Appendix H Land Condition Assessment

Land Condition Assessment

Shenandoah South 2

28-May-2024

Beetaloo Joint Venture Exploration Project - Shenandoah South 2

Revision 0 – 28-May-2024
Prepared for – Tamboran B2 Pty Ltd – ABN: 42 105 431 525

Land Condition Assessment

Shenandoah South 2

Client: Tamboran B2 Pty Ltd

ABN: 42 105 431 525

Prepared by

AECOM Australia Pty Ltd
Larrakia Country, Level 3, 9 Cavenagh Street, Darwin NT 0800, GPO Box 3175, Darwin NT 0801, Australia
T +61 1800 868 654 F +61 8 8942 6299 www.aecom.com
ABN 20 093 846 925

28-May-2024

Job No.: 60623736

AECOM in Australia and New Zealand is certified to ISO9001, ISO14001 and ISO45001.

Quality Information

Document	Land Condition Assessment
Ref	60623736
Date	28-May-2024
Originator	William Riddell, Tiane McQuire, Vidushi Thusithana, David van den Hoek
Verifier/s	Alana Court

Revision History

Rev	Revision Date	Details	Approved	
			Name/Position	Signature
0	28-May-2024	LCA Report for Shenandoah South 2	Alana Court Technical Director - Environment	

Table of Contents

List of Plates

List of Tables

List of Figures

List of Acronyms

Acronym	Meaning
°C	Degrees Celsius
%	Percentage
AAPA	Aboriginal Areas Protection Authority
AS	Australian Standard
BOM	Bureau of Meteorology
CLA	Cambrian Limestone Aquifer
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DoH	Department of Health (NT)
DPIR	Department of Primary Industry and Resources (NT)
DEPWS	Department of Environment, Parks and Water Security (NT)
E&A	Exploration and Appraisal
EPA	Environment Protection Authority (NT)
EP##	Exploration Permit (e.g., EP76, EP98 and EP117)
EMP	Environmental Management Plan
EPBC	Environmental Protection and Biodiversity Conservation
ESCP	Erosion and Sediment Control Plan
GPS	Global Positioning Device
Ha	hectare
IBA	Important Bird Area
ILUA	Indigenous Land Use Agreement
km	Kilometre
km^2	Square kilometres
km/hr	Kilometre per hour
LCA	Land Condition Assessment
m	metre
MD	Measured Depth
MNES	Matters of National Environmental Significance
mm	millimetre
NLC	Northern Land Council
NT	Northern Territory
OHS	Occupational Health and Safety
RWA	Restricted Work Area
TO	Traditional Owner
TPWC Act	*Territory Parks and Wildlife Conservation Act*
WoNS	Weed of National Significance

1.0 Introduction

1.1 Purpose of this Report

AECOM Australia Pty Ltd (AECOM) completed a Land Condition Assessment (LCA) for Tamboran B2 Pty Ltd (Tamboran) associated with the proposed exploration area located within Exploration Permit 98 (EP98) in the Beetaloo Sub-Basin, Northern Territory (NT). The Beetaloo Joint Venture are proposing establishing exploration well pads and associated infrastructure for the Shenandoah South Exploration and Appraisal (E&A) program.

The primary aim of this LCA is to identify and document site condition of the proposed Shenandoah South E&A Program area to inform the environmental risk assessment. This LCA report summarises the result of the survey and documents baseline conditions of the Shenandoah South 2 (Shenandoah S2) well site.

The baseline field survey was completed in December 2022.

1.2 Project Boundary

The area assessed under this LCA occur on the Shenandoah Perpetual Pastoral Lease (PPL) and is within Tamboran permits EP98 (Figure 1). The Shenandoah S2 area is accessed via the existing Kyalla Turn-in located off the Stuart Highway and along the existing access track prepared as part of the existing Kyalla 117 N2 exploration program.

The location of the Shenandoah South E&A area and Shenandoah S2 well site is presented in Figure 2.

1.3 Tamboran's Proposed Activities

Tamboran planning to undertake exploration activities at the Shenandoah S2 which will require construction of well pad and associated infrastructure.

