. The Mac Clark Conservation Reserve (NT Por. 1602) and the Old Andado Station (NT Por. 2447) fall within EP107 and EP93 respectively, however these areas will not be impacted by the Project.

This CHA report encompasses all seismic lines outlined in Section 1 above and Figure 1 below.

Seismic Line		Pastoral	Ab	ooriginal Land - ALRA Land		Native Title		Other
EP107	•	Andado Station (NT Por. 1361, 1103 & 1104)	•	Nil	•	DCD2018/002 (New Crown and Andado Pastoral Leases	•	Nil
EP97	•	Nil	•	Simpson Desert 3 (ALRA Claim)	•	DCD2018/002 (New Crown and Andado Pastoral Leases	•	Vacant Crown Land (NT Por. 4207)
EP93	•	Andado Station (NT Por. 1361 & 1104)	•	Pmer Ulperre Ingwemirne Arletherre Aboriginal Land Trust Simpson Desert 3 (ALRA Claim) Central Simpson Desert Repeat (ALRA Claim)	•	Nil	•	Vacant Crown Land (NT Por. 4207 & 4209)

#### Table 1: BR Simpson Land Tenure



Figure 1: Project Area Location

### 1.3 Proposed Project Works

The objective of the BRS Exploration Project is to identify the basin shape and base tectonics via the acquisition of 2D seismic information. This new seismic will be modelled with the extensive historical 2D seismic over the area. The planned seismic acquisition is plotted to assess the area within the Eromanga-Pedirka-Warburton Basin complex to delineate the depocenters of the Eringa and Madigan Troughs. The expected outcome is the improved definition of the formations within the region providing a better understanding of the axis of these troughs and their connection to the overall basin shape. This is aimed to identify the existence of any stratigraphic reservoirs within the granted exploration permits EP93, EP97 & EP107 that may have the potential to host conventional and unconventional hydrocarbons.

In acquiring the seismic information, BR Simpson plans to concurrently undertake the survey, acquisition and rehabilitation of any cleared areas. Seismic line and vehicle access clearing will be restricted to maintenance of the existing road verge [where following existing road, fence lines or access ways] and where practical, with minimal clearance of vegetation (4 m wide) by skim grading with the blade set at 25 mm above ground surface when crossing country. A GPS based navigational guidance system will be utilized to guide all line preparation machinery.

Given the generally open nature of the vegetation, BR Simpson expects ground disturbance activities to be restricted to degrassing and a ground sweep of larger shrubs to ensure good ground contact of the vibrosource. For the 2D seismic survey, AHV-IV rubber tyred vibrators will be utilized, operating as a single source array of two to three vibrators. The seismic intends to use cordless geophones to allow machines to move freely around obstacles and larger vegetation.

The location of the seismic lines has been selected based on the location of the historical seismic and intends to utilize so far as is possible the inter dune swale area and to take advantage of low-density vegetation or previously cleared sites. Where dune crossing is required, BR Simpson plans to access the shallower windward side approach to minimise any potential risk to the dune face. All access ways will be immediately rehabilitated after all site operations have been completed and all associated equipment has been relocated.

Photographic monitoring points will be established prior to the start of line preparation and at nominally 5 km intervals to document pre-disturbance and post-restoration condition. The process is repeated after line preparation and again after recording. The revisit intervals are aimed to be at one year, two years and four years, with the return period determined by weather/road conditions and current activity in the region.

AAPA Authority Certificates have been granted for the proposed seismic program. The Certificates provide for a cleared work area of 150 m either side of seismic centre line (300 m total width).

### 1.4 Consultation

BR Simpson Pty Ltd has aimed to develop an Indigenous engagement approach to undertake the seismic program and associate planning and approvals. This has included regular consultation with the Central Land Council (CLC) and the participation of Traditional Owners as cultural monitors for AAPA sacred site assessments for the Project. The below CLC Rangers and Traditional Owner accompanied the heritage and ecological assessment teams for a short period in this Project, however there was no extended participation in fieldwork due to their own sacred site and other commitments.





### 1.5 The Authors

#### Heritage Project Manager:

holds a Bachelor of Archaeology with Honours from Flinders University, South Australia. He has extensive experience in cultural heritage management and community consultation, coupled with the management of largescale developments such as mining and civil construction projects in the Northern Territory. The also has a professional background in land access management and aspects of environmental management, including compliance. He has been a co-author of several published academic archaeological journal articles and has been invited to speak at mining industry conferences in the Northern Territory.

#### Field Archaeologist:

holds a Bachelor of Archaeology with Honours, a Master of Science in Pathology and is currently a PhD candidate with Griffith University. The second second

## 2 Legislative Context

### 2.1 Statutory Considerations

Central Australia has a rich Indigenous cultural environment which includes a long history of human occupation and land use spanning at least at least 35,000 years (Smith 2013) and a recent past of that includes contact with European explorers, miners and pastoralists from the 1880's onwards (Tietkens 1891). The Project Areas and the wider landscape represent the outcome of thousands of years of Aboriginal people's management under traditional practices governed by Traditional Law.

The significance of this material and cultural record varies substantially, depending upon one or a combination of its aesthetic, historic, scientific, social or spiritual values for past, present or future generations (Australia ICOMOS Burra Charter 2013). Through time, these values can change or be impacted upon by both natural mechanisms and human intervention. To ensure impacts to the potential cultural heritage values of a place or object are understood, protected or managed accordingly, in addition to Traditional Law, a range of Territory and Commonwealth legislation exists.

Legislation has occurred at the state, territory, and national level. This is the result of the evolution of the Australian constitutional framework, particularly the inclusion of new themes, such as Aboriginality, heritage and the environment into an existing regulatory framework. The result of this developmental change is that the Commonwealth retains responsibility for Indigenous issues, while the States and Territories retain control of land use and development approvals. Therefore, both Commonwealth and the Northern Territory Acts may apply in particular circumstances within the Northern Territory.

The following Sections are provided so that there is a robust understanding of the legislative framework which may pertain to heritage matters within the Project Areas. Statutory registers searches are presented in Section 3.1

### 2.1.1 Commonwealth Legislation:

Aboriginal Land Rights (Northern Territory) Act 1976 (ALRA). This Act changed Aboriginal reserves within the Northern Territory to freehold title held in trust. The ALRA mandated the formation of Land Councils to act in the interests of Northern Territory Aboriginal people in the areas of land, access to lands, employment and the development of businesses. The Central Land Council is the statutory authority responsible under the ALRA for the study areas.

The ALRA also defined Sacred Sites as 'sites that are sacred, or otherwise significant, in the Aboriginal Tradition'. The ALRA protected these sites from damage, whether accidental or intentional. The Central Land Council assists in the protection of sacred sites and areas of significance both on land and in the sea.

The *NT Aboriginal Sacred Sites Act 1989* uses the above definition of sacred in its purpose of protecting these sites outside of Land Trust lands. On Crown Lands or leaseholds, the general process is for the AAPA to conduct the Sacred Site surveys with the relevant Site Custodians, then issue an Authority Certificate under the *NT Aboriginal Sacred Sites Act 1989*.

*Native Title Act 1993* (NTA). Native Title is "the communal, group or individual rights and interests of Aboriginal people and Torres Strait Islander people in relation to land and waters, possessed under traditional law and custom, by which those people have a connection with an area which is recognised under

Australian law" (s 223 NTA) (National Native Title Tribunal 2016). The NTA establishes the processes to determine where native title exists, how future acts impacting upon native title land may be undertaken, and to provide compensation where future acts extinguish or are inconsistent with the existence or exercise of native title. The NTA gives Indigenous Australians who hold native title rights and interests (including native title claims) the right to access and use traditional lands, be consulted and, in some cases, to participate in decisions about activities proposed to be undertaken on the land.

**Aboriginal and Torres Strait Islander Heritage Protection Act 1984.** This Act is intended as a last resort defence for significant sites, meaning that the Act is meant to provide emergency protection for Aboriginal and Torres Strait Islander heritage sites when all other avenues have been exhausted. Generally, an Aboriginal person or group of persons, must apply to the Minister to have protective covenants placed over an area or site (DAWE 2022). The power to provide such protection resides in Section 51 of the Constitution giving the Commonwealth powers on Aboriginal issues. Therefore, this Act may override all State and Territory cultural heritage acts.

**The** *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) commenced on 16 July 2000 with heritage amendments coming into effect on 1 January 2004. The EPBC provides for a National Heritage List of natural, historic and Indigenous places that are of outstanding significance to the nation. The EPBC also provides for a Commonwealth List that includes natural, historic and Indigenous places of significance that are owned or controlled by the Commonwealth. Ownership or control of these places allows the Commonwealth to protect or manage these places according to the significance of the place.

The Australian Government Department of the Environment (the Department) administers the EPBC Act, including administration of the heritage lists and providing support to the Australian Heritage Council established under the *Australian Heritage Council Act 2003*. The Department maintains the Australian Heritage Database which includes places on both Commonwealth lists, all places on state registers and other places included in the former Register of the National Estate established in 1976.

### 2.1.2 Northern Territory Legislation:

**Aboriginal Sacred Sites Act 1989.** The NT Aboriginal Sacred Sites Act 1989 was enacted to complement the ALRA. Like the ALRA, the Aboriginal Sacred Sites Act protects sites that are 'sacred and otherwise of significance in the Aboriginal Tradition'. Sacred Sites are protected whether the location of the sites are known or not by any person or company seeking to do work on lands.

The *Aboriginal Sacred Sites Act* is administered by the Aboriginal Areas Protection Authority (AAPA). AAPA can issue an Authority Certificate indemnifying any proponent for an area upon application and payment of a fee. The Authority Certificate will contain conditions limiting or preventing works in and around registered and recorded Sacred Sites. The Authority Certificate will contain maps outlining any restricted work areas in the area of application.

**Heritage Act 2011.** The NT Heritage Act came into effect on 1 October 2012. The Heritage Act provides protection for the same classes of places as the previous NT Heritage Conservation Act 1991, with some changes. As under the previous Act, members of the community can nominate areas, places, sites, buildings, shipwrecks and heritage objects to the register. If the Minister agrees that these features are of special significance to the heritage of the NT, the place is added to the register and receives statutory protection. The Heritage Act allows for processes to approve works and maintenance for a heritage place.

The *Heritage Act* provides a 'blanket' or 'presumptive' protection for Aboriginal and Macassan archaeological places and objects until a decision by the Chief Executive of the Department of Tourism and Culture (or their delegate for smaller sites) is made to either permanently protect these places or permit their disturbance or destruction. This decision-making process is triggered by an *Application to Carry Out Work on a Heritage Place or Object*. A permit will generally only be issued if consultation with the relevant Traditional Owners or Custodians of the sites or their representatives has occurred. There are penalties for accidental or deliberate destruction of these sites.

### 2.2 Regulatory Organisations

**Central Land Council (CLC).** The CLC is an independent statutory authority of the Commonwealth responsible under the ALRA, with the authority and capacity to direct and administer Aboriginal Land Trusts and areas under Native Title. This authority also provides the legal power to help Aboriginal people negotiate with governments and private companies over projects on their land.

The CLC also assists Aboriginal peoples within Central Australia to manage their traditional lands, including the protection of sites of significance in the Aboriginal Tradition and issuing permits to enter and perform other activities on Aboriginal land.

**Aboriginal Areas Protection Authority (AAPA).** The AAPA is an independent statutory authority established under the *Northern Territory Aboriginal Sacred Sites Act 1989*. The Authority is responsible for the protection of Aboriginal sacred sites on land and sea across the Northern Territory. The AAPA seeks to implement a practical balance between sacred site protection and economic development.

**Heritage Branch, NT Department of Families, Housing and Communities.** Heritage Branch is the regulatory authority responsible for administering most sections of the NT *Heritage Act 2011*. Heritage Branch is also responsible for administering the *NT Heritage Register*, the *NT Archaeological Database* and providing logistical support for the NT Heritage Council.

## 3 Desktop study and predictive model

### 3.1 Heritage and sacred site register searches

### 3.1.1 Northern Territory Heritage Registers

#### Heritage Register Database

As presented in Figure 2 below, a search of the NT Heritage Register notes that two Declared Heritage places are located within EP107 and EP93. These Declarations include the following features:

- Mac Clark Conservation Reserve. Located within EP107, 10 km from the southern end of EP107-Line 3.
- 2. Old Andado Station. Located within EP93, 15 km from the southern end of EP107-Line 5.

The proposed seismic program will not impact these features.

#### Archaeological Site Databases

The NT Archaeological Site Database maintained by the Heritage Branch, NT Department of Families, Housing and Communities, records nine known archaeological sites solely within EP107. These sites include the following features:

- 1. Simpson Desert Claypan I. Stone artefact scatter.
- 2. Simpson Desert Claypan II. Stone artefact scatter, hearth, stone arrangement, grindstone portable.
- 3. Mac Clark sites. Stone artefact scatter.
- 4. Mac Clark sites. Stone artefact scatter.
- 5. East Bore 1. Stone artefact scatter.
- 6. East Bore 2. Quarry.
- 7. East Bore 3. Quarry.
- 8. East Bore 4. Unknown site type.
- 9. East Bore South 1. Unknown site type.

All sites on the NT Archaeological Database are a minimum of 5 km from the nearest proposed seismic line. As such, the proposed seismic program will not impact these features.

#### Sacred Sites

An AAPA Authority Certificate has been provided for each lease area i.e. EP107, EP97 and EP93 (See Appendix 1). The Authority Certificates are dated between 22-23 August 2021 and as such, they remain current.

The Authority Certificates show a number of Registered and Recorded sacred sites in the wider lease areas, however there are no sites within the proposed seismic line construction corridors. BR Simpson have advised that AAPA have provided a working corridor width of 300 m for the construction of the seismic lines through all lease areas.

Several sacred sites are noted to be located adjacent to existing pastoral access tracks through EP107, which the Certificate provides the following conditions:

1. The applicant shall ensure that the conditions of this Certificate are included in any subsequent contract or tender documents for the works or use described herein.

- 2. The applicant shall ensure any agent, contractor or employee is aware of the conditions of this Certificate and the obligations of all persons (who enter on, or carry out works or use land on which there is a sacred site) under Part IV of the Northern Territory Aboriginal Sacred Sites Act 1989 (NT).
- 3. This Certificate shall lapse and be null and void if the works in question or the proposed use is not commenced within 24 months of this Certificate.
- 4. The applicant shall ensure any agent, contractor or employee is aware of the content of section 40(1) of the Northern Territory Aboriginal Sacred Sites Act 1989 (NT) which provides that this Certificate does not negate the need for consent, approval or permission for the subject works or use of the land which may be required under another statute.
- 5. Within the area marked Restricted Works Area 1 (RWA1) on Annexure 'A', associated with sacred site 5948-4, no work shall take place or no damage shall occur. The features of sacred site 5948-4 include: An area of Waddy Wood trees.
- 6. Within the area marked Restricted Works Area 2 (RWA2) on Annexure 'A', associated with sacred site 5948-3, no work shall take place or no damage shall occur. The features of sacred site 5948-3 include: An area of Waddy Wood trees.
- 7. Within the area marked Restricted Works Area 3 (RWA3) on Annexure 'A', associated with sacred site 6047-2, no work shall take place or no damage shall occur. The features of sacred site 6047-2 include: A swamp area.
- 8. Within the area marked Restricted Works Area 4 (RWA4) on Annexure 'A', associated with sacred site 6047-17, no work shall take place or no damage shall occur.

The features of sacred site 6047-17 include: A large area of Waddy Wood trees.

### 3.1.2 Commonwealth Heritage Registers

#### **Australian National Heritage Database**

A search of the National Heritage Database notes there are no registered sites within EP107, EP97 and EP93. The following locations were recorded on the Register of the National Estate (Non-statutory archive):

- 1. Mac Clark (Acacia Peuce) Conservation Reserve (File No. 7/10/007/0001)
- 2. Old Andado Homestead (File No. 7/10/007/0003)
- 3. Simpson Desert (File No. 7/10/008/0002)

With the exception of the Simpson Desert, the proposed seismic activities will not impact these places. Impacts to the Simpson Desert are expected to be minimal as outlined in Section 1.3 above.

#### **Commonwealth Heritage List**

A search of the National Heritage List notes there are no registered sites within EP107, EP97 and EP93.

The Simpson Desert, as a whole, was nominated to the National Heritage List (File No. 7/10/008/0002), however the nomination has expired and is no longer eligible for the 'priority assessment list' (PPAL).

Under the EPBC Act, the Australian Heritage Council (AHC) can only assess places for the National Heritage List if the places are on the AHC's assessment work plan (known as the "priority assessment list"). The Minister sets this work plan each financial year. A nomination becomes ineligible if it has been considered for two consecutive work plans but not included. However, a nominated place ruled ineligible in this way can be re-nominated, thereupon becoming eligible again for consideration.



Figure 2: Heritage Register Searches

## 3.2 Desktop Assessment

The desktop assessment section of this CHA, aimed to identify areas likely to hold Aboriginal archaeological sites or historical features, which could then assist the field surveys in prioritising key risk areas. This assessment included mapping and assessment of existing site databases, previous heritage studies, historical mapping, Land Systems, surface geology and hydrology. The results of this desktop assessment are summarised in Table 2 below. Previous land disturbance factors are presented in Section 3.3 below.

Desktop		
Assessment	Data Summary	Conclusions
Туре		
Existing Regulatory Site Databases (see search results within Section 3.1)	A noted in Section 3.1 above, search of all regulatory heritage databases resulted in the identification of no heritage features within the proposed seismic lines. Notwithstanding this, a number of features are listed on the NT Archaeological Database and NT Heritage Register in the land units surround the proposed seismic lines. The heritage features include stone artefact scatters, quarries, hearths, stone arrangements, sacred sites and historic features. The regional search results from show a strong association between archaeological features and watercourses and outcropping geological units with raw material suitable for the manufacture of stone artefact.	Within the propose seismic line corridors there is a high likelihood of Aboriginal archaeological places, which is expected to be dominated by isolated stone artefacts, artefact scatters and quarry sites. It is likely these places will be associated with watercourses, palaeochannels, drainage depressions, claypans and rock outcrops. It is unlikely that historic features will be encountered given the remoteness of the area and general lack of past developments.
Previous Archaeological Studies and Historical Mapping	<ul> <li>At least three previous archaeological studies are noted to have been undertaken within the Project Areas. These studies include:</li> <li>1. Smith, M 1995, 'An archaeological appraisal of Mac Clark (Acacia Peuce) Conservation Reserve Simpson Desert, NT',</li> <li>2. Hill, T, 2009, 'Archaeological heritage assessment. EP 107 Magee site (NT) proposed 2009 seismic survey program - East Bore'.</li> <li>3. Author/Date unknown.</li> <li>Smith (1995, p. 19) recorded 13 archaeological sites within and adjacent to the then proposed Mac Clark (Acacia Peuce) Conservation Reserve. The sites largely consisted of stone artefact scatters and quarries adjacent to watercourses, on gibber plains and rocky rises. The largest of</li> </ul>	<ul> <li>Coupled with these previous studies, the consultant's previous findings across central Australia have demonstrated the following general patterns in the archaeological record that relate to the Project Areas:</li> <li>Surface lithic artefact scatters generally occur on or near rock outcrops and adjacent to watercourses, claypans and drainage depressions.</li> <li>Lithics are most frequently manufactured from the most common suitable raw materials in the local region.</li> <li>Cultural features are most likely to occur in areas less than 200 metres from watercourses/riparian land units.</li> <li>There is generally a paucity of Aboriginal archaeological sites located in areas where there is an absence of outcropping stone</li> </ul>

Table 2: Summary of Physical Environment factors predicting Aboriginal archaeological site distribution

Desktop Assessment	Data Summary	Conclusions
Туре		
	the scatters included high densities of artefacts exposed in blowouts on a small lineal dune covering a 600 m x 30 m area. The dune intersected a large system of claypans and palaeodrainage. Hill (2009) recorded five archaeological sites within dune systems, along watercourses and drainage depressions and on stony rises. Hill (2009) notes that most sites were of moderate to high archaeological significance. The largest of these sites covered a 2000 m x 200 m area. Author/Date unknown has recorded two archaeological features on the NT	or water resources.
	Archaeological Database which lie in dune systems adjacent to large claypans. The site contents include stone artefact scatters, portable grindstones, stone arrangements, hearths and charcoal. No further information is provided on the database.	
Land Systems	Land System data is often a very useful tool in analysing the potential for archaeological materials in a Project Area. The Desktop Study for this project found that there was insufficient information available to draw robust conclusions based on Land Systems vs previously recorded archaeological features (including regionally), other than Land Systems with the highest potential for heritage features included those which included watercourses, palaeochannels and geological changes.	Individual Land Units within Land Systems were identified as having archaeological potential and were define from satellite mapping in most instances. Individual land Units and Landforms were sometime better identified in the field for survey.
	EP93 and EP97 are dominated by aeolian sands in the form of lineal dune systems, with minimal rock suitable for the manufacture of stone artefacts.	
Surface Geology	EP107, has a greater diversity of outcropping geological in addition to the abovementioned aeolian sands. The seismic lines traverse palaeochannels with river gravels, potential outcrops of shale, mudstone, ochreous claystone, kaolinitic sandstone, sandstone, siltstone and silcrete.	Based on previous regional archaeological studies, there is a high potential for stone artefact scatters and quarries across all land units with outcropping and in areas adjacent to drainage lines and depressions, including claypans.
	Elevation across the Project Areas was noted as generally lineal dune systems, low-lying rises and mesas and claypans/drainage depressions.	

Desktop		
Assessment	Data Summary	Conclusions
Туре		
Hydrology	EP93 and EP97 have few drainage features within the proposed seismic lines, with the exception of a small number of drainage depressions, drainage lines and claypans. There are no major watercourses or palaeochannels through the areas. Conversely, EP107 has a large number of drainage depressions and claypans, palaeochannels and drainage lines that will be traversed by the proposed seismic lines. Most of the water appears to flow north through the Todd River and Hale River drainage systems and palaeochannels.	Past archaeological studies across Central Australia show a strong correlation between water resources and Aboriginal archaeological site distribution. As such, there is likely a higher potential for archaeological features within the land units surrounding larger watercourse, drainage depressions and claypans.

### 3.3 Previous Land Disturbance Factors

Land disturbance factors in the Project Area have made some changes to the pre-contact environment. These included but are not limited to:

 Pastoral impacts. In brief, pastoral impacts within the Project Areas have been significant, with land cleared for property infrastructure, intensive grazing, stock watering infrastructure, fencing, permanent yards and changes to the traditional fire regimes. Early pastoral activities also had a significant impact on the traditional lifeways of Aboriginal People throughout Australia, including within the Project Area.

Pastoral activities have occurred across the Northern Territory for over 150 years, after John McDouall Stuart's crossing of the country from Adelaide to Point Stuart, near Darwin, in 1861– 62 (Stuart 1865). The earliest permanent European settlement within the Project Areas was at Old Andado Homestead (est. 1880). Old Andado Homestead lies on the western margin of EP93 and was the original homestead for Andado Station until 1960. Andado Station has grazed sheep, cattle and horses over the last 140 years, with a current holding of 3000 cattle.

- 2) Road and track construction and maintenance. This disturbance tends to destroy or distort the archaeology record in road and track corridors (e.g. grading and displaying or damaging artefact and/or gravel extraction from quarries then laid on road surfaces often contain artefacts from the extraction point. Crushed gravel can be misidentified as artefacts).
  - a) Road and tracks allow increased access to culturally sensitive landscapes by the public using the new road systems. This increases the risk of inadvertent damage to sites and/or the purposeful removal of cultural materials by visitors.
- 3) Invasive species such as cattle, horses, donkeys and camels disturb watercourses, dune stability and introduce weed species and erosion in native environments. These factors impact on archaeological sites in a number of ways:

- Watercourses, claypans and drainage depressions: Site and artefact densities are generally higher closer to water bodies. Erosion of watercourse and drainage depression margins can impact on vertical and lateral site integrity. Sub-surface sites are often exposed due to erosion caused by cattle and feral animals.
- ii) Weeds: Change fire regimes and can sometimes change the composition of native vegetation.
- iii) Cattle and feral animals disturb archaeological sites by 'padding' and over grazing.
- 4) Impact of uncontrolled bushfires arising from increased presence of humans, resulting in the destruction of significant flora sites (e.g. culturally modified trees and other significant vegetation such as the rare Acacia peuce tree).
- 5) Petroleum and mineral exploration. Exploration has occurred across the wider Project Areas from the early 20th century until current. The construction of historic seismic lines, drill pads and access tracks, can cause similar types of impacts as the vehicle tracks discussed above.

### 3.4 Archaeological Predictive Model

Based on the Desktop Assessment outlined above and the experience of the Consultants in Arid Zone archaeology, the following predictive model statements can be made for the Project Areas:

- Artefact typology variability and site densities are higher near fresh water sources, or former fresh water sources (i.e. salt lake systems and palaeochannels). All watercourses (including ephemeral sources), drainage depressions and claypans have a high potential for sites with archaeological materials.
- 2. There may also be complete absence of artefactual material in arid land units without water.
- 3. Sites recorded in the more arid land units away from more 'predictable' and larger water sources are likely to be small with limited diversity in raw materials and artefact types.
- 4. Stone artefact quarries occur where suitable rock is available on the land surface. In Central Australia, and likely in the wider Project Area, raw material such as chalcedony, silcretes and quartz were the primary materials used for flaked stone tools. Therefore, any related outcropping geology containing these raw materials should be regarded as having a high potential for lithic scatters, including, quarry sites and secondary reduction sites nearby.
- 5. Outcropping sedimentary rock, such as sandstones, have been used by Aboriginal people in the past for manufacturing grindstones, painting and engraving (petroglyphs). Both types of rock art have been previously recorded in the Project Area. Areas where this stone is present are highly likely to contain some archaeological materials and should be subject to a 100% sample survey.

## 4 Heritage Survey Methodology

This study employed a heritage assessment strategy to assess the likelihood of finding archaeological and/or heritage sites within the Project Areas. The heritage assessment strategy identified representative parts of the Project Areas to survey through the abovementioned desktop study, which was further refined in the field.

Survey areas were developed through assessing the likelihood and types of sites occurring within a given land unit. If, for example, no cultural heritage features were located a given land unit through the desktop study and this notion was supported by field observations, the methodology was then extrapolated to suggest there is a very low risk of impacting sites protected under the *Heritage Act 2011*. These low-risk areas were excluded from further field surveys.

The Project Areas were surveyed during May 2022, ensuring that representative land units of high-risk<sup>2</sup> environments within the proposal footprint were adequately assessed.

## 4.1 Proposed Cultural Heritage Survey Areas

Drawing on the desktop modelling, the proposed seismic lines transected 43 land units that were preliminarily identified as having a higher potential for archaeological features (see Table 3 and Figure 3). These areas were identified on the presence of landforms, drainage and geological units that were likely resource and/or occupation areas for past Aboriginal land use practices.

These areas represented approximately 12% of the overall proposed seismic line corridors. The remaining 88% of the seismic line corridors were considered to have very low potential for archaeological features given the absence of suitable landforms, drainage and geological units. Further refinement of these preliminary heritage survey areas was undertaken during the fieldwork (see Section 5.2)

ID	Feature	Length (m)
CHSA001_EP107_Line1	Drainage	4268
CHSA002_EP107_Line1	Drainage and palaeodrainage	12639
CHSA003_EP107_Line2	Drainage and vegetation change	3398
CHSA004_EP107_Line2	Drainage and palaeodrainage	2561
CHSA005_EP107_Line2	Drainage and geological change	1035
CHSA006_EP107_Line2	Two drainage basins	1226
CHRA007_EP107_Line2	Drainage and geological change	2251
CHSA008_EP107_Line2	Drainage	5401
CHSA009_EP107_Line2	Drainage and geological change	1259
CHSA010_EP107_Line2	Drainage and palaeodrainage extending to west between dunes	4023
CHSA011_EP107_Line2	Drainage and geological change	3538
CHSA012_EP107_Line2	Drainage and palaeodrainage extending east and west between dunes	3427
CHSA013_EP107_Line3	Drainage and palaeodrainage, extends to south along the line	1387
CHSA014_EP107_Line3	Drainage depressions within larger palaeodrainage channel	828
CHSA015_EP107_Line3	Drainage margin	1987
CHSA016_EP107_Line3	Drainage and geological change	3654

#### Table 3: Proposed Cultural Heritage Survey Areas

<sup>&</sup>lt;sup>2</sup> *High-risk environments* are those which have a high potential for containing cultural heritage features. These environments are identified following comprehensive background research and consultation.

ID	Feature		
		(m)	
CHSA017_EP107_Line3	Large drainage depression	1157	
CHSA018_EP107_Line3	Large drainage depression complex to west	1877	
CHSA019_EP107_Line3	Small series of drainage depressions	955	
CHSA020_EP107_Line3	Small series of drainage depressions to east	731	
CHSA021_EP107_Line3	Potential palaeodrainage system extending north and south.	1071	
CHSA022_EP107_Line3	Small series of drainage depressions to east	744	
CHSA023_EP107_Line3	Claypan and potential drainage depressions	960	
CHSA024_EP107_Line4	Small drainage depression to east	309	
CHSA025_EP107_Line4	Drainage area	655	
CHSA026_EP107_Line4	Drainage area	583	
CUSA027 ED107 Line4	Major drainage system, geological and landform changes. Ochreous	04.00	
CHSA027_EP107_LINE4	claystone noted in the geology		
CHSA028_EP107_Line5	Claypans and drainage to north	1409	
CHSA029_EP107_Line5	Drainage depression	630	
CHSA030_EP107_Line5	Drainage depression	230	
CHSA031_EP107_Line5	Drainage depression to west	381	
CHSA032_EP107_Line5	Drainage depression to west	921	
CHSA033_EP107_Line5	Major drainage system	9073	
CHSA034_EP107_Line5	Numerous drainage depressions through area	6735	
CHSA035_EP107_Line5	Drainage depression	1522	
CHSA036_EP93_Line1	Drainage depressions between dune systems	2253	
CHSA037_EP93_Line1	Drainage depressions between dune systems	2767	
CHSA038_EP93_Line1	Drainage depressions between dune systems	2260	
CHSA039_EP93_Line1	Drainage depression	2326	
CHSA040_EP93_Line2	Drainage depression	241	
CHSA041_EP93_Line2	Watercourse - small but discharges into major drainage system	327	
CHSA042_EP97_Line1	Drainage depression/clay pan	557	
CHSA043_EP97_Line1	Drainage depression/clay pan	1025	



Figure 3: Preliminary Cultural Heritage Survey Areas

### 4.2 Cultural Heritage Site Definition

Assessment of the cultural heritage resources within the Project Areas was aimed to be approached holistically, to include an understanding of both cultural and archaeological contexts where possible. Notwithstanding this, as outlined in Section 1.4 above, Traditional Owner site custodians only joined the field team for a short duration. This resulted in minimal cultural attributes of features being recorded and a dominance towards archaeological site recording.

Culturally, Central Australia has a wide distribution of sites including Dreamings, campsites, ceremony places, burials, resource areas and travel routes across traditional lands. The knowledge, location and extent of these features is governed by Traditional Law, however in the absence of this information, archaeological sites were recorded on their physical attributes only.

Sacred sites and other sites with intangible cultural significance have to a large extent been captured through the AAPA Authority Certificate processes (See Appendix 1: AAPA Authority Certificates). The Authority Certificates should be used as the principal documents guiding construction works around these features.

From an archaeological perspective, *the NT Heritage Act 2011* (Division 2, p. 7) defines archaeological features relevant to this study as follows:

### Meaning of archaeological place and Aboriginal or Macassan archaeological place

- (1) An *archaeological place* is a place that:
  - (a) relates to the past human occupation of the Territory; and
  - (b) has been modified by the activity of the occupiers.
- (2) An *Aboriginal or Macassan archaeological place* is a place that:
  - (a) relates to the past human occupation of the Territory by Aboriginal or Macassan people; and
  - (b) has been modified by the activity of those people.
- 7 Meaning of *object*

6

8

- (1) An *object* is a natural or manufactured object that is moveable.
- (2) An *object* includes an archaeological object but does not include a place.

#### Meaning of archaeological object and Aboriginal or Macassan archaeological object

- (1) An *archaeological object* is a relic that:
  - (a) relates to the past human occupation of the Territory; and
  - (b) is in an archaeological place.
- (2) An *Aboriginal or Macassan archaeological object* is a relic that:
  - (a) relates to the past human occupation of the Territory by Aboriginal or Macassan people; and
  - (b) is:
  - (i) in an Aboriginal or Macassan archaeological place; or
  - (ii) stored in a place in accordance with Aboriginal tradition, including, for example, in an Aboriginal keeping place.