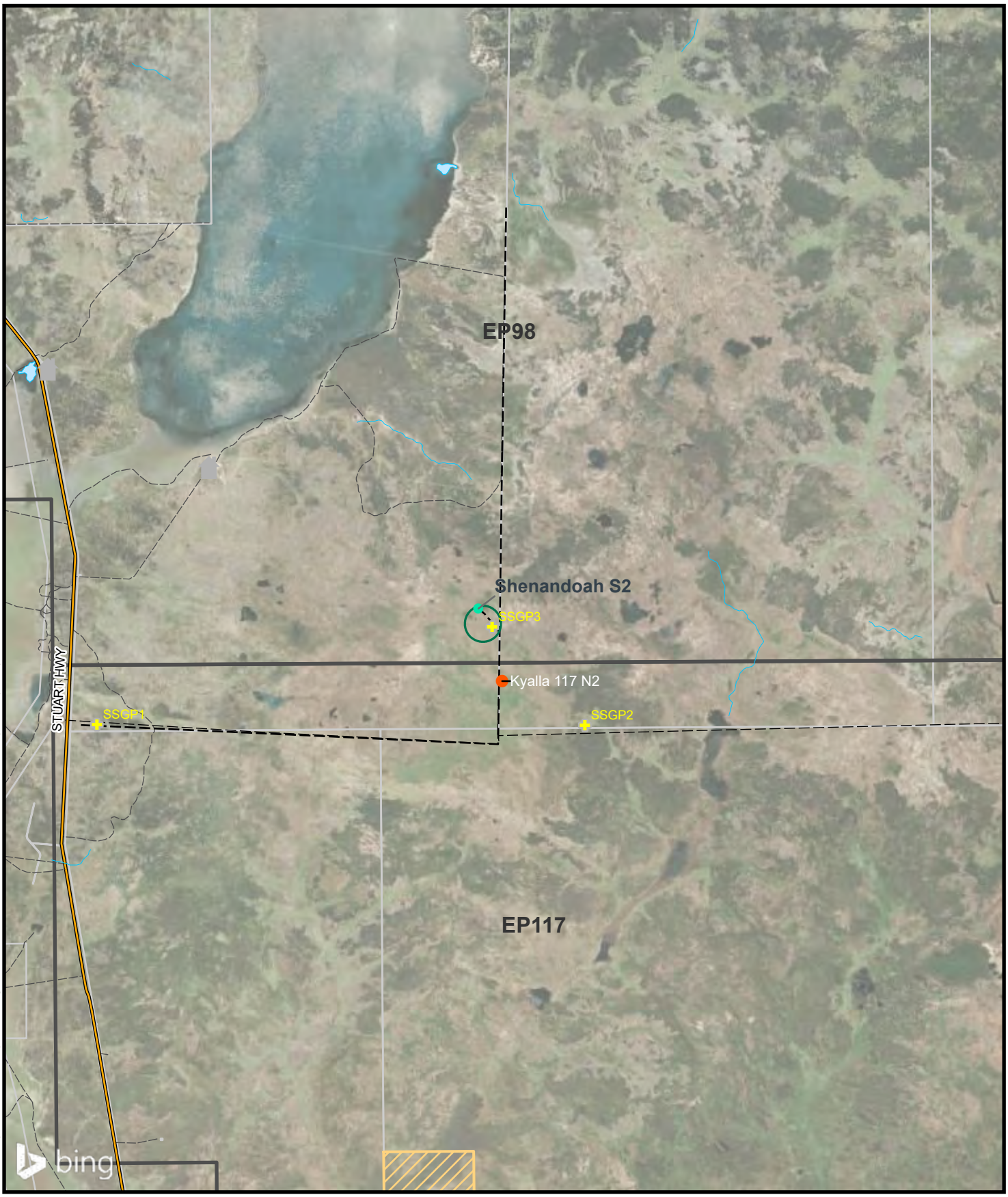
This report was initially prepared for Tamboran for the clearing and placement of well site infrastructure, including but not limited to well pads, pipeline and gathering lines, access track, camp pad, helipad, laydown areas, groundwater bores, site turn-ins, firebreaks / fence lines, and associated infrastructure in accordance with the Regulation 5 of the Petroleum (Environment) Regulations 2016. This abridged report version focusses on the LCA of the Shenandoah S2 site as it specifically relates to the placement of the Sturt Plateau compression facility (SPCF) on the repurposed 5.0 ha laydown area, adjacent to the Shenandoah S2 well pad.

1.4 Scope of Works

This report describes the assessment methodology and outcomes of the field survey for future onshore gas exploration sites.

The scope of work for the LCA involved:

- A review of historical data and reports prepared during the previous Beetaloo onshore oil and gas exploration programs.
- A search of the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) Protected Matters database at 10 km and 50 km buffer (June 2023).
- A search of the Northern Territory (NT) Natural Resource Maps Database (flora and fauna Atlas database) (6/02/2023) and the more recently published Strategic Regional Environmental and Baseline Assessment for the Beetaloo Sub-basin (SREBA) data set.
- Completion of a LCA field survey of the proposed exploration E&A area (December 2022, March-April 2023).
- Preparation of this report.



AECOM
www.aecom.com

N

GEOCENTRIC DATUM OF AUSTRALIA 94

0 2.5 5 10
Kilometres

- Proposed Exploration Well Pad
- Shenandoah Well Site
- Gravel Pits
- Tracks
- Highway
- Water Bodies
- Permit Areas
- Pastoral Lease Boundary
- Aboriginal Land

LOCATION

Data sources:
Permit Area, Cadastre - NT Gov 2019.
Places, Vegetation - Aust Gov 2019
Highways, Roads, Drainage - StreetPro 2019

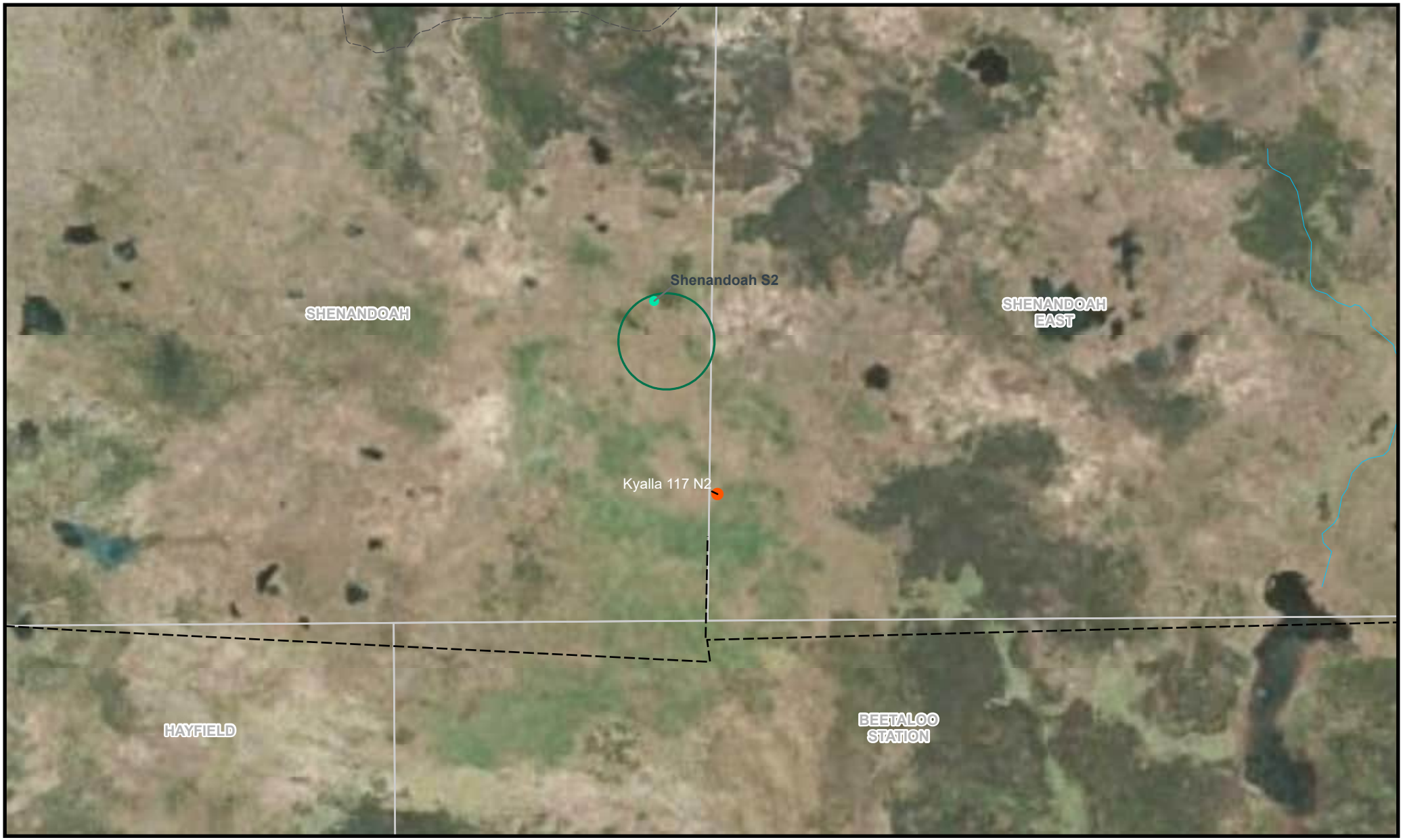
tamboran

Project Location - Land Tenure, Exploration Permits and Well Pad Area

PROJECT ID	60623736
CREATED BY	sam.schroder
LAST MODIFIED	31-May-2024
VERSION	1

Figure 1

Filename: \\na.aecomnet.com\lfs\APAC\Melbourne-AUMEL1\Legacy\Groups\WTR\SpatialSys\Projects\2024\Beetaloo\ArcGIS Pro\02_MapProjects\60623736_Shenandoah_FigueUpdates_v1.aprx



AECOM

www.aecom.com

N

GEOCENTRIC DATUM OF AUSTRALIA 94

0 1 2 4

Kilometers