### 9 Meaning of *relic*

- (1) A *relic* is:
  - (a) an artefact or thing given shape by a person; or
  - (b) human or animal skeletal remains; or

- (c) something else prescribed by regulation.
- (2) An artefact or thing can be of any material.
  - Examples for subsection (2)
    - 1 A secret or ceremonial object.
    - 2 A log or bark coffin.
    - 3 Human remains.
    - 4 Rock or wood carvings or engravings.
    - 5 Stone tools.
- (3) However, an artefact or thing made for sale is not a relic.
- (4) In addition, a thing prescribed by regulation is not a relic.

For recording archaeological features and sites, according to McDonald (2005, p. 172), a contiguous landscape approach, where multiple features are present, is current best-practice and represents a progression which recognises archaeological and cultural landscapes as an appropriate management scale. Where there are high densities of cultural materials, according to McDonald (2005, p. 172), there is no choice but to define management units beyond the level of the isolated artefacts and sites. This CHA report interprets this approach as meaning that artefacts, sites, continuous scatters and site complexes are related over the landscape, however definitions of each of these categories are necessary to provide an adequate management system for the archaeology of a survey area.

Following this approach, this CHA report uses the following definitions of site type relevant to the Project Areas:

This study uses the following definitions of site type:

- 1. Lithic or stone artefact scatters containing flaked, ground stone artefacts and possibly hearthstones. Contact sites of Aboriginal origin may also include metals or flaked ceramics used for cutting. Artefact scatters may occur as surface scatters of material or as stratified deposits where there have been repeated occupations. Some lithic scatters are called camp sites which are high density lithic scatters with hearths and sometimes grindstones. Therefore, camping is the implied activity indicated by the archaeological record in these places.
- 2. Stone Quarry or primary reduction site. A site where stone for flaked or edge-ground artefacts have been extracted from an outcropping source of stone. This is a broad definition a stone quarry and there are further subdivisions of this site type (Hiscock and Mitchell 1993). According to Hiscock and Mitchell (1993) most surface hard stone quarries have associated reduction sites.
- **3. Knapping location**, consisting of one or more knapping floors, are discrete scatters of artefacts, anywhere in the landscape, resulting from stone being worked or reduced at that spot. The criteria for a knapping floor are that the original block of stone can be at least partially reconstructed from scattered flaked stone pieces (Hiscock and Mitchell 1993). A knapping floor can exist as a feature within the context of an open site or archaeological deposit. However, there are certain methodological problems in identifying such features arising from post-depositional processes.
- 4. Stone Arrangements can range from simple cairns to more elaborate arrangements. Some stone arrangements were used in ceremonial activities and represent sacred or totemic sites. Other stone features were constructed by Aboriginal people as route markers, territory markers, and walls of huts, animal traps, hides, or seed traps. Stone arrangements also exist as a result of

historical activity, such as mineral tenement markers or isolated grave sites.

- 5. Hearths are a common feature in arid and semi-arid Australia, often comprising a number of stones arranged into a square or round formation. These were used as heat retaining rocks when cooking food. Rocks in hearths will show evidence of heating and are sometimes fragmented. There is often a diversity of raw materials within the hearth. Some, or all, of the rocks may have been brought to the area from a distance.
- 6. Rock Art sites include two main types of rock art, engravings and pounding's where the pattern is one of relief and the pictures were apparently produced by removing material from the rock surface and drawings, stencils and paintings where the material was added to the rock surface. Bees wax designs have also been recorded in the wider region.
- **7.** Rock shelter occupation sites contain a deposit of cultural material that has built up over time containing flaked or ground stone artefacts, faunal material and other various items of Aboriginal material culture including ancestral human skeletal remains, wax designs, rock art, grinding hollows, and caches of material culture objects.
- 8. Site complexes are groups of sites in similar landscapes where the cultural materials are effectively continuous. Bird and Hallam (2006, p. 11) described these as integrated cultural landscapes with which have local variations in artefact densities with artefact distributions being effectively continuous.
- **9.** Culturally modified trees (CMT) typically result from a sectional removal of bark (and sometimes timber) from a tree trunk or limb. CMTs range from small (15 x 5cm) lenticular apertures such as those resulting from sugarbag procurement, to large canoe CMTs which can present a scar several meters in length.
- **10. Aboriginal Wells** have resulted from water procurement activities. These sites can vary in size and form, from hand dug depressions to natural features such as sink holes. Sources of water across the arid landscape were vitally important in the seasonal migration patterns of Aboriginal people. As the only water source in some areas, wells were carefully curated, often with rocks placed over the entrance to a well to prevent fouling by animals. Rock art (e.g. petroglyphs), grinding groves, stone artefact scatters and sometimes burials are often located in association with wells.
- **11. Burial** practices differ considerably throughout cultural groups in Central Australia, and skeletal material can vary from highly fragmented bones to large burial complexes containing many individuals.
- **12. Grinding hollows, grooves, and patches** are the physical evidence of grinding and processing materials on basement rock. Grinding hollows and patches where utilised to grind food and plant materials (i.e. wild rice, seeds, nuts, tubers, bulbs), as well as ochre for painting. Grinding patches and grooves may also have been utilised to prepare edge ground axes during production and maintenance.
- **13. Historic/Contact sites** include sites of primarily Aboriginal cultural origin that include 'modern' materials to manufacture flaked artefacts. Sites that include foreign materials, such as glass, ceramics or metal that exhibit modification by Aboriginal people are regarded as *contact sites*.

### 4.3 Identifying stone artefacts

A requirement for successful Aboriginal archaeological heritage assessment involves the accurate identification of archaeological materials. Since the identification of stone artefacts is basic to the accurate recognition and measurement of the archaeological record, it is imperative that people undertaking archaeological surveys be able to differentiate between natural objects and artefacts. Principles of artefact identification employed in this survey follow those recommended by Hiscock (1984), Holdaway and Stern (2004) and Andrefsky (1998).

Each time sufficient force is placed on the surface of an isotropic rock, it will fracture into two pieces. The fragment that has been struck contains the ring-crack, where fracture was initiated, and is called the flake. The flake is usually the smaller of the two pieces of stone. The larger fragment, from which the flake has been removed, is called the core. On both the flake and the core the surface that is struck is called the platform. Flakes are identified by the distinctive surface created when they are removed from the core. The classification of artefacts in this survey was based on identifiable characteristics outlined by Hiscock (1984). For an object to be classed as a flaked artefact, it needed to possess one or more of the following characteristics:

- 1 A positive or negative ring crack;
- 2 A distinct positive or negative bulb of percussion;
- 3 A definite eraillure scar in an appropriate position beneath a platform;
- 4 Remnants of flake scars (dorsal scars and ridges).

These characteristics indicate the application of an external force to a core. Artefact morphologies will be described by using the four types of artefacts as defined by Hiscock (1984, pp. 128-129):

- 1 Flake: Flakes exhibit a set of characteristics that indicate they have been struck from a core. The most indicative characteristics are ring-cracks, which show where the hammer hit the core. The ventral surface may also be deformed in particular ways, for example a bulb or eraillure scar.
- 2 Core: A piece of stone with one or more negative flake scars, but no positive flake scars.
- 3 Retouched Flake: A flake that has had flakes removed from it, identified by flake scars on or deriving from the ventral surface.
- 4 Flaked Piece: This is a chipped artefact which cannot be classified as a flake, core, or retouched flake. This category is used only when an artefact was definitely chipped but could not be placed in another group.

Other artefacts and implement types that have been identified in Northern and Central Australia are listed below following characteristics as outlined by McCarthy (1976), Cundy (1989), Kamminga (1982) and Holdaway and Stern (2004):

- 1 Unifacial Points are flakes that have been retouched along the margins from one surface (either dorsal or ventral) to give or enhance its pointed shape. These unifacial points are sometimes symmetrical or leaf shaped.
- 2 Bifacial Points and axes are retouched onto both ventral and dorsal surfaces of a flake to enhance or give the artefact its point shape. These points and axes may have the platform removed and the proximal end rounded. Distribution of bifacial points is largely limited to the

Top End and Kimberley. Some bifacially flaked implements extend east to Cloncurry and south into the arid zones.

- 3 Edge ground axes. Classified primarily by the shaping process of flaking, pecking and polishing. These generally have only one working edge that has been ground to a sharp margin but there are also examples with two leading edges.
- 4 Grindstones are characterised by a worn and abraded surface(s). The surface may either have a concave depression or a convex surface.
- 5 Hammerstones show use wear on the surface in the forms of abrasion, pitting and edge fracturing with some negative scarring from the process of producing stone tools.
- 6 Pounders are artefacts that are used primarily for processing food and plant materials.
- 7 Anvils are characterised by abraded and peck surfaces that are the result of using the surface to for bipolar reduction of cores.
- 8 Tula Adzes are a specialised composite adze used to carve wood and sharpen wooden implements (Doelman and Cochrane 2012). The Tula was often hafted into the proximal end of a woomera (spear thrower). The tool was resharpened by retouching the blade until the blade length was too short to continue to use. The resulting 'tula slug' was removed from the hafting and replaced by a fresh tula flake. Tulas and tula slugs are common finds in Central Australia. Tula flakes are identifiable by having a convex dorsal surface and a concave ventral surface. The flake length is usually shorter than flake width. Tula flakes are also often characterised by thicker wide platforms.

### 4.4 Defining Site Boundaries

It is necessary to define site boundaries for the description of heritage places and the mitigation of impacts on these places. Boundaries of sites can be based on geographic features, such as rock shelters and watercourse banks, which are defined by easy to distinguish geographic features. Other sites, such as some stone artefact scatters, and groups of culturally modified trees are more difficult to define.

For the purposes of this study, cultural materials are defined as sites, background scatters and isolated artefacts when the following criteria are met:

- Sites should have average artefact densities more than five times the average density of the background scatter in the same area and exceed five artefacts in a ten-metre diameter area. Sites may cover large areas with a lower density scatter (n<5 per 10m diameter area) and have some clusters of higher density.
- A site boundary exists where the artefact densities are diminished sufficiently to be equal to the background density level or an environmental feature defines a boundary, such as a creek bed or road.
- A background scatter is an area where the average artefact density is higher than the average background density but does not exceed five artefacts in a ten-metre diameter area. Effectively, a background scatter is small and or low-density scatter that does not constitute a site.
- Isolated artefacts are single or multiple artefacts that do not satisfy the criteria for a site or a

background scatter.

### 4.5 Site Recording and Survey Methodology

The survey employed a pedestrian sampling methodology initially targeting the higher archaeological risk areas as outlined in Section 4.1 above. These proposed survey areas were then further refined in the field due to access constraints and field observations. The employed survey methodology aimed to identify archaeological features and key cultural heritage risk areas which had the potential to contain archaeological features, to minimise impacts on these values for the construction and operation of the proposed seismic program.

Using the methodological approaches outlined above, the following protocols were adopted to adequately record sites and artefacts:

- 1. The proposed Project Areas were mapped using a GIS (using QGIS). Heritage site database records, land systems, geology, hydrology, and satellite imagery layers were added to the GIS to identify areas likely to hold cultural sites/archaeological materials based on the desktop predictive modelling. A Cultural Heritage Survey Areas (CHSA) layer was developed.
- 2. The proposed CHSAs were uploaded to an Android Tablet using Avenza Maps software.
- 3. The sample areas were access via helicopter and vehicle and transacted on foot.
- 4. All sites, heritage features and isolated artefacts were recorded using a set of standard recording forms linked to the mobile GIS.
- 5. The location of all sites was recorded using datum GDA2020. The Tablet had an accuracy of 3-5 metres in open canopy terrain.
- 6. The tracks of all transects were recorded using the tracking feature on the Tablet.
- 7. Archaeological features and points of interest were photographed during the course of the survey recording.

The following characteristics were recorded of each site and isolated artefact:

- 1. Location using the UTM coordinate system MGA2020 on Datum GDA2020.
- 2. Environment: basic details of land unit, geomorphology, vegetation etc.
- 3. Site boundaries are recorded for each site using the mobile GIS software.
- 4. Site contents: basic details of types of artefacts, raw materials etc.
- 5. Ethnographic origin: Aboriginal, European historical, etc.
- 6. Archaeological significance and further archaeological potential.
- 7. Disturbance factors, such as clearing, animal activity, erosion or road works.
- 8. Site visibility: estimate of how much of the ground surface was visible on site and in the surrounding area.
- 9. Site and artefact images. Images of artefacts in larger sites are a representative sample.

The results of this survey, along with a map of transects completed are presented in the next section.

## 5 Heritage Assessment Results

The following section outlines a summary of the results of the field investigations undertaken between 18th May 2022 and 24 May 2022. The complete list of each archaeological site, its location and brief description is presented in Appendix 1.

### 5.1 Transects

In summary, the proposed BR Simpson Exploration Project required approximately ~815 kms of seismic lines (n=11) to be assessed for Aboriginal and historical archaeological features. The 11 proposed seismic lines were between approximately 40 km and ~135 km in length, with a corridor width of approximately 40 m to allow for minor realignments during the exploration program (AAPA have provided for 300 m width as a clearance corridor with respect to sacred sites).

A clearance survey of all Project Areas was not considered necessary or practical given the size of the area, the predicted site distribution patterns and safety constraints arising from the remoteness of the Project. Accordingly, 43 proposed Cultural Heritage Survey Areas (CHSA) were identified in advance of the field surveys through a desktop predictive model (see Section 4.1). This model drew on known archaeological site distribution patterns within Central Australia, coupled with a review of satellite imagery, outcropping geological data and hydrological modelling of the Project Areas. Hydrological modelling included mapping current watercourses, claypans, drainage lines and interpreting the location of potential paleochannels.

Principally, this purposive sampling approach was to provide a robust assessment of those areas which would likely to contain archaeological materials. Secondly, the selection of transect areas was also aimed to ensure all representative land units within the Project Areas were adequately assessed for their cultural heritage potential.

In practice, the CHSA transect locations required further modification in the field at the time of survey to account for limited vehicle access through the dune systems within EP107, EP93 and EP97 and overall time constraints. Given the access constraints encountered, the modified approach sought to provide sufficient information to allow the attributes of archaeological finds to be extrapolated to other areas across the Project Areas with similar land unit characteristics.

As presented in Table 4 below (see also Figure 4, Figure 5 and Figure 6), a total of 33 transects areas were walked during the field assessment. Based on logged GPS tracks, the pedestrian transects encompassed approximately 78 km and sampled 10 of the initially proposed CHSAs and 23 alternate survey areas. All primary land units were assessed by the surveys including, dune systems, claypans, rocky elevations, paleochannels and drainage areas. Extra focus was also afforded to palaeochannel claypans (often in association with Coolabah trees) and gibber flats/plains for their analogous potential to contain significant archaeological features.

The six southern seismic lines within EP93 and EP97 were assessed with helicopter assistance (see Figure Figure 5 and Figure 6), which allowed the survey team to rapidly identify and land at suitable transect areas. Conversely, the northern lines within EP107 were accessed by light vehicle, which restricted the number of locations which could be assessed.

Weather conditions were clear and sunny, with maximum daily temperatures recorded between 21 and 26 deg Centigrade. Ground surface visibility was generally good and exceeded more than 80% in most transects, although some areas of dense spinifex, tussock grasses and mulga reduced the effectiveness of surveys. Overall, the ground exposure was more than adequate to identify archaeological sites and isolated artefacts. Cultural heritage features were found in nine of the 33 transect areas assessed and will be discussed in the following section.

#### Land Unit Transect Transect ID СН GSV Disturbance Description Date Length (m) Feature EP107-Line 1 10,785 Livestock 24/05/22 Yes Dune Very wide series of 80-CHSA002 100% disturbance. systems on Interdunal swales broken margin of intermittently by drainage and low/eroded/deflated dunes. palaeodraina Heavy livestock disturbance. ge system Coarse red sandy/loam substrate, grass tussock herbaceous and prostrate forbe communities dominate. High cultural heritage potential. 5,532 EP107-Line 2 Nil Dune Wide (up to 800m) 40-Medium -24/05/22 CHSA008 80% systems on Interdunal swale. Mixed heavy margin of livestock claypan and red sandy claypans substrate. Kerosene grass disturbance, and other tussock increasing communities dominate around sandy regions; water rolledclaypans pebbles occupy the surface of claypans; intermediate/mixed clay littered with gravel. Water rolled pebbles indicate remnant landscape on which dunes have subsequently overlaid. Mulga copses associated with clay pans and increased livestock disturbance. Good potential for cultural heritage but none observed within transect. Yes 5,621 23/05/22 EP107-Line 2 Ironstone Red sandy substrate and 20-Livestock CHSA009 60% disturbance. mound/outc dune system surrounding an rop outcropping ironstone mound. Water rolled cobbles and pebbles on gently rising swale flanks noted in some areas. Grass tussock and herbaceous forbe communities dominate. High cultural heritage potential. EP107-Line 3 10,230 70% 22/05/22 Yes Dune Wide elevated, interdunal Minor CHSA021 evidence for systems swale between 2000m east low/eroded/delated dunes. livestock of major Red sandy substrate disturbance. drainage and dominated by rasa tussock palaeodraina communities and occasional

#### Table 4: Survey Transect Data (CH = Cultural Heritage, GSV = Ground Surface Visibility)

Transect ID	СН	Land Unit Feature	Transect Length (m)	Description	GSV	Disturbance	Date
		ge system		acacia bushes. No cultural heritage observed within proposed seismic line, but a number of features noted closer to the drainage zone to the southwest.			
EP107-Line 4 (North) CHSA027	Yes	Claypans, drainage and escarpment	2,028	Claypan flanked by low energy erosional loam accumulated by run off from rock escarpment 500m South. Transition to red sandy substrate to the north. Grass tussock and prostrate forbe communities dominate with occasional acacia. High cultural heritage potential.	50%	Minor evidence for livestock disturbance.	21/05/22
EP107-Line 4 (South) CHSA027	Yes	Escarpment and deflated ground surface	2,073	Gibber-pedi plain rich in water-rolled iron stone pebbles and silcrete cobbles on a sandy loam substrate. High run-off area from raised escarpment 300m to north. High cultural heritage potential.	50%	Minor evidence for livestock disturbance.	21/05/22
EP107-Line 5 CHSA035	Nil	Dune system and claypans	2,528	Interdunal swale between high dunes. Proposed seismic line runs adjacent a large clay pan 100m to the west and cuts through red sandy substrate dominated by kerosene grass ( <i>aristada</i> <i>sp.</i> ) punctuated by infrequent coolabah and acacia sp. Surface of clay-pan littered with heavily water- rolled pebbles and calcium carbonate (limestone). Calcareous landscapes form at base of dune layers indicating an ancient landscape or dunes have moved - inclusion of water- rolled pebbles suggests former. Good potential for cultural heritage but none observed within transect. 4x4cm quartz pebble located high on flank of sand dune from remnant fire pit, or dropped by either a passing human or an animal (reptile	90%	Negligible livestock disturbance.	23/05/22

Transect ID	СН	Land Unit Feature	Transect Length (m)	Description	GSV	Disturbance	Date
				or raptor potentially mistaking it for an egg).			
EP107-Line 5_Stop 1	Nil	Palaeochann el and dune system	3,432	Wide interdunal swale. Palaeochannel of mixed red sandy clay with gravel. Infrequent coolabah and corkwood in landscape otherwise dominated by kerosene grass ( <i>aristada</i> <i>contorta</i> ) tussocks. Good potential for cultural heritage but none observed within transect.	80- 100%	Minor evidence for livestock disturbance.	23/05/22
EP107-Line 5_Stop 2	Nil	Dune systems and claypans	1,503	Proposed seismic line runs along the slightly elevated eastern flank of the Interdunal swale, 200m from clay-pan to the west at base of tall dune. Red sandy substrate. Spinifex and kerosene grass tussocks dominate with occasional <i>acacia sp.</i> corkwood.	95%	Minor evidence for livestock disturbance.	23/05/22
EP107-Line 5_Stop 3	Yes	Dune systems and claypans	1,635	Seismic line cuts high along the eastern swale flank between two low dunes on red sandy substrate. Grass tussock communities and <i>acacia sp</i> , dominate with irregular coolabah, mulga and corkwood trees. No cultural heritage noted within seismic line but some features noted in claypan to west.	80%	Minor evidence for livestock disturbance.	23/05/22
EP93_Line 1 CHSA036	Yes	Dune systems and claypans	1,359	Shallow claypans within wide dune swale. Claypans extend throughout the area flanking the Fink River (17km to the south) and its tributaries (9km to the north). Spinifex and kerosene grass tussocks dominate with occasional <i>acacia sp.</i> Cultural heritage noted in areas around claypan.	80%	Minor evidence for livestock disturbance.	18/05/22

Transect ID	СН	Land Unit Feature	Transect Length (m)	Description	GSV	Disturbance	Date
EP93-Line 1 CHSA037	Yes	Dune systems and claypans	871	Shallow claypans within wide dune swale. Claypans extend throughout the area. Spinifex and kerosene grass tussocks dominate with occasional <i>acacia sp</i> . Cultural heritage noted is areas around claypan.	80%	Minor evidence for livestock disturbance.	18/05/22
EP93-Line 1 CHSA39	Nil	Dune systems and claypans	1,030	Hale River palaeochannel. Claypan mixed with red sand. Well-watered site with sporadic stunted coolabahs through the centre and casuarina on the margins. Good potential for cultural heritage but none observed within transect.	90%	Evidence for livestock disturbance.	19/05/22
EP93-Line 1 - Stop 1	Nil	Dune systems	2,870	Interdunal swale dominated by grass and occasional herbaceous communities. Red sandy substrate. Low cultural heritage potential.	90%	Nil observed	18/05/22
EP93-Line 1_Stop 2	Nil	Dune systems	893	Interdunal swale dominated by acacia (wattle) and spinifex with occasional senna. Reduced grass species and ground coverage. Low cultural heritage potential.	100%	Nil observed	19/05/22
EP93-Line 1 CHSA038	NA	Dune systems	NA	Fly-over with no claypans or drainage observed	NA	NA	19/05/22
EP93-Line 1_Stop 3	Nil	Dune systems	2,383	Grassy swale with red sandy substrate populated predominantly by spinifex, 'salad plants' and herbaceous emu bush. Occasional acacia. Low cultural heritage potential.	90%	Nil observed	19/05/22
EP93-Line 2_Stop 1	Nil	Dune systems	180	Interdunal swale dominated by grass and occasional herbaceous communities. Red sandy substrate. Low cultural heritage potential.	85%	Nil observed	20/05/22
EP93-Line 2_Stop 2	Nil	Dune systems and palaeochann el	1,939	Interdunal swale on Hale Ck palaeochannel. Adjacent swales lined with old growth coolabah and occasional senna. Ubiquitous blanket of prostrate forbes typically	60- 100%	Heavy camel/cattle disturbance.	20/05/22

Transect ID	СН	Land Unit Feature	Transect Length (m)	Description	GSV	Disturbance	Date
				exploiting disturbed environments. Low/ eroded dunes flank swales. Substrate is either clay or mixed clay-sand mix. No cultural heritage observed but moderate potential			
EP93-Line 2_Stop 3	Nil	Dune systems	278	Wide Interdunal swale dominated by spinifex tussocks. Occasional herbaceous 'lambs tail' communities. Red sandy substrate. Low cultural heritage potential.	90%	Nil observed	20/05/22
EP93-Line 3_Stop 1	Nil	Dune systems	1,327	Interdunal swale with grass tussock communities on red sandy substrate. Acacia and herbaceous shrubs on margins/foot of dunes. Low cultural heritage potential.	95%	Evidence for camel/cattle disturbance.	19/05/22
EP93-Line 3_Stop 2	Nil	Dune systems	865	Swale dominated by grass tussocks, particularly spinifex. Red sandy substrate. Low cultural heritage potential.	75%	Nil observed	19/05/22
EP93-Line 3_Stop 3	Nil	Dune systems	3,061	Swale between low/eroded dunes. Red sandy substrate. Reduced spinifex amongst grass communities. Acacia (wattle) prominent. Low cultural heritage potential.	90%	Nil observed	19/05/22
EP93-Line 4_Stop 1	Nil	Dune systems	1,849	Interdunal swale dominated by acacia sp, reduced grass communities. Red sandy substrate. Low cultural heritage potential.	95%	Evidence for minor camel/cattle disturbance.	20/05/22
EP93-Line 4_Stop 2	Nil	Dune systems	1,482	Reduced spinifex tussocks and increased smaller grass tussock understory. Sporadic acacia. Red sandy substrate. Low cultural heritage potential.	60%	Nil observed	20/05/22
EP93-Line 4_Stop 3	Nil	Dune systems	1,602	Clay-red sand mixed swale between low/eroded dunes. Aristida holothera grass communities and sporadic senna and infrequent grevillea bushes. Low	70%	Nil observed	20/05/22

Transect ID	СН	Land Unit Feature	Transect Length (m)	Description	GSV	Disturbance	Date
				cultural heritage potential.			
EP93-Line 5_Stop 1	Nil	Dune systems	1,525	Interdunal swale with grass tussocks. Sandy substrate. Low cultural heritage potential.	60%	Nil observed	20/05/22
EP93-Line 5_Stop 2	Nil	Dune systems	410	Swale between low/eroded/deflated dunes. Spinifex tussock dominate grass communities. Occasional <i>acacia sp.</i> , Red sandy substrate. Low cultural heritage potential.	80%	Nil observed	20/05/22
EP93-Line 5_Stop 3	Nil	Dune systems	459	Raised swale dominated by grass communities, particularly spinifex tussocks. Red sandy substrate. Low cultural heritage potential.	95%	Evidence for minor camel/cattle disturbance.	20/05/22
EP97-Line 1 CHRA043	Yes	Dune systems and claypans	2,050	Large claypan with substrate mixed clay/red sand. Soft and 'spongy' under foot. Cultural heritage noted with high potential for other features in land units surrounding claypan.	100%	Disturbance by camel noted	19/05/22
EP97-Line 1_Stop 1	Nil	Dune systems	1,380	Interdunal swale. Low cultural heritage potential.	80%	Disturbance by camel noted	19/05/22
EP97-Line 1_Stop 2	Nil	Dune systems	1,930	Interdunal swale. Low cultural heritage potential.	80%	Nil observed	19/05/22
EP97-Line 1_Stop 3	Nil	Dune systems	2,364	Interdunal swale. Low cultural heritage potential.	80%	Nil observed	19/05/22
EP97-Line 1_Stop 4	Nil	Dune systems	923	Interdunal swale. Low cultural heritage potential.	80%	Nil observed	19/05/22
EP97-Line 1 CHSA0042	Nil	Dune system	NA	Fly-over with no claypan observed	NA	NA	19/05/22



Figure 4: Cultural Heritage transect EP107



Figure 5:Cultural heritage transect EP93


Figure 6: Cultural Heritage Transect EP97

#### 5.2 Archaeological Results

The results of the survey included the recording of 11 archaeological sites and 14 isolated finds (see Table 5, Figure 7, Figure 8, Figure 9 and Appendix 2: Archaeological Feature Descriptions and Records). The archaeological features were all Aboriginal in origin and consisted of low-density artefact scatters (8 sites), quarry areas (2 sites), a stone arrangement (1 site), isolated grindstone (1 find), a manuport (1 find) and isolated flakes, cores and an axe (12 finds). The sites and isolated finds were generally recorded as individual features, however where some were considered to have a shared association with a distinct landscape feature they have been described as site complexes.

For example, site complexes BRS22 AS04(a-g) and BRS22 AS06(a-e) both comprised of several recorded isolated artefacts and individual site components, which have been grouped together based on their apparent shared landscape association. BRS22 AS04(a-g) comprised of three isolated artefacts and four low density lithic scatters bound by an erosional/deflated, bowl-like formation, which likely supported a shared landscape use through raw materials and water resources. Similarly, BRS22 AS06(a-e) contained isolated arefacts, evidence of quarrying and a potential stone arrangement, which share the stone and water resources of a rocky rise and mesa formation.

As a whole, the Project Area contained a site distribution pattern which most often identified archaeological features in association with palaeochannels, claypans, rocky outcrops with drainage features, gibber plains and at the toe of steeper, east-facing dunes. However not all claypans observed archaeological sites, which should not be considered as an absence of past use of these areas, but rather the narrow footprint of the seismic lines.

There was a distinct absence of archaeological materials across land systems without evidence for water systems (palaeochannel) and/or raw materials suitable for the manufacture of stone artefacts. Similarly, wide swales bound by low and/or eroded/deflated sand dunes were less likely to present archaeological features. Furthermore, sand coverage on the west-facing dune slopes was more expansive and likely buried any potential to observe the archaeology.

A higher frequency of archaeological features was recorded within EP107, as compared to EP97 and EP93. This observation was likely due to the seismic lines within EP107 traversing better watered and resource rich land units (see Table 4 above), including areas which contained raw materials suitable for the manufacture of stone artefacts. Whilst it is noted that reduced transect times were spent within EP97 and EP93, due to helicopter refuelling constraints, it is unlikely that frequency or distribution pattern of artefacts would have significantly changed if the intensity of surveys had increased in these areas.

As presented in Table 5, the current proposed location of the seismic lines would impact site complexes BRS22 AS04(a-g) and BRS22 AS06(a-e), with all other recorded features being a minimum distance of 20m from centreline.

Survey limitations and potential risks to unidentified cultural heritage features is presented in the following section.

Seismic Line	Site ID	Proximity to Seismic Line	Site Type	Site Size	Site Description	Land Unit
EP107- Line1	BRS22 IA04	100m south of seismic line	lsolated Artefact	<1m2	1 x whole flake (Silcrete)	Dune swale
EP107- Line2	BRS22 IA05	110m south of seismic line	Isolated Artefact	<1m2	1 x core (Silcrete)	Dune swale
EP107- Line2	BRS22 IA07	75m north of seismic line	lsolated Artefact	<1m2	1 x whole flake (Silcrete)	Dune swale
EP107- Line2	BRS22 IA08	40m north of seismic line	lsolated Artefact	<1m2	Grind plate (non-portable), Sandstone conglomerate, Minimum three distinct grinding surfaces.	Dune swale
EP107- Line2	BRS22 IA09	20m north of seismic line	lsolated Artefact	<1m2	Manuport halfway up dune flank. Heat fractured. Potentially part of a hearth.	Dune system
EP107- Line2	BRS22 AS06(e)	40m north of seismic line (part of overall site complex falls within seismic line)	Isolated Artefact	<1m2	Whole flake, lake located on ironstone outcrop. Site forms part of a wider site complex which includes isolated artefacts, manuports, stone arrangements and quarrying (site ID: BRS22 AS09 (a-e)). Overall site size = 150m x 80m	Stony hill and mesa/outcrop, with ephemeral drainage
EP107- Line2	BRS22 AS06(a)	130m north of seismic line (part of overall site complex falls within seismic line)	Isolated Artefact	<1m2	Whole flake, lake located on ironstone outcrop. Site forms part of a wider site complex which includes isolated artefacts, manuports, stone arrangements and quarrying. Overall site size = 150m x 80m	Stony hill and mesa/outcrop, with ephemeral drainage
EP107- Line2	BRS22 AS06(b)	120m north of seismic line (part of overall site complex falls within seismic line)	Percussion Scars/Quarry	>10m2 (may extend across unsurve yed areas)	Percussion scars on outcropping rock edges. Likely the result of quarrying. Site forms part of a wider site complex which includes isolated artefacts, manuports, stone arrangements and quarrying. Overall site size = 150m x 80m	Stony hill and mesa/outcrop, with ephemeral drainage