- Proposed Exploration Well Pads
- Existing Exploration Well Pads
- Shenandoah Lease Pad Area
- Tracks
- Pastoral Lease Boundary

LOCATION

Data sources:
Permit Area, Cadastre - NT Gov 2019.
Places, Vegetation - Aust Gov 2019
Highways, Roads, Drainage - StreetPro

tamboran

Project Area - Land Tenure, Exploration Permits and Well Pad Area

PROJECT ID	60623736
CREATED BY	CummingsL
LAST MODIFIED	22-May-2024
VERSION	1

Figure 2

Filename: \\na.aecomnet.com\ifs\APAC\Melbourne-AUMEL1\Legacy\Groups\WTR\SpatialSys\Projects\2024\Beetaloo\ArcGIS Pro\02_MapProjects\60623736_Shenandoah_FigueUpdates_v1.aprx

2.0 Assessment Method

2.1 Desktop Review

Field data collected between 2005 and 2023 within the permit areas was mapped based on image interpretation, with ground-truthing of the proposed survey areas being completed during field assessments (refer Section 2.3). This information was reviewed prior to the field work to identify the following:

- Vegetation types and flora and fauna species within the region that potentially occur within the Shenandoah South E&A Program area, using previous reports and aerial / satellite imagery.
- *Environment Protection and Biodiversity Conservation Act* (EPBC Act) and *Territory Parks and Wildlife Conservation Act* (TPWC Act) listed threatened species or communities that potentially occur within the Shenandoah South E&A Program area.
- Matters of national environmental significance or other matters protected by the EPBC Act that potentially occur within the Shenandoah South E&A Program area.
- Weeds or feral animals listed under the EPBC Act or *Weeds Management Act* that potentially occur within the Shenandoah South E&A Program area.