Seismic Line	Site ID	Proximity to Seismic Line	Site Type	Site Size	Site Description	Land Unit
EP107- Line2	BRS22 AS06(c)	30m north of seismic line (part of overall site complex falls within seismic line)	Quarry	>10m2 (may extend across unsurve yed areas)	Iron rich, silicified sandstone outcrop with evidence of quarrying. Site forms part of a wider site complex which includes isolated artefacts, manuports, stone arrangements and quarrying. Overall site size = 150m x 80m	Stony hill and mesa/outcrop, with ephemeral drainage
EP107- Line2	BRS22 ASO6(d)	60m north of seismic line (part of overall site complex falls within seismic line)	Stone Arrangement	100m2	Features appears to be a cleared area 8m diameter. Raised flat area between two ironstone mounds (east and west of circle). Circle open to north. Site forms part of a wider site complex which includes isolated artefacts, manuports, stone arrangements a	Stony hill and mesa/outcrop, with ephemeral drainage
EP107- Line4	BRS22 ASO4(a)	50m west of seismic line (part of overall site complex falls within seismic line)	Low density artefact scatter	5m2	Lithic reduction site 5m2. Silcrete core and 7 flakes (2 primary, 2 secondary, and 4 tertiary). 1 x flake (chert). Site forms part of a larger complex 100m x 75m (BRS22 AS04(a-g). Artefacts continue to foot of escapement before ceasing.	Area is a topographic 'bowl' collecting run-off from escarpments on all sides
EP107- Line4	BRS22 AS04(b)	30m west of seismic line (part of overall site complex falls within seismic line)	Isolated Artefact	<1m2	1 x large flake (silcrete). Site forms part of a larger complex 100m x 75m (BRS22 AS04(a-g). Artefacts continue to foot of escapement before ceasing.	Area is a topographic 'bowl' collecting run-off from escarpments on all sides
EP107- Line4	BRS22 ASO4(c)	Within seismic line	Isolated Artefact	<1m2	2 x whole flakes (quartz), 2 x whole flakes (silcrete). Site forms part of a larger complex 100m x 75m (BRS22 AS04(a-g). Artefacts continue to foot of escapement before ceasing.	Area is a topographic 'bowl' collecting run-off from escarpments on all sides
EP107- Line4	BRS22 AS04(d)	Within seismic line	Low density artefact scatter	10m2	Low density artefact scatter, with 11 x flakes (silcrete) and 1x flake (chert). Site forms part of a larger complex 100m x 75m (BRS22 AS04(a-g). Artefacts continue to foot of	Area is a topographic 'bowl' collecting run-off from escarpments on all sides

Seismic Line	Site ID	Proximity to Seismic Line	Site Type	Site Size	Site Description	Land Unit
					escapement before ceasing.	
EP107- Line4	BRS22 AS04(e)	30m west of seismic line (part of overall site complex falls within seismic line)	Low density artefact scatter	10m2	Low density artefact scatter, with 2x retouched flakes (silcrete), 6 x flakes (silcrete) and 2 x flakes (quartz). Site forms part of a larger complex 100m x 75m (BRS22 AS04(a-g). Artefacts continue to foot of escapement before ceasing.	Area is a topographic 'bowl' collecting run-off from escarpments on all sides
EP107- Line4	BRS22 AS04(f)	90m west of seismic line (part of overall site complex falls within seismic line)	Isolated Artefact	<1m2	1 x whole flake (Silcrete). Site forms part of a larger complex 100m x 75m (BRS22 AS04(a-g). Artefacts continue to foot of escapement before ceasing.	Area is a topographic 'bowl' collecting run-off from escarpments on all sides
EP107- Line4	BRS22 AS05	23m east of seismic line	Low density artefact scatter	<10m2	Chert reduction site (1 core and 3 flakes) Clay pan Flanked by low energy erosional loam accumulated by Run off from rock escarpment 500m South.	Claypan at base of hill
EP107- Line4	BRS22 AS04(g)	50m west of seismic line (part of overall site complex falls within seismic line)	Low density artefact scatter	3m2	Low density artefact scatter and reduction area, with 16 flakes (silcrete) of varying sizes. Site forms part of a larger complex 100m x 75m (BRS22 AS04(a-g). Artefacts continue to foot of escapement before ceasing.	Area is a topographic 'bowl' collecting run-off from escarpments on all sides
EP107- Line5	BRS22 IAO6	250m west of seismic line	Isolated Artefact	<5m2	Multi-tool axe/grind plate (iron stone; incomplete, rhomboid - 7x4(blade)x7x1cm/ 1.5cm wide in section), retouched chert flake and silcrete flake recorded in a 5m <sup>2</sup> area. No other heritage observed in a cursive search (30m <sup>2</sup> ).	Claypan/ paleochannel within dune swale
EP97- Line1	BRS22 IA03	70m south of seismic line	Isolated Artefact	20m2	Three artefacts (1 x flake (silcrete) 1x flake (chert), 1 x flake (chert)) spread over ~20m along southern margin	Claypan within dune swale

Seismic Line	Site ID	Proximity to Seismic Line	Site Type	Site Size	Site Description	Land Unit
					of claypan.	
EP93- Line1	BRS22 AS01	1000m north of seismic line	Low density artefact scatter	>100m2	Chert debitage. Chert flakes (retouched and debitage). Very dispersed (1 artefact/10m2) along margin of Claypan	Claypan within dune swale
EP93- Line1	BRS22 AS02	1000m north of seismic line	Low density artefact scatter	>100m2	Chert debitage. Chert and silcrete flakes and sandstone grindstone fragments dispersed (1 artefact/10m2) along margin of claypan	Claypan within dune swale
EP93- Line1	BRS22 AS03	315m south of seismic line	Low density artefact scatter	10m2	Silcrete reduction scatter (10m2) Low density (1 artefact/m2) Clay plan	Claypan within dune swale
EP93- Line1	BRS22 IA01	280m south of seismic line	Isolated Artefact	<1m2	1 x flake (Silcrete) on margin of claypan	Claypan within dune swale
EP93- Line1	BRS22 IA02	280m south of seismic line	Isolated Artefact	<1m2	1 x flake (Silcrete) on margin of claypan	Claypan within dune swale

This figure has been removed to respect and protect the cultural sensitivities of the area following consultation with Traditional Owners

Figure 7: Survey Results EP107

This figure has been removed to respect and protect the cultural sensitivities if the area following consultation with Traditional Owners

Figure 8: Survey Results EP93

This figure has been removed to respect and protect the cultural sensitivities of the area following consultatiion with Traditional Owners

Figure 9: Survey Results EP97

#### 5.3 Survey Gaps and Limitations

Following the results of the surveys, 30 Cultural Heritage Risk Areas (CHRA) were identified (see Table 6, Figure 10, Figure 11 and Figure 12). These locations are classified as potentially risk areas on the basis that they have been identified as areas which have a higher potential for containing archaeological features and were not assessed during the fieldwork. The CHRA's were identified through the predictive model outlined in Section 3 and further refined following the results of field assessment. Survey limitations at these locations was primarily due to the lack of access within the survey timeframe to the more remote proposed seismic lines.

In brief, 25 of the CHRAs fell within EP107 and were associated with drainage lines, drainage depressions, larger claypans, palaeodrainage channels and rocky rises. Three CHRAs fell within EP97 and two within EP93, which were all principally associated with claypans and drainage features. In developing the CHRAs, only well-defined and/or larger claypans were included due to the general absence of archaeological features observed in the smaller and more ephemeral drainage features.

ID	Length (m)	Feature	Cultural Heritage Potential
EP107_Line 1_CHRA01	220	Drainage depression and small drainage line	Low-medium risk of isolated stone artefacts and low-density scatters of stone artefacts
EP107_Line 1_CHRA02	224	Drainage lines	Low-medium risk of isolated stone artefacts and low-density scatters of stone artefacts
EP107_Line 1_CHRA03	587	Three small drainage lines	Low-medium risk of isolated stone artefacts and low-density scatters of stone artefacts
EP107_Line 1_CHRA04	283	Drainage depressions	Low-medium risk of isolated stone artefacts and low-density scatters of stone artefacts
EP107_Line 1_CHRA05	425	Two small drainage lines	Low-medium risk of isolated stone artefacts and low-density scatters of stone artefacts
EP107_Line 1_CHRA06	4267	Network of claypans and palaeodrainage systems	High risk of isolated artefacts and scatters of stone artefacts
EP107_Line 1_CHRA07	8517	Drainage and palaeodrainage	Moderate-high risk of isolated artefacts and scatters of stone artefacts
EP107_Line 2_CHRA01	21667	Drainage, palaeodrainage and some rocky rises extending east and west between dunes	High risk of isolated artefacts and scatters of stone artefacts
EP107_Line 2_CHRA02	573	Claypans within dune swale	Low-medium risk of isolated stone artefacts and low-density scatters of stone artefacts
EP107_Line 2_CHRA03	363	Claypans between two dune swales	Low-medium risk of isolated stone artefacts and low-density scatters of stone artefacts
EP107_Line 2_CHRA04	739	Drainage and stony rise	High risk of isolated artefacts, scatters of stone artefacts and culturally significant features
EP107_Line 2_CHRA05	2251	Drainage and stony rises	High risk of isolated artefacts, scatters of stone artefacts and culturally significant features
EP107_Line 2_CHRA06	1583	Two drainage depressions and a claypan	Moderate-high risk of isolated artefacts and scatters of stone artefacts
EP107_Line 2_CHRA07	3818	Todd River palaeodrainage	Moderate-high risk of isolated artefacts and

Table 6: Cultural Heritage Risk Areas

ID	Length (m)	Feature	Cultural Heritage Potential
		system	scatters of stone artefacts
EP107_Line 3_CHRA01	1986	Drainage system and claypan	Moderate-high risk of isolated artefacts and scatters of stone artefacts
EP107_Line 3_CHRA02	3654	Drainage and a sequence of stony rises	High risk of isolated artefacts, scatters of stone artefacts and culturally significant features
EP107_Line 3_CHRA03	1155	Large drainage depression	High risk of isolated artefacts and scatters of stone artefacts
EP107_Line 4_CHRA01	309	Small drainage depression to east	Low-medium risk of isolated stone artefacts and low-density scatters of stone artefacts
EP107_Line 4_CHRA02	655	Claypan	Low-medium risk of isolated stone artefacts and low-density scatters of stone artefacts
EP107_Line 4_CHRA03	6090	Major drainage system, geological and landform changes. Ochreous claystone noted in the geology	High risk of isolated artefacts, scatters of stone artefacts and culturally significant features
EP107_Line 5_CHRA01	629	Drainage depression	Low-medium risk of isolated stone artefacts and low-density scatters of stone artefacts
EP107_Line 5_CHRA02	230	Drainage depression	Low-medium risk of isolated stone artefacts and low-density scatters of stone artefacts
EP107_Line 5_CHRA03	920	Drainage lines and depression to west	Low-medium risk of isolated stone artefacts and low-density scatters of stone artefacts
EP107_Line 5_CHRA04	10113	Major rocky rise with drainage lines drainage system to east. Large claypan system to south.	High risk of isolated artefacts, scatters of stone artefacts and culturally significant features
EP107_Line 5_CHRA05	6734	Numerous drainage depressions through area and rocky rise to south	High risk of isolated artefacts, scatters of stone artefacts and culturally significant features
EP93_Line 1_CHRA01	539	Claypans between two dune swales	Low-medium risk of isolated stone artefacts and low-density scatters of stone artefacts
EP93_Line 2_CHRA01	251	Watercourse - small but discharges into major drainage system	Low-medium risk of isolated stone artefacts and low-density scatters of stone artefacts
EP97_Line 1_CHRA01	349	Claypans between two dune swales	Low-medium risk of isolated stone artefacts and low-density scatters of stone artefacts
EP97_Line 1_CHRA02	368	Claypans within dune swale	Low-medium risk of isolated stone artefacts and low-density scatters of stone artefacts
EP97_Line 1_CHRA03	333	Claypans within dune swale	Low-medium risk of isolated stone artefacts and low-density scatters of stone artefacts

This figure has been removed to respect and protect the cultural sensitivities of the area following consultation with Traditional Owners.

Figure 10: Cultural Heritage Risk Areas E107

This figure has been removed to respect and protect the cultural sensitivities of the area following consultation with Traditional Owners

Figure 11: Cultural Heritage Risk Areas (CHRA) EP93

This figure has been removed to respect and protect the cultural sensitives of the area following consultation with Traditional Owners

Figure 12:Cultural Heritage Risk Areas (CHRA) EP97

### 6 Cultural Heritage Significance Assessment

#### 6.1 Assessment Processes of Cultural Significance

Cultural heritage management in Australia is underpinned by legislation, coupled with the ethics and principles established by heritage management practice. In addition to statutory law, several guidelines have been developed to support the protection and management of Indigenous heritage places on Commonwealth land. These include but are not limited to: Ask First, A guide to respecting Indigenous heritage places and values (2002); Engage Early, Guidance for proponents on best practice Indigenous engagement for environmental assessments under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) (2016); and Practice Notes for the Australian ICOMOS Burra Charter 2013 (hereafter referred to as the "Burra Charter"). Legislative basis for the protection and conservation of Indigenous archaeological places and objects within the Project Area is discussed in Section 2.

The cultural heritage values of sites and objects recorded during the survey followed key Indigenous heritage management and significance assessment principles from the Burra Charter Practice Note, 'The Burra Charter and Indigenous Cultural Heritage Management, 2013' (see also The Burra Charter and Archaeological Practice, 2013). These are summarised below for reference:

Place	Includes locations that embody spiritual value (such as Dreaming places, sacred landscapes and stone arrangements), social and historical value (such as massacre sites), as well as scientific value (such as archaeological sites). In fact, one place may be all of these things or may embody all of these values at the same time.
Cultural Significance	Is very broadly defined to include 'aesthetic, historical, scientific, social or spiritual value for past, present or future generations'. This definition captures places of cultural significance to Indigenous cultures. It also includes places that provide a physical location that is integral to the existence, observation and practice of intangible heritage. The Burra Charter definition of cultural significance encompasses all forms of spirituality, regardless of the culture from which it emanates. Similarly, aesthetic value is not limited to a 'western' perception of aesthetics.
Knowledge and expertise of	It is critical that assessments of cultural significance for Indigenous
Indigenous peoples	heritage places reflect the views and input of the relevant Indigenous knowledge-holders.
Precise Assessments	Practitioners must define the location and form of a place, and the values that it embodies, with sufficient clarity to inform an assessment or the development of policy.
Changing Values	Assessments of significance need to be responsive to the dynamic nature of Indigenous cultures.
Defining Site Boundaries	Assessments of significance that concentrate on the visual characteristics of a place, and use those characteristics to establish a 'boundary' for the place, may fail to appreciate its broader cultural or spiritual setting. Importantly, heritage practitioners must not inappropriately privilege tangible places and objects over the intangible aspects of
	heritage.
Maintenance, preservation,	Practitioners may identify conservation needs and responses that are at
restoration, reconstruction	odds with those identified by the traditional owners of a
and appropriate 'change'	place, with the potential for misunderstanding and conflict.
can be cultural dependant	

These principles outlined in the Burra Charter are generally those by which most cultural heritage practices in Australia are determined, including the assessment of significance of individual heritage places and objects.

In summary, cultural heritage landscapes, places, sites and objects can be significant in a number of ways:

- 1 Significant to a group or many groups of people due to their connection to the past.
- 2 Significant to a specific group of people because they have religious or spiritual significance to those people (Sacred Sites, Dreaming Sites or Story Places for example),
- 3 Significant to a group or many groups due to the relationship of place in the wider context of an ecological and cultural landscape.
- 4 Significant because of their research potential: their importance of the site in answering questions about past and in some instance's current human behaviour.
- 5 Significant due to their representativeness or uniqueness: sites or places that are rare or unique and are therefore conserved as a representative example.

Following the assessment of significance, the future conservation of a heritage place is decided by weighing up the level of assigned significance against the practicality of conserving the place. In terms of Indigenous site, these decisions should be made in direct consultation with Traditional Owners and guided by their views and input. To assess the practicality of conserving a heritage site, regulatory mechanisms are usually used to assess the condition of the place (whether it will survive for much longer) and the economic implications of deciding to apply permanent heritage protection.

#### 6.2 Assessment Principles of Scientific and Research Significance

Scientific and research significance, including archaeological significance, is determined by assessing the ability of an object, site or area to add to the scientific knowledge of history or pre-history. This scientific knowledge for example, may include the ability of an object, site or area to provide an insight into past social patterns (e.g. trade and exchange networks), technologies, substance patterns, timings of occupation, and/or paleoenvironmental conditions.

Accordingly, in general the more information an object, site or area can add to understanding the past, the higher its scientific significance. Notwithstanding this, some sites or object may also have higher levels of scientific significance due to its aesthetics, rarity and representativeness rather than an ability to inform greater details about the past. Areas or sites so judged are often recorded in detail or conserved *in situ* because they may add to our understanding of the past. It also may involve conserving a place until all practical scientific observations can be made, for example, in the salvage of artefact scatters before a development commences.

# 6.3 Significance Assessment of Aboriginal Archaeological Sites Recorded within the Project Area

The results of the survey included the recording of 11 archaeological sites and 14 isolated finds (see Section 5.2 and Appendix 2: Archaeological Feature Descriptions and Records). Several of these features were also considered to have a shared association with distinct landscape features and were described as site complexes.

In general, the recording of the archaeological features was relatively brief but aimed to capture sufficient

information to understand and assess the archaeological significance of the features within the footprint areas. Information recorded for each feature included: locational data, brief site descriptions, artefact sample counts, geomorphic and environmental contexts, condition, and a photographic record. This information has been used to provide a significance rating for each archaeological site.