Table 1 provides a chronological list of reports (2004 - 2023), previously compiled in relation to environmental approvals and management support for petroleum exploration activities in the Beetaloo Sub-basin, NT.

The extent of work undertaken since 2004 has enabled a good understanding of the natural environment, which has been used in assessing the land condition of the Shenandoah S2 Program area.

Table 1 Summary of Existing Environmental Assessment and Reports for the Beetaloo Basin (2004-2023)

Date	Report
Sweetpea Petroleum	
Jul- Aug 2004	Baseline land condition assessment (LCA)
	Site database established
Jul 2005	Exploration EMP finalised and approved
November 2019 to February 2020	LCA for EP136 (Seismic and Drilling Exploration Program)
Petrohunter Australia (Partner to Sweetpea)	
Dec 2006	Baseline vegetation assessment
Apr 2007	Drill site assessments
Apr 2007	Annual report
Jun 2007	Update of the existing EMP to include the new Exploration Permit areas
Jul 2007	Drill Site maps
Jul 2007	Supplemental Environmental Management Plan, Drilling Program 2007, Beetaloo Basin, NT
Jul 2007	Soil erosion assessment
Jul 2007	Groundwater quality
July 2007	Emergency Maps
Jul 2007	Environment & Heritage Induction Materials

Date	Report
Falcon Oil and Gas	
Dec 2010	Drill site condition assessments
Jan 2011	Archaeological survey
March 2011	Site-specific drilling EMP
2011	Falcon Shenandoah 1 Stimulation and Testing Groundwater Monitoring
2011/2012	Shenandoah 1 Re-Entry Environment Plan (EP)
July 2012	EP99 Archaeological Survey, Beetaloo Basin
2013	EP99 Seismic Exploration Environmental Management Plan
Tamboran B2 Pty Ltd	
2015 and 2016	Beetaloo Basin Environmental and Heritage Assessment and preparation of Approval documentation
October 2018	LCA and Heritage Assessment of proposed well area (Velkerri 76 S1-1, Velkerri 76 S2-1, Velkerri 117 E1-1, Velkerri 98 N1-2, Kyalla 117 N2-1 and Kyalla 117 W1-2, Kyalla 98 W1-1)
July 2019	Weed Survey of Kyalla 117 N2-1 and access tracks, including Kalala S1 and Amungee NW-1H
December 2019	LCA and Heritage Assessment of EP76, EP117 and EP98
June 2020	Beetaloo Exploration Program Annual Weed Survey Report 2020
September 2021	Land Condition Assessment and weed surveys for Velkerri 76 N1, Amungee NW and Beetaloo W
May 2022	Additional Land Condition Assessment field survey of this specific proposed exploration program
December 2022	Land Condition Assessment field survey in Tamboran B2 Pty Ltd permit area
March - April 2023	Land Condition Assessment specific to the revised Amungee NW-3, Amungee NW-4, Shenandoah South and Shenandoah North well site and seismic areas.

2.2 SREBA Data Set

AECOM have undertaken a review of the recently published SREBA data (DEPWS, 2022a) and reports which were prepared by the Northern Territory Government specifically for the Beetaloo Sub-basin. The aim of the SREBA is to provide the information necessary for sound decisions to be made about the development of any onshore shale gas industry in the region.

To prepare this LCA report, AECOM have utilised the outputs to supplement the data obtained in the field during the survey. The terrestrial ecosystem baseline data reviewed include:

- regional vegetation mapping
- description of regional biogeographic patterns for terrestrial biodiversity
- spatial distribution models for significant species and communities
- identification and mapping of areas of high conservation value
- evaluation of the sensitivity of significant species to development.

2.3 Field Assessment and Reporting

The aim of this LCA is to document the proposed Shenandoah S2 Program area condition prior to activities occurring and inform Tamboran on potential constraints that will require specific environmental mitigations.

The LCA field survey completed for the Shenandoah S2 site used an aerial rapid condition assessment method like previous assessments carried out by AECOM for past exploration activities. The method allows for large areas to be surveyed over a relatively short period of time using a helicopter platform to assess proposed exploration area, as well access remote locations for on-ground-truthing.