Whilst Traditional Owners accompanied the overall BR Simpson assessment program, they did not participate in the archaeological field surveys due to their own concurrent sacred site and environmental programs. Consultation with Traditional Owners regarding archaeological features was generally undertaken following fieldwork (where possible).

Central Australia as a whole should be considered as a significant cultural landscape, given the spiritual importance to Aboriginal people who have a long history of more than 30,000 years within the region. This relationship with Country is demonstrated by the density of sacred sites and Dreaming pathways around the Project Areas, as well as its limitless archaeological research potential across the wider region.

All sites have archaeological significance ratings largely reflective of their scientific values, with those given a higher rating based on their ability to better inform the past and/or are more representative of a particular site type. It is also possible that the significance rating of these sites could change to a lower or higher rating following additional investigations such as targeted archaeological excavations, and detailed recordings of whole site complexes or wider regional studies.

In general, the significance assessments drew on the abovementioned Burra Charter guides and criteria outlined in the NT Heritage Act, which included the following considerations:

- 1 Whether the place or object is important to the course or pattern of the Northern Territory's cultural or natural history.
- 2 Whether the place or object possesses uncommon, rare, or endangered aspects of the Northern Territory's cultural or natural history.
- 3 Whether the place or object has potential to yield information that will contribute to an understanding of the Territory's cultural or natural history.
- 4 Whether the place or object is important in demonstrating the principal characteristics of a class of cultural or natural places or environments.
- 5 Whether it is important in exhibiting particular aesthetic characteristics.
- 6 Whether it is important in demonstrating a high degree of creative or technical achievement during a particular period.
- 7 Whether it has a strong or special association with a particular community or cultural group for social, cultural, or spiritual reasons, including the significance of the place to the Aboriginal people as part of their continuing and developing cultural traditions.
- 8 Whether it has a special association to the life or works of a person or group of persons, of importance to the Northern Territory's history.

All archaeological features were also assessed as having varying levels of potential attributes to provide information on a combination of the following key research areas:

- 1. Whether the site could contribute to understanding settlement patterns of Aboriginal people across the region.
- 2. The connectedness of individual sites and/or land systems.
- 3. Are the contents of sites part of a complex or related sites or land systems?

- 4. Were the drainage depressions/soaks associated with localised subsistence practices or watering points for traversing Country?
- 5. Provenance of stone raw materials used in artefact manufacture.
- 6. Lithic technologies.
- 7. Temporality of human occupation and palaeoenvironmental conditions.

Isolated artefacts and low-density lithic scatters, with the exception of those associated with the two site complexes (i.e BRS22 AS04 (a-g) and BRS22 AS06 (a-e)), were considered of low archaeological and cultural significance due to their abundance in the landscape and understanding that minimal scientific information would be lost if they were salvaged from their current in-situ locations.

BRS22 AS04 (a-g) and BRS22 AS06 (a-e) were respectively assessed as having low to moderate and high levels of archaeological significance due to their rarity and potential ability to provide valuable information on the past human occupation of the area.

Comparable to much of regional Australia, some impacts to the significance of the sites were evident due to high bioturbation levels from a long history of cattle grazing across the region.

Individual site significance assessments are presented in Table 7.

Seismic Line	ID	Site Type	Site Size	Site Condition	Structure	Location	Arch Significance
EP93-Line1	BRS22 AS01	Low density artefact scatter	>100m2	Good	Surface only	1000m north of seismic line	Low
EP93-Line1	BRS22 AS02	Low density artefact scatter	>100m2	Good	Surface only	1000m north of seismic line	Low
EP93-Line1	BRS22 AS03	Low density artefact scatter	10m2	Good	Surface only	315m south of seismic line	Low
EP107-Line4	BRS22 AS04(a)	Low density artefact scatter	5m2	Good	Surface only	50m west of seismic line (part of overall site complex falls within seismic line)	Low to Moderate
EP107-Line4	BRS22 AS04(b)	lsolated Artefact	<1m2	Good	Surface only	30m west of seismic line (part of overall site complex falls within seismic line)	Low to Moderate
EP107-Line4	BRS22 AS04(c)	Isolated Artefact	<1m2	Good	Surface only	Within seismic line	Low to Moderate
EP107-Line4	BRS22 AS04(d)	Low density artefact scatter	10m2	Good	Surface only	Within seismic line	Low to Moderate
EP107-Line4	BRS22 AS04(e)	Low density artefact scatter	10m2	Good	Surface only	30m west of seismic line (part of overall site complex falls within seismic line)	Low to Moderate

#### Table 7: Cultural Heritage Significance Assessment

Seismic Line	ID	Site Type	Site Size	Site Condition	Structure	Location	Arch Significance
EP107-Line4	BRS22 AS04(f)	lsolated Artefact	<1m2	Good	Surface only	90m west of seismic line (part of overall site complex falls within seismic line)	Low to Moderate
EP107-Line4	BRS22 AS04(g)	Low density artefact scatter	3m2	Good	Surface only	50m west of seismic line (part of overall site complex falls within seismic line)	Low to Moderate
EP107-Line4	BRS22 AS05	Low density artefact scatter	<10m2	Good	Surface only	23m east of seismic line	Low
EP107-Line2	BRS22 AS06(a)	lsolated Artefact	<1m2	Good	Surface only	130m north of seismic line (part of overall site complex falls within seismic line)	High
EP107-Line2	BRS22 AS06(b)	Percussion Scars/Quarry	>10m2 (may extend across unsurveyed areas)	Good	Surface only	120m north of seismic line (part of overall site complex falls within seismic line)	High
EP107-Line2	BRS22 AS06(c)	Quarry	>10m2 (may extend across unsurveyed areas)	Good	Surface only	30m north of seismic line (part of overall site complex falls within seismic line)	High
EP107-Line2	BRS22 AS06(d)	Stone Arrangement	100m2	Fair	Surface with potential for shallow subsurface	60m north of seismic line (part of overall site complex falls within seismic line)	High
EP107-Line2	BRS22 AS06(e)	lsolated Artefact	<1m2	Good	Surface only	40m north of seismic line (part of overall site complex falls within seismic line)	High
EP93-Line1	BRS22 IA01	Isolated Artefact	<1m2	Good	Surface only	280m south of seismic line	Low
EP93-Line1	BRS22 IA02	Isolated Artefact	<1m2	Good	Surface only	280m south of seismic line	Low
EP97-Line1	BRS22 IA03	Isolated Artefact	20m2	Good	Surface only	70m south of seismic line	Low
EP107-Line1	BRS22 IA04	Isolated Artefact	<1m2	Good	Surface only	100m south of seismic line	Low

Seismic Line	ID	Site Type	Site Size	Site Condition	Structure	Location	Arch Significance
EP107-Line2	BRS22 IA05	Isolated Artefact	<1m2	Good	Surface only	110m south of seismic line	Low
EP107-Line5	BRS22 IA06	Isolated Artefact	<5m2	Good	Surface only	250m west of seismic line	Low
EP107-Line2	BRS22 IA07	Isolated Artefact	<1m2	Good	Surface only	75m north of seismic line	Low
EP107-Line2	BRS22 IA08	Isolated Artefact	<1m2	Good	Surface only	40m north of seismic line	Low
EP107-Line2	BRS22 IA09	Isolated Artefact	<1m2	Good	Surface only	20m north of seismic line	Low

### 7 Development Risks and Recommendations

The following section outlines the potential impacts on archaeological sites resulting from the construction of the proposed seismic lines. These impacts are limited to the proposed Project works set out in Section 1.3 above.

Recommendations are then presented that will assist in the protection and management of archaeological features. Note that Sacred Sites remain protected under the ALRA and the *NT Sacred Sites Act 1989*. The proposed seismic lines do not directly contact any recorded or registered Sacred Sites.

#### 7.1 Potential Impacts on Recorded Aboriginal Archaeological Sites

#### 7.1.1 Direct Impacts to Cultural Heritage Features

The proposed BR Simpson Exploration Project may require the clearing of vegetation and skim grading to construct approximately ~815kms of seismic lines.

Accordingly, as outlined in Section 5.2 above, within the current alignments the proposed seismic line construction will impact upon two site complexes ((i.e BRS22 AS04 (a-g) and BRS22 AS06 (a-e)) and 30 CHRAs.

In general, the potential direct impacts of the proposed seismic on the cultural heritage resources within the Project Area include, but are not limited to:

- 1. The clearing of surface archaeological remains especially lithic material and quarries.
- 2. Destroying the integrity of a site complex when only a portion of the site has been surveyed and understood.
- 3. The unexpected revealing and/or destruction of subsurface material culture or human remains.
- 4. Removal of culturally significant artefacts by contractors, visitors and staff working on the Project.

#### 7.1.2 Indirect Impacts to Cultural Heritage Features

Whilst this Report largely centres on the exploration programs development components, which have the potential to physically impact the cultural resources within its footprint, it should be noted that other

indirect factors resulting from the Project's activities may also risk further impact upon the area's cultural values. The potential indirect impacts of the proposed seismic lines on the archaeological and cultural heritage resources within the Project Area include, but are not limited to:

- 1. Increased access to culturally sensitive landscapes by pastoralist and to a lesser degree the public using the seismic lines to access the areas.
- 2. Impacts to the perception of a place's cultural value once it has been altered (both from within the underlying Estate Groups and neighbouring groups who share common cultural beliefs and ties).
- 3. Incremental destruction of places through increased development opportunities that may result from the Project's success.
- 4. The construction design and method resulting in post-construction erosion of significant archaeological sites and cultural heritage features.

#### 7.1.3 Potential for Previously Undetected Aboriginal Archaeological Sites

All representative land units within the Project Area were sampled as part of the archaeological assessment. This sampling was coupled with additional targeted surveys of several accessible drainage depressions, watercourse crossings and areas with geology identified to potentially contain artefact bearing raw materials. Based on the results of this survey and the predictive modelling, it is likely unrecorded archaeological features remain in some unsurveyed land units throughout the Project Areas. It is also possible some undetected archaeological features may have been obscured by vegetation or sediment within the survey transects, however, these would be largely restricted to additional isolated finds or low-density concentrations of stone artefacts.

Additionally, there is a high potential for undetected buried archaeological features on the margins of larger drainage depressions and watercourses and within dune systems adjacent to well-watered areas. This notion is based on the incidences of archaeological features recorded in these land units and an understanding of depositional environments from other regional studies.

30 CHRAs were assessed as potentially containing undetected archaeological features. These areas, as outlined in Section 5.3 above, have been categorized with varying risk potential from low to high based on the proposed seismic lines construction through land units with higher archaeological potential. These higher risk land units include larger drainage depressions, claypans, watercourses, palaeochannels and stony rises. The associated risk management recommendations are presented in the following section. The cultural heritage risks these areas pose will be minimized once their applicable management recommendations have been implemented.

Conversely, in areas away from water resources or suitable outcropping geology there is considered to be a very low residual risk of unrecorded/unidentified archaeological features. These areas, as indicated by the field team, fall within low resource zones; in particular there is an absence of reliable surface water and outcropping stone that may have drawn Aboriginal people to these areas in the past, beyond brief visits.

#### 7.2 Recommendations

This report makes recommendations on the cultural heritage recorded in this study according to its significance to Traditional Owners, its archaeological significance, the risk of impacts during construction of the proposed seismic lines and the condition of the site at the time of survey (see Cultural Heritage Significance Assessments, Section 6 above).

- 1. BR Simpson should avoid impacts to recorded heritage places, protected by the *NT Heritage Act* where practicable.
  - a. Where impacts to heritage places are unavoidable, BR Simpson should seek for an approval to carry out work on a heritage place or object (a work approval) under 72 of the *Heritage Act*.
    - i. All site mitigation works should be undertaken well in advance of construction activities.
- 2. BR Simpson should implement measures to protect undiscovered heritage sites, including policies and procedures for the inadvertent discovery of cultural heritage places such as:
  - i. Discovery of Aboriginal archaeological objects and places; and
  - ii. Discovery of human remains.
- 3. BR Simpson should implement workforce training and inductions, which include:
  - a. Cultural awareness.
  - b. Cultural heritage protection.
  - c. Protocols for the management of Aboriginal archaeological sites.
  - d. Identification of Aboriginal archaeological sites.
- 4. BR Simpson should ensure Traditional Owners/Site Custodians are engaged in future heritage management decision making.
- 5. To minimise potential impacts to Sacred Sites, it is recommended that BR Simpson make available to the construction teams the conditions of any Sacred Sites Authority Certificate under the *Northern Territory Aboriginal Sacred Sites Act 1989 (NT)* prior to construction activities.
- 6. BR Simpson should implement the recommendations of all Cultural Heritage Risk Areas as outlined in Table 8 below, to ensure the risk within each area has been adequately managed prior and during construction.
  - a. Any additional clearance surveys should be undertaken well in advance of the construction phase to allow for appropriate mitigation strategies to be implemented.

ID	Feature	Length (m)	Recommendations
EP107_Line 1_CHRA01	Drainage depression and small drainage line	220	1) Construction to use blade up traverse of drainage lines up to 50m each side; or 2) Cultural heritage monitors through areas
EP107_Line 1_CHRA02	Drainage lines	224	Realign seismic line 70m to east to avoid clay pan
EP107_Line 1_CHRA03	Three small drainage lines	587	Realign seismic line 70m to east to avoid clay pan
EP107_Line 1_CHRA04	Drainage depressions	283	Realign seismic line 50m to north to avoid drainage depressions

Table 8: CHRA Recommendations

ID	Feature	Length (m)	Recommendations
EP107_Line 1_CHRA05	Two small drainage lines	425	Realign seismic line 70m to east to avoid drainage lines and drainage depression
EP107_Line 1_CHRA06	Network of claypans and palaeodrainage systems	4267	<ol> <li>Undertake archaeological inspections through area; or 2) Engage cultural heritage monitors through areas.</li> </ol>
EP107_Line 1_CHRA07	Drainage and palaeodrainage	8517	<ol> <li>Undertake archaeological inspections through area; or 2) Engage cultural heritage monitors through areas; or 3) employ low impact ground disturbance clearing of vegetation only.</li> </ol>
EP107_Line 2_CHRA01	Drainage, palaeodrainage and some rocky rises extending east and west between dunes	21667	<ol> <li>Avoid rocky rises with 100m buffer if possible;</li> <li>Undertake archaeological inspections through area; or</li> <li>Engage cultural heritage monitors through areas</li> </ol>
EP107_Line 2_CHRA02	Claypans within dune swale	573	1) Realign seismic lines to at least 150m from toe of rocky rises and 50m east of claypan extent to avoid drainage depressions; or 2) Undertake archaeological inspections through area; or 3) Engage cultural heritage monitors through areas.
EP107_Line 2_CHRA03	Claypans between two dune swales	363	1) Construction to use blade up traverse of claypans up to 100m each side; or 2) Cultural heritage monitors through areas
EP107_Line 2_CHRA04	Drainage and stony rise	739	Realign seismic line 100m to north to avoid drainage depressions
EP107_Line 2_CHRA05	Drainage and stony rises	2251	1) Avoid rocky rises with 100m buffer if possible; or 2) Undertake archaeological inspections through area; or 3) Engage cultural heritage monitors through areas
EP107_Line 2_CHRA06	Two drainage depressions and a claypan	1583	Realign seismic line 100m to north to avoid drainage depressions
EP107_Line 2_CHRA07	Todd River palaeodrainage system	3818	<ol> <li>Undertake archaeological inspections through area; or 2) Engage cultural heritage monitors through areas; or 3) reduce length of seismic line to avoid entering the area</li> </ol>
EP107_Line 3_CHRA01	Drainage system and claypan	1986	<ol> <li>Realign seismic lines to avoid drainage and rocky outcrops; or 2) Undertake archaeological inspections through area; or</li> <li>Engage cultural heritage monitors through areas.</li> </ol>

ID	Feature	Length (m)	Recommendations
EP107_Line 3_CHRA02	Drainage and a sequence of stony rises	3654	Realign seismic line 100m north of site BRS22 AS06 boundary
EP107_Line 3_CHRA03	Large drainage depression	1155	<ol> <li>Relocated seismic line to other side of eastern lineal dune to avoid drainage depression, but also avoid drainage depression within that swale; or 2) Undertake archaeological inspections through area; or 3) Engage cultural heritage monitors</li> </ol>
EP107_Line 4_CHRA01	Small drainage depression to east	309	1) Construction to use blade up traverse of claypan up to 50m each side; or 2) Cultural heritage monitors through areas
EP107_Line 4_CHRA02	Claypan	655	1) Construction to use blade up traverse of claypan up to 50m each side; or 2) Cultural heritage monitors through areas
EP107_Line 4_CHRA03	Drainage system, geological and landform changes. Ochreous claystone noted in the geology	6090	<ol> <li>Avoid rocky rises and claypans with 100m buffer if possible; or 2) Undertake archaeological inspections through area; or</li> <li>Engage cultural heritage monitors through areas</li> </ol>
EP107_Line 5_CHRA01	Drainage depression	629	Realign seismic line 70m to east to avoid clay pan
EP107_Line 5_CHRA02	Drainage depression	230	Realign seismic line 70m to east to avoid clay pan
EP107_Line 5_CHRA03	Drainage lines and depression to west	920	Realign seismic line 70m to east to avoid drainage lines and drainage depression
EP107_Line 5_CHRA04	Major rocky rise with drainage lines drainage system to east. Large claypan system to south.	10113	1) Realign seismic lines to at least 150m from toe of rocky rises and 50m east of claypan extent to avoid drainage depressions; or 2) Undertake archaeological inspections through area; or 3) Engage cultural heritage monitors through areas.
EP107_Line 5_CHRA05	Numerous drainage depressions through area and rocky rise to south	6734	<ol> <li>Realign seismic lines to adjoining narrow dune swale to west, which contain no drainage or rocky outcrops; or 2) Undertake archaeological inspections through area; or</li> <li>Engage cultural heritage monitors through areas.</li> </ol>
EP93_Line 1_CHRA01	Claypans between two dune swales	539	1) Construction to use blade up traverse of claypans up to 100m each side; or 2) Cultural heritage monitors through areas

ID	Feature	Length (m)	Recommendations
EP93_Line 2_CHRA01	Watercourse - small but discharges into major drainage system	251	1) Construction to use blade up traverse of claypans up to 100m each side; or 2) Cultural heritage monitors through areas
EP97_Line 1_CHRA01	Claypans between two dune swales	349	1) Construction to use blade up traverse of claypans up to 100m each side; or 2) Cultural heritage monitors through areas
EP97_Line 1_CHRA02	Claypans within dune swale	368	1) Construction to use blade up traverse of claypans up to 100m each side; or 2) Cultural heritage monitors through areas
EP97_Line 1_CHRA03	Claypans within dune swale	333	1) Construction to use blade up traverse of claypans up to 100m each side; or 2) Cultural heritage monitors through areas
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### • Appendix 1: AAPA Authority Certificates

The AAPA authority certificate(s) 202010920 \_EP93 has been issued. The AAPA authority certificate(s) 202010924 \_EP97 has been issued. The AAPA authority certificate(s) 202010926 \_EP107 has been issued.

# AUTHORITY CERTIFICATE FOR BR SIMPSON PTY LTD EP93 EXPLORATION PROGRAM - 202010920

Activities authorised by the Petroleum Act for petroleum exploration inclusive of ground disturbance land and vegetation clearing requisite for: vehicle and helicopter access; seismic and other survey techniques; construction of camps; drilling for, but not production of, hydrocarbons; environmental and ecological surveys, installation of new and/or use of existing water bores, water extraction (ground or surface) and water monitoring activities; and all works ancillary to the above mentioned works including routine and ongoing maintenance of any infrastructure and or services.

# AUTHORITY CERTIFICATE FOR BR SIMPSON PTY LTD EP97 EXPLORATION PROGRAM - 202010924

Activities authorised by the Petroleum Act for petroleum exploration inclusive of ground disturbance land and vegetation clearing requisite for: vehicle and helicopter access; seismic and other survey techniques; construction of camps; drilling for, but not production of, hydrocarbons; environmental and ecological surveys, installation of new and/or use of existing water bores, water extraction (ground or surface) and water monitoring activities; and all works ancillary to the above mentioned works including routine and ongoing maintenance of any infrastructure and or services.

# AUTHORITY CERTIFICATE FOR BR SIMPSON PTY LTD EP107 EXPLORATION PROGRAM - 202010926

Activities authorised by the Petroleum Act for petroleum exploration inclusive of ground disturbance land and vegetation clearing requisite for: vehicle and helicopter access; seismic and other survey techniques; construction of camps; drilling for, but not production of, hydrocarbons; environmental and ecological surveys, installation of new and/or use of existing water bores, water extraction (ground or surface) and water monitoring activities; and all works ancillary to the above mentioned works including routine and ongoing maintenance of any infrastructure and or service.

# • Appendix 2: Archaeological Feature Descriptions and Records

#### Site Name: BRS22 AS01

Site Location	
Seismic Line: EP93-Line1	Date: 5/18/2022
Easting 6	Northing:
Transect ID: CHSA036_EP93-Line 1	Proximity to Work Areas: 1000m north of seismic line

Archaeological Description		
Site Type: Low density artefact scatter		
Site Access Status: Unrestricted		
Site Description: Chert debitage. Chert flakes (rt and debitage). Very dispersed (1 artefact/10m2) along margin of claypan		
Area (m <sup>2</sup> ): >100m2		
Artefact Types: Debitage, Flakes and RT Flakes		
Raw Materials: Chert		
Site Structure: Surface only		
Condition: Good	Disturbance Factors: Nil	

#### **Physical Context**

Site Context: Claypan within wide dune swale

Land Unit: Claypan within dune swale

Distance to water: <10m (claypan)

Outcropping Geology: (Qs) Sandy dunefields

#### Significance Assessment

#### Archaeological Significance: Low



#### Site Name: BRS22 AS02

Site Location	
Seismic Line: EP93-Line1	Date: 5/18/2022
Easting:	Northing:
Transect ID: CHSA036_EP93-Line 1	Proximity to Work Areas: 1000m north of seismic line

Archaeological Description		
Site Type: Low density artefact scatter		
Site Access Status: Unrestricted		
Site Description: Chert debitage. Chert and silcrete flakes and sandstone grinstone fragments dispersed (1 artefact/10m2) along margin of claypan		
Area (m <sup>2</sup> ): >100m2		
Artefact Types: Debitage, Flakes, RT Flakes & Grindstone fragments		
Raw Materials: Chert, Silcrete and Sandstone		
Site Structure: Surface only		
Condition: Good	Disturbance Factors: Nil	

Physical Context
Site Context: Claypan within wide dune swale
Land Unit: Claypan within dune swale
Distance to water: <10m (claypan)
Outcropping Geology: (Qs) Sandy dunefields

#### Significance Assessment

Archaeological Significance: Low



#### Site Name: BRS22 AS03

Site Location	
Seismic Line: EP93-Line1	Date: 5/18/2022
Easting:	Northing:
Transect ID: CHSA037_EP93-Line 1	Proximity to Work Areas: 315m south of seismic line

Archaeological Description		
Site Type: Low density artefact scatter		
Site Access Status: Unrestricted		
Site Description: Silcrete reduction scatter (10m2) Low density (1 artefact/m2) Clay plan		
Area (m <sup>2</sup> ): 10m2		
Artefact Types: 10 x Flakes		
Raw Materials: Silcrete		
Site Structure: Surface only		
Condition: Good	Disturbance Factors: Minor evidence for livestock disturbance.	

Physical Context
Site Context: Shallow claypans within wide dune swale. Claypans extend throughout the area.
Land Unit: Claypan within dune swale
Distance to water: <10m (claypan)
Outcropping Geology: (Qs) Sandy dunefields

#### Significance Assessment

Archaeological Significance: Low



#### Site Name: BRS22 AS04(a)

Site Location	
Seismic Line: EP107-Line4	Date: 5/21/2022
Easting:	Northing:
Transect ID: CHSA027_EP107-Line (South)	Proximity to Work Areas: 50m west of seismic line (part of overall site complex falls within seismic line)

Archaeological Description		
Site Type: Low density artefact scatter		
Site Access Status: Unrestricted		
Site Description: Lithic reduction site 5m2. Silcrete core and 7 flakes (2 primary, 2 secondary, and 4 tertiary). 1f(c). Site forms part of a larger complex 100m x 75m (BRS22 AS04(a-g). Artefacts continue to foot of escapement before ceasing.		
Area (m <sup>2</sup> ): 5m2		
Artefact Types: 8 x Flakes, 1 x Core		
Raw Materials: Silcrete and Chert		
Site Structure: Surface only		
Condition: Good	Disturbance Factors: Minor evidence for livestock disturbance	

#### Physical Context

Site Context: Gibber-pedi plain rich in water-rolled iron stone pebbles and silcrete cobbles on a sandy loam substrate. High run-off area from raised escarpment 300m to north.

Land Unit: Area is a topographic 'bowl' collecting run-off from escarpments on all sides

Distance to water: <100m (ephemeral drainage)

Outcropping Geology: (KIr) Shale, mudstone, ochreous claystone, kaolinitic sandstone, sandstone & (Qa) Alluvium including river gravel

#### Significance Assessment



#### Site Name: BRS22 AS04(b)

Site Location	
Seismic Line: EP107-Line4	Date: 5/21/2022
Easting:	Northing:
Transect ID: CHSA027_EP107-Line (South)	Proximity to Work Areas: 30m west of seismic line (part of overall site complex falls within seismic line)

Archaeological Description	
Site Type: Isolated Artefact	
Site Access Status: Unrestricted	
Site Description: 1 x large flake (silcrete). Site forms part of a larger complex 100m x 75m (BRS22 AS04(a-g). Artefacts continue to foot of escapement before ceasing.	
Area (m <sup>2</sup> ): <1m2	
Artefact Types: 1 x Flake	
Raw Materials: Silcrete	
Site Structure: Surface only	
Condition: Good	Disturbance Factors: Minor evidence for livestock disturbance

#### **Physical Context**

Site Context: Gibber-pedi plain rich in water-rolled iron stone pebbles and silcrete cobbles on a sandy loam substrate. High run-off area from raised escarpment 300m to north.

Land Unit: Area is a topographic 'bowl' collecting run-off from escarpments on all sides

Distance to water: <100m (ephemeral drainage)

Outcropping Geology: (Klr) Shale, mudstone, ochreous claystone, kaolinitic sandstone, sandstone & (Qa) Alluvium including river gravel

#### Significance Assessment



#### Site Name: BRS22 AS04(c)

Site Location	
Seismic Line: EP107-Line4	Date: 5/21/2022
Easting:	Northing:
Transect ID: CHSA027_EP107-Line (South)	Proximity to Work Areas: Within seismic line

Archaeological Description	
Site Type: Isolated Artefact	
Site Access Status: Unrestricted	
Site Description: 2 x whole flakes (qz), 2 x whole flakes (sl). Site forms part of a larger complex 100m x 75m (BRS22 AS04(a-g). Artefacts continue to foot of escapement before ceasing.	
Area (m <sup>2</sup> ): <1m2	
Artefact Types: 4 x Flakes	
Raw Materials: Quartz & Silcrete	
Site Structure: Surface only	
Condition: Good	Disturbance Factors: Minor evidence for livestock disturbance

#### **Physical Context**

Site Context: Gibber-pedi plain rich in water-rolled iron stone pebbles and silcrete cobbles on a sandy loam substrate. High run-off area from raised escarpment 300m to north.

Land Unit: Area is a topographic 'bowl' collecting run-off from escarpments on all sides

Distance to water: <100m (ephemeral drainage)

Outcropping Geology: (Klr) Shale, mudstone, ochreous claystone, kaolinitic sandstone, sandstone & (Qa) Alluvium including river gravel

#### Significance Assessment



#### Site Name: BRS22 AS04(d)

Site Location	
Seismic Line: EP107-Line4	Date: 5/21/2022
Easting:	Northing:
Transect ID: CHSA027_EP107-Line (South)	Proximity to Work Areas: Within seismic line

Archaeological Description	
Site Type: Low density artefact scatter	
Site Access Status: Unrestricted	
Site Description: Low density artefact scatter, with 11f(sl) and 1f(c). Site forms part of a larger complex 100m x 75m (BRS22 AS04(a-g). Artefacts continue to foot of escapement before ceasing.	
Area (m <sup>2</sup> ): 10m2	
Artefact Types: 11 x Flakes, 1 x Core	
Raw Materials: Silcrete and Chert	
Site Structure: Surface only	
Condition: Good	Disturbance Factors: Minor evidence for livestock disturbance

#### **Physical Context**

Site Context: Gibber-pedi plain rich in water-rolled iron stone pebbles and silcrete cobbles on a sandy loam substrate. High run-off area from raised escarpment 300m to north.

Land Unit: Area is a topographic 'bowl' collecting run-off from escarpments on all sides

Distance to water: <100m (ephemeral drainage)

Outcropping Geology: (Klr) Shale, mudstone, ochreous claystone, kaolinitic sandstone, sandstone & (Qa) Alluvium including river gravel

#### Significance Assessment



#### Site Name: BRS22 AS04(e)

Site Location	
Seismic Line: EP107-Line4	Date: 5/21/2022
Easting:	Northing:
Transect ID: CHSA027_EP107-Line (South)	Proximity to Work Areas: 30m west of seismic line (part of overall site complex falls within seismic line)

Archaeological Description		
Site Type: Low density artefact scatter		
Site Access Status: Unrestricted		
Site Description: Low density artefact scatter, with 2rf(sl), 6f(sl) and 2f(qz). Site forms part of a larger complex 100m x 75m (BRS22 AS04(a-g). Artefacts continue to foot of escapement before ceasing.		
Area (m²): 10m2		
Artefact Types: 2 x Retouched Flakes, 8 x Flakes		
Raw Materials: Quartz & Silcrete		
Site Structure: Surface only		
Condition: Good	Disturbance Factors: Minor evidence for livestock disturbance	

#### **Physical Context**

Site Context: Gibber-pedi plain rich in water-rolled iron stone pebbles and silcrete cobbles on a sandy loam substrate. High run-off area from raised escarpment 300m to north.

Land Unit: Area is a topographic 'bowl' collecting run-off from escarpments on all sides

Distance to water: <100m (ehemeral drainage)

Outcropping Geology: (KIr) Shale, mudstone, ochreous claystone, kaolinitic sandstone, sandstone & (Qa) Alluvium including river gravel

#### Significance Assessment



#### Site Name: BRS22 AS04(f)

Site Location	
Seismic Line: EP107-Line4	Date: 5/21/2022
Easting:	Northing:
Transect ID: CHSA027_EP107-Line (South)	Proximity to Work Areas: 90m west of seismic line (part of overall site complex falls within seismic line)

Archaeological Description	
Site Type: Isolated Artefact	
Site Access Status: Unrestricted	
Site Description: 1 x whole flake (Silcrete). Site forms part of a larger complex 100m x 75m (BRS22 AS04(a-g). Artefacts continue to foot of escapement before ceasing.	
Area (m²): <1m2	
Artefact Types: 1 x Flake	
Raw Materials: Silcrete	
Site Structure: Surface only	
Condition: Good	Disturbance Factors: Minor evidence for livestock disturbance

#### **Physical Context**

Site Context: Gibber-pedi plain rich in water-rolled iron stone pebbles and silcrete cobbles on a sandy loam substrate. High run-off area from raised escarpment 300m to north.

Land Unit: Area is a topographic 'bowl' collecting run-off from escarpments on all sides

Distance to water: <100m (ehemeral drainage)

Outcropping Geology: (KIr) Shale, mudstone, ochreous claystone, kaolinitic sandstone, sandstone & (Qa) Alluvium including river gravel

#### Significance Assessment


## Site Name: BRS22 AS04(g)

Site Location	
Seismic Line: EP107-Line4	Date: 5/21/2022
Easting:	Northing:
Transect ID: CHSA027_EP107-Line (South)	Proximity to Work Areas: 50m west of seismic line
	(part of overall site complex falls within seismic line)

#### **Archaeological Description**

Site Type: Low density artefact scatter

Site Access Status: Unrestricted

Site Description: Low density artefact scatter and reduction area, with 16 flakes (silcrete) of varying sizes. Site forms part of a larger complex 100m x 75m (BRS22 AS04(a-g). Artefacts continue to foot of escapement before ceasing.

Area (m<sup>2</sup>): 3m2

Artefact Types: 16 x Flakes

Raw Materials: Silcrete

Site Structure: Surface only

Condition: Good

Disturbance Factors: Minor evidence for livestock disturbance

#### **Physical Context**

Site Context: Gibber-pedi plain rich in water-rolled iron stone pebbles and silcrete cobbles on a sandy loam substrate. High run-off area from raised escarpment 300m to north.