The following site characteristics were recorded as part of the LCA:

- the presence of drainage lines and the direction of surface flows
- the distance to the nearest sensitive receptors (such as significant vegetation communities or fauna habitats)
- soil characteristics and intactness
- soil suitability for wastewater disposal
- vegetation communities (based on dominant species within each canopy strata)
- fauna habitat features, such as hollows, logs, and burrows (the fauna habitat quality for each mapped vegetation community type would be assessed)
- incidental fauna sightings
- the presence or absence of Northern Shrike-tit (*Falcunculus whitei*) via call-playback surveys and active searches
- the presence or absence of Gouldian Finch (*Erythrura gouldiae*) via active searches
- the presence of weeds and/or feral animals (*i.e.* indication of scats, tracks, wallows etc.)
- general land use description.

The field locations assessed for the Shenandoah S2 Program are presented in Table 2 and Figure 2. A total of 14 proposed well site areas and three seismic lines were surveyed in December 2022 and April 2023.

Table 2 Field survey assessment proposed exploration area for Shenandoah S2

Exploration Area	GDA94, Zone 53	
	Easting	Northing
Well Site		
Shenandoah S2	355291	8140676

2.4 Flood Assessment

A hydraulic assessment was conducted to inform potential flooding risks and design requirements for the Shenandoah South E&A Program proposed areas. The extent of inundation within the Shenandoah S2 area depends on the severity of the wet season and can range from remaining completely dry to widespread flooding. An assessment of the flood levels was completed for the proposed well site locations (Figure 3).

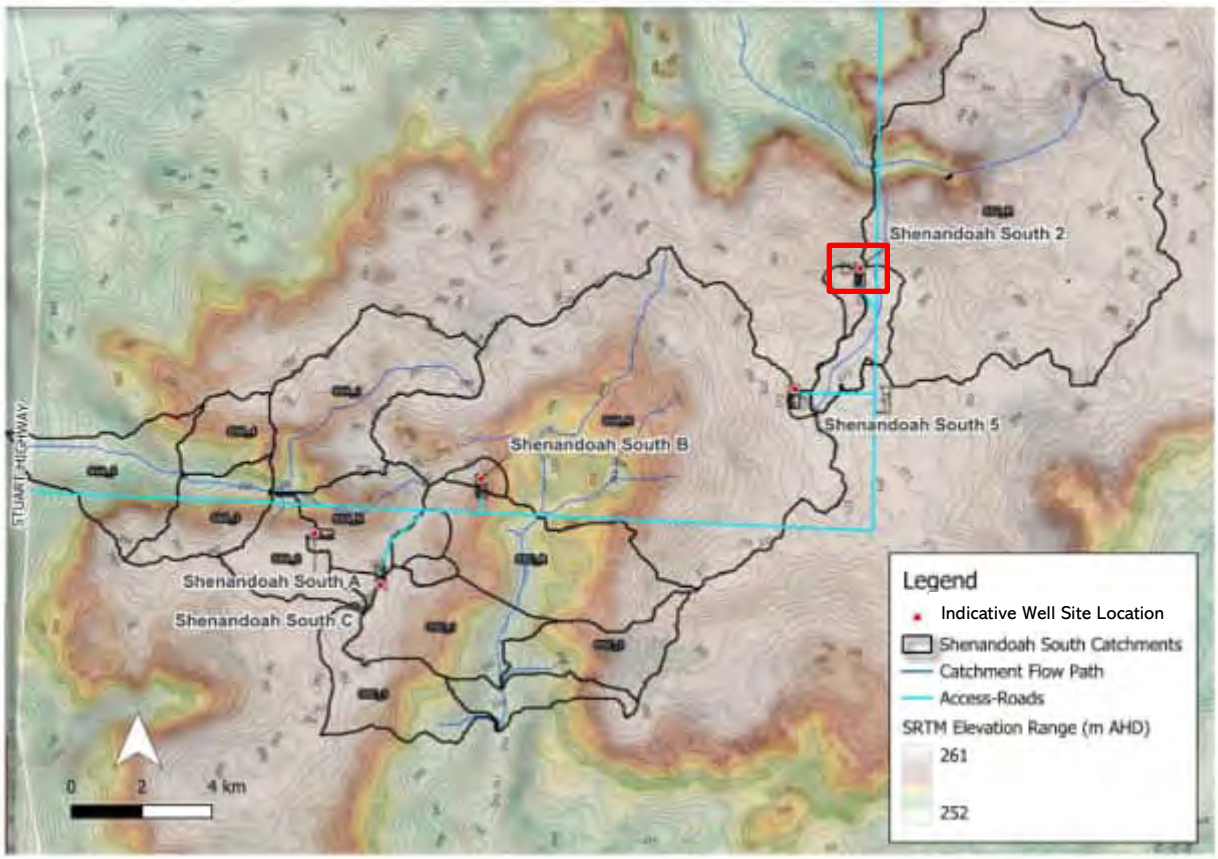


Figure 3 Location of Shenandoah S2 in the Catchments of Shenandoah South E&A Program Area

The methodology used for the hydraulic assessment is described in Table 3. For consistency, the same methodology previously used for Tamboran well sites has been adopted.

Table 3 Hydraulic Assessment Methodology

Item	Description
Topographical Data	Shuttle Radar Topography Mission (SRTM) ~1s (30 m). There was no other available ground level survey and aerial Light Detection And Ranging (LiDAR) data available for the areas around the well site. This includes the LASer (LAS) LiDAR point cloud data of the Beetaloo Basin which also does not cover the proposed well site location.
Catchment Flow Estimation	Queensland Urban Drainage Manual (QUDM) 2017 Rural rational method. The flow estimation method is consistent with the previous investigation used for Tamboran's exploration areas which is in the same catchment as the proposed well site (Figure 3).
Hydraulic Assessment	One-dimensional (1D) Manning's n open channel flow calculation using FlowMaster software: • Channel cross sectional information – Taken from the available STRM data • Channel slope – Estimated from the available STRM data • Manning's n roughness – Estimated for Google Earth© satellite photography.

It is noted that the vertical accuracy of SRTM data varies from 5 to 10 m and therefore the vertical accuracy of the flood levels in the investigation should be expected to have a similar order of accuracy. Further detailed surveys will be conducted of the well site areas to inform final placement of the well sites within the landscape to avoid flood areas.

3.0 Physical Environment

3.1 Climate

The climate of the Shenandoah S2 area can be described as arid to semi-arid. The climate is monsoon influenced and has a distinctive wet and dry season. The wet season occurs in summer, between October and March and is characterised by hot and wet conditions. The dry season occurs during the winter months between May and August and is characterised by mild days and cool nights. September and April are transitional months, with occasional rainfall. Approximately 90% of the rainfall occurs during the Wet Season, and annual totals show moderate variability from year to year.

Daly Waters airstrip is 62 km north of the permit area and recorded the highest average rainfall in the region at this time, with 163 mm falling in January and 183 mm in February. The May to September period is generally very dry, with average monthly rainfall ranging from 0.3 – 6.4 mm (BOM, 2023). The annual rainfall pattern within the area is highly variable. Drought conditions are known to occur in the region once every 10 years (Holt & Bertram, 1981).

Average maximum and minimum temperatures are also high in the wet season and lower in the dry season, with slightly greater extremes of temperature in the southern part of the region. At Daly Waters, annual monthly maximum temperatures range between 28.9 °C (June) and 38.2 °C (Nov), and minimums between 11.9 °C (Jul) and 24.2 °C (Dec) (DEPWS 2022b).

Land capability assessment for Shenandoah South E&A Program was completed in December 2022 at the start of the wet season and April 2023 at the end of the wet.

The average annual rainfall experienced in the region (which includes the BOM data from Daly Waters Airstrip) is shown in Table 4.