Land Unit: Area is a topographic 'bowl' collecting run-off from escarpments on all sides

Distance to water: <100m (ehemeral drainage)

Outcropping Geology: (Klr) Shale, mudstone, ochreous claystone, kaolinitic sandstone, sandstone & (Qa) Alluvium including river gravel

#### Significance Assessment

Archaeological Significance



Low to Moderate

Site Location	
Seismic Line: EP107-Line4	Date: 5/21/2022
Easting:	Northing:
Transect ID: CHSA_EP107-Line 4 (North)	Proximity to Work Areas: 23m east of seismic line

Archaeological Description		
Site Type: Low density artefact scatter		
Site Access Status: Unrestricted		
Site Description: Chert reduction site (1 core and 3 flakes). Claypan flanked by low energy erosional loam accumulated by Run off from rock escarpment 500m South.		
Area (m <sup>2</sup> ): <10m2		
Artefact Types: 1 x Core & 3 x Flakes		
Raw Materials: Chert		
Site Structure: Surface only		
Condition: Good	Disturbance Factors: Livestock disturbance.	

## **Physical Context**

Site Context: Claypan flanked by low energy erosional loam accumulated by run off from rock escarpment 500m South. Transition to red sandy substrate to the north.

Land Unit: Claypan at base of hill

Distance to water: <10m (claypan)

Outcropping Geology: (Qa) Alluvium including river gravel

## Significance Assessment



# Site Name: BRS22 AS06(a)

Site Location	
Seismic Line: EP107-Line2	Date: 5/23/2022
Easting:	Northing:
Transect ID: CHSA009_EP107-Line 2	Proximity to Work Areas: 130m north of seismic line (part of overall site complex falls within seismic line)

Archaeological Description		
Site Type: Isolated Artefact		
Site Access Status: Restricted Access		
Site Description: Whole flake, lake located on ironstone outcrop. Site forms part of a wider site complex which		
includes isolated artefacts, manuports, stone arrangements and quarrying. Overall site size = 150m x 80m		
Area (m <sup>2</sup> ): <1m2		
Artefact Types: 1 x flake		
Raw Materials: Stone (ironstone)		
Site Structure: Surface only		
Condition: Good	Disturbance Factors: Nil noted	

Physical Context
Site Context: Stony hill and mesa/outcrop, with ephemeral drainage
Land Unit: Stony hill and mesa/outcrop, with ephemeral drainage
Distance to water: <100m (ehemeral drainage)
Outcropping Geology: (Pc), Sandstone, pebbly sandstone, tilliod (diamictite), boulder conglomerate, siltstone. &
(Qs), Alluvium including river gravel

# Significance Assessment



# Site Name: BRS22 AS06(b)

Site Location	
Seismic Line: EP107-Line2	Date: 5/23/2022
Easting:	Northing:
Transect ID: CHSA009_EP107-Line 2	Proximity to Work Areas: 120m north of seismic line (part of overall site complex falls within seismic line)

Archaeological Description		
Site Type: Percussion Scars/Quarry		
Site Access Status: Restricted Access		
Site Description: Percussion scars on outcropping rock edges. Likley the result of quarrying.		
Site forms part of a wider site complex which includes isolated artefacts, manuports, stone arrangements and		
quarrying. Overall site size = 150m x 80m		
Area (m <sup>2</sup> ): >10m2 (may extend across unsurveyed areas)		
Artefact Types: Silicified sandstone boulders		
Raw Materials: Stone (iron rich silicified sandstone)		
Site Structure: Surface only		
Condition: Good	Disturbance Factors: Weathering	

## **Physical Context**

Site Context: Stony hill and mesa/outcrop, with ephemeral drainage

Land Unit: Stony hill and mesa/outcrop, with ephemeral drainage

Distance to water: <100m (ehemeral drainage)

Outcropping Geology: (Pc), Sandstone, pebbly sandstone, tilliod (diamictite), boulder conglomerate, siltstone. & (Qs), Alluvium including river gravel

## Significance Assessment



## Site Name: BRS22 AS06(c)

Site Location	
Seismic Line: EP107-Line2	Date: 5/23/2022
Easting:	Northing:
Transect ID: CHSA009_EP107-Line 2	Proximity to Work Areas: 30m north of seismic line
	(part of overall site complex falls within seismic line)

#### **Archaeological Description**

Site Type: Quarry

Site Access Status: Restricted Access

Site Description: Iron rich, silicified sandstone outcrop with evidence of quarrying.

Site forms part of a wider site complex which includes isolated artefacts, manuports, stone arrangements and quarrying. Overall site size = 150m x 80m

**Disturbance Factors: Weathering** 

Area (m<sup>2</sup>): >10m2 (may extend across unsurveyed areas)

Artefact Types: Silicified sandstone boulders

Raw Materials: Stone (iron rich silicified sandstone)

Site Structure: Surface only

Condition: Good

#### **Physical Context**

Site Context: Stony hill and mesa/outcrop, with ephemeral drainage

Land Unit: Stony hill and mesa/outcrop, with ephemeral drainage

Distance to water: <100m (ehemeral drainage)

Outcropping Geology: (Pc), Sandstone, pebbly sandstone, tilliod (diamictite), boulder conglomerate, siltstone. & (Qs), Alluvium including river gravel

## Significance Assessment



# Site Name: BRS22 AS06(d)

Site Location	
Seismic Line: EP107-Line2	Date: 5/23/2022
Easting:	Northing:
Transect ID: CHSA009_EP107-Line 2	Proximity to Work Areas: 60m north of seismic line (part of overall site complex falls within seismic line)

Archaeological Description		
Site Type: Stone Arrangement		
Site Access Status: Restricted Access		
Site Description: Features appears to be a cleared area 8m diameter. Raised flat area between two ironstone mounds (east and west of circle). Circle open to north. Site forms part of a wider site complex which includes isolated artefacts, manuports, stone arrangements a		
Area (m <sup>2</sup> ): 100m2		
Artefact Types: Silicified sandstone boulders and earth		
Raw Materials: Stone (iron rich silicified sandstone)		
Site Structure: Surface with potential for shallow su- surface		
Condition: Fair	Disturbance Factors: Weathering	

## **Physical Context**

Site Context: Stony hill and mesa/outcrop, with ephemeral drainage

Land Unit: Stony hill and mesa/outcrop, with ephemeral drainage

Distance to water: <100m (ehemeral drainage)

Outcropping Geology: (Pc), Sandstone, pebbly sandstone, tilliod (diamictite), boulder conglomerate, siltstone. & (Qs), Alluvium including river gravel

## Significance Assessment



# Site Name: BRS22 AS06(e)

Site Location	
Seismic Line: EP107-Line2	Date: 5/23/2022
Easting:	Northing:
Transect ID: CHSA009_EP107-Line 2	Proximity to Work Areas: 40m north of seismic line (part of overall site complex falls within seismic line)

Archaeological Description			
Site Type: Isolated Artefact			
Site Access Status: Restricted Access			
Site Description: Whole flake, lake located on ironstone outcrop.			
Site forms part of a wider site complex which includes isolated artefacts, manuports, stone arrangements and			
quarrying (site ID: BRS22 AS09 (a-e)). Overall site size = 150m x 80m			
Area (m <sup>2</sup> ): <1m2			
Artefact Types: 1 x flake			
Raw Materials: Stone (fine grained igneous)			
Site Structure: Surface only			
Condition: Good Disturbance Factors: Nil noted			

## **Physical Context**

Site Context: Stony hill and mesa/outcrop, with ephemeral drainage

Land Unit: Stony hill and mesa/outcrop, with ephemeral drainage

Distance to water: <100m (ehemeral drainage)

Outcropping Geology: (Pc), Sandstone, pebbly sandstone, tilliod (diamictite), boulder conglomerate, siltstone. & (Qs), Alluvium including river gravel

## Significance Assessment



Site Location	
Seismic Line: EP93-Line1	Date: 5/18/2022
Easting:	Northing:
Transect ID: CHSA037_EP93-Line 1	Proximity to Work Areas: 280m south of seismic line

Archaeological Description				
Site Type: Isolated Artefact				
Site Access Status: Unrestricted				
Site Description: 1 flake (Silcrete) on margin of claypan				
Area (m <sup>2</sup> ): <1m2				
Artefact Types: 1 x Flake				
Raw Materials: Silcrete				
Site Structure: Surface only				
Condition: Good	Disturbance Factors: Minor evidence for livestock disturbance.			

Physical Context
Site Context: Shallow claypans within wide dune swale. Claypans extend throughout the area.
Land Unit: Claypan within dune swale
Distance to water: <10m (claypan)
Outcropping Geology: (Qs) Sandy dunefields

# Significance Assessment



Site Location	
Seismic Line: EP93-Line1	Date: 5/18/2022
Easting:	Northing:
Transect ID: CHSA037_EP93-Line 1	Proximity to Work Areas: 280m south of seismic line

Archaeological Description				
Site Type: Isolated Artefact				
Site Access Status: Unrestricted				
Site Description: 1 flake (Silcrete) on margin of claypan				
Area (m <sup>2</sup> ): <1m2				
Artefact Types: 1 x Flake				
Raw Materials: Silcrete				
Site Structure: Surface only				
Condition: Good	Disturbance Factors: Minor evidence for livestock disturbance.			

Physical Context
Site Context: Shallow claypans within wide dune swale. Claypans extend throughout the area.
Land Unit: Claypan within dune swale
Distance to water: <10m (claypan)
Outcropping Geology: (Qs) Sandy dunefields

# Significance Assessment



Site Location	
Seismic Line: EP97-Line1	Date: 5/19/2022
Easting:	Northing:
Transect ID: CHSA043_EP97-Line 1	Proximity to Work Areas: 70m south of seismic line

# Archaeological Description

Site Type: Isolated Artefact

Site Access Status: Unrestricted

Site Description: Three artefacts (1f(s) 1f(c)) 1f(c)) spread over ~20m along southern margin of claypan.

Area (m<sup>2</sup>): 20m2

Artefact Types: 3 x Flake

Raw Materials: Silcrete and Chert

Site Structure: Surface only

Condition: Good

Disturbance Factors: Livestock disturbance.

## **Physical Context**

Site Context: Large claypan with substrate mixed clay/red sand within dune swale.

Land Unit: Claypan within dune swale

Distance to water: <10m (claypan)

Outcropping Geology: (Qs) Sandy dunefields

## Significance Assessment

Archaeological Significance: Low													
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Site Location	
Seismic Line: EP107-Line1	Date: 5/24/2022
Easting:	Northing:
Transect ID: CHSA002_EP107-Line 1	Proximity to Work Areas: 100m south of seismic line

Archaeological Description					
Site Type: Isolated Artefact					
Site Access Status: Unrestricted					
Site Description: 1 x whole flake (Silcrete)					
Area (m <sup>2</sup> ): <1m2					
Artefact Types: 1 x Flake					
Raw Materials: Silcrete					
Site Structure: Surface only					
Condition: Good	Disturbance Factors: Med-heavy livestock				
	disturbance				

#### **Physical Context**

Site Context: Very wide series of Interdunal swales broken intermittently by low/eroded dunes. Heavy livestock disturbance. Coarse red sandy/loam substrate, grass tussock herbaceous and prostrate forbe communities dominate. GSV 80-100%.

Land Unit: Dune swale

Distance to water: Within Todd River paleochannel

Outcropping Geology: (Qs) Alluvium including river gravel

## Significance Assessment



Site Location	
Seismic Line: EP107-Line2	Date: 5/24/2022
Easting:	Northing:
Transect ID: CHSA002_EP107-Line 1	Proximity to Work Areas: 110m south of seismic line

Archaeological Description	
Site Type: Isolated Artefact	
Site Access Status: Unrestricted	
Site Description: 1 x core (Silcrete)	
Area (m <sup>2</sup> ): <1m2	
Artefact Types: 1 x Core	
Raw Materials: Silcrete	
Site Structure: Surface only	
Condition: Good	Disturbance Factors: Med-heavy livestock disturbance

#### **Physical Context**

Site Context: Very wide series of Interdunal swales broken intermittently by low/eroded dunes. Heavy livestock disturbance. Coarse red sandy/loam substrate, grass tussock herbaceous and prostrate forbe communities dominate. GSV 80-100%.

Land Unit: Dune swale

Distance to water: Within Todd River paleochannel

Outcropping Geology: (Qs) Alluvium including river gravel

## Significance Assessment



Site Location	
Seismic Line: EP107-Line5	Date: 5/23/2022
Easting:	Northing:
Transect ID: EP107-Line 5_Stop 3	Proximity to Work Areas: 250m west of seismic line

Archaeological Description	
Site Type: Isolated Artefact	
Site Access Status: Unrestricted	
Site Description: Multi-tool axe/grind plate (iron stone; incomplete, rhomboid - 7x4(blade)x7x1cm/ 1.5cm wide in section), retouched chert flake and silcrete flake recorded in a 5mÅ <sup>2</sup> area. No other ch observed in a cursive search (30mÅ <sup>2</sup> ).	
Area (m <sup>2</sup> ): <5m2	
Artefact Types: 1 x RT Flake, 1 x Flake, 1 x Axe, 1	
Raw Materials: Ironstone, Chert & Silcrete	
Site Structure: Surface only	
Condition: Good	Disturbance Factors: Nil

Phy	vsical	Context	
	ysicai	CONTEXT	

Site Context: Clay-pan on the low (western) margin of an interdune swale. Part of palaeo-channel identified further north along the same swale adjacent seismic line EP107-Line 5.

Land Unit: Claypan/paleochannel within dune swale

Distance to water: <10m (claypan)

Outcropping Geology: (Qs) Sandy dunefields

## Significance Assessment



Site Location	
Seismic Line: EP107-Line2	Date: 5/24/2022
Easting:	Northing:
Transect ID: CHSA002_EP107-Line 1	Proximity to Work Areas: 75m north of seismic line

Archaeological Description	
Site Type: Isolated Artefact	
Site Access Status: Unrestricted	
Site Description: 1 x whole flake (Silcrete)	
Area (m <sup>2</sup> ): <1m2	
Artefact Types: 1 x Flake	
Raw Materials: Silcrete	
Site Structure: Surface only	
Condition: Good	Disturbance Factors: Livestock disturbance.

Physical Context
Site Context: Very wide swale, bounded by low, eroded dunes
Land Unit: Dune swale
Distance to water: <100m to clay pans within dune swale
Outcropping Geology: (Qs, Qa) Alluvium sand dunes and river gravel

# Significance Assessment



Site Location	
Seismic Line: EP107-Line2	Date: 5/24/2022
Easting:	Northing:
Transect ID: CHSA002_EP107-Line 1	Proximity to Work Areas: 40m north of seismic line

Archaeological Description	
Site Type: Isolated Artefact	
Site Access Status: Unrestricted	
Site Description: Grind plate (non-portable), Sandstone conglomerate, Minimum three distinct grinding	
surfaces.	
Area (m <sup>2</sup> ): <1m2	
Artefact Types: 1 x Grindstone	
Raw Materials: Sandstone	
Site Structure: Surface only	
Condition: Good	Disturbance Factors: Livestock disturbance.

## **Physical Context**

Site Context: Very wide swale, bounded by low, eroded dunes

Land Unit: Dune swale

Distance to water: <100m to clay pans within dune swale

Outcropping Geology: (Qs, Qa) Alluvium sand dunes and river gravel

# Significance Assessment



Site Location	
Seismic Line: EP107-Line2	Date: 5/24/2022
Easting:	Northing:
Transect ID: CHSA002_EP107-Line 1	Proximity to Work Areas: 20m north of seismic line

Archaeological Description		
Site Type: Isolated Artefact		
Site Access Status: Unrestricted		
Site Description: Manuport halfway up dune flank. Heat fractured. Potentially part of a hearth.		
Area (m <sup>2</sup> ): <1m2		
Artefact Types: 1 x Manuport		
Raw Materials: Sandstone		
Site Structure: Surface only		
Condition: Good	Disturbance Factors: Livestock disturbance.	

Physical Context
Site Context: Very wide swale, bounded by low, eroded dunes
Land Unit: Dune system
Distance to water: <100m to clay pans within dune swale
Outcropping Geology: (Qs, Qa) Alluvium sand dunes and river gravel

## Significance Assessment

Appendix 3: Archaeological Feature Mapping

This figure has been removed to respect and protect the cultural sensitivities of the area following consultation with Traditional Owners

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