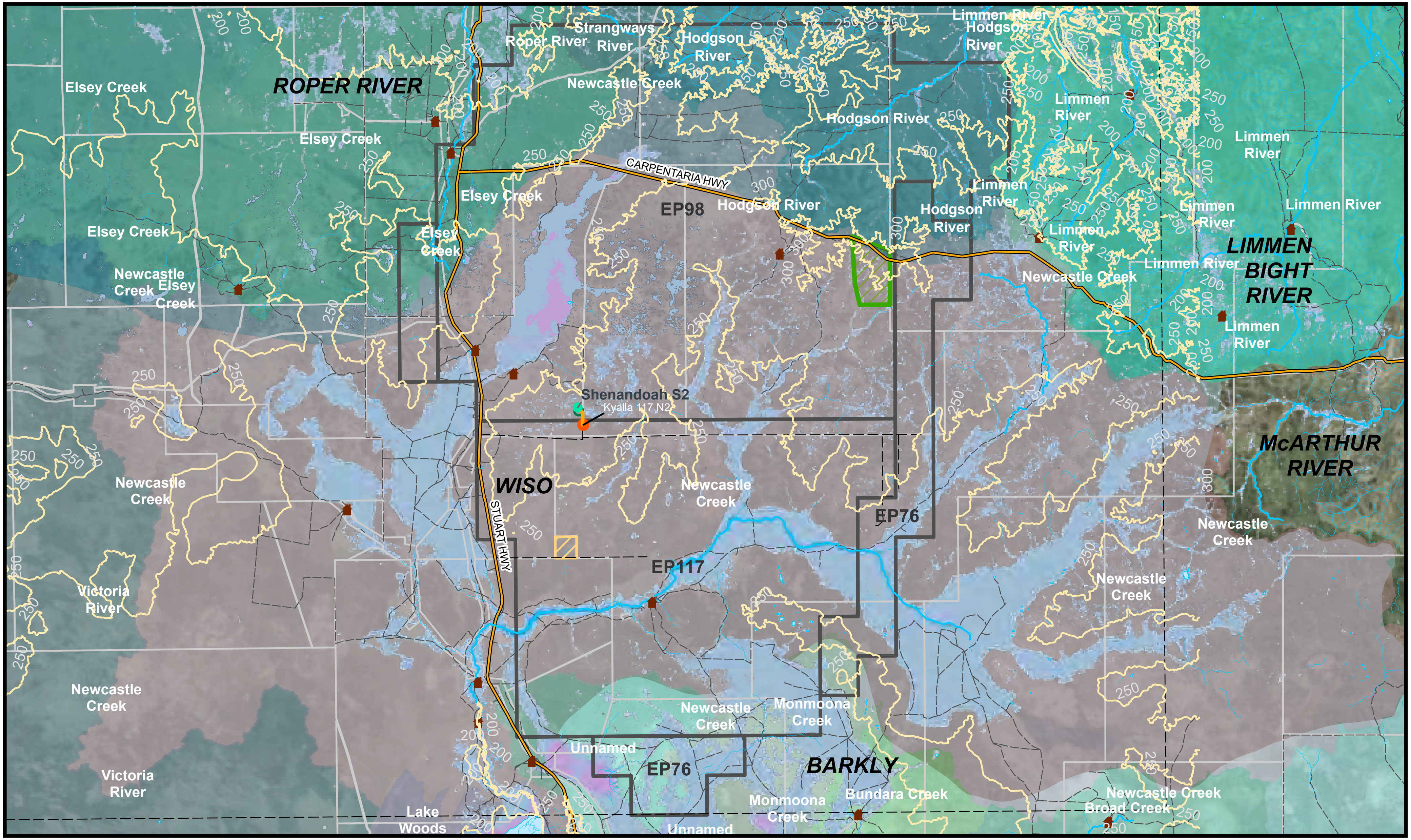
Table 4 Annual rainfall 2016 – 2023 Shenandoah S2 (Daly Waters Airstrip)

Year	Annual rainfall (mm)	Months during which rain was recorded
2016	608	12
2017	866	7
2018	752	7
2019	277	8
2020	951	9
2021	679	7
2022	561	10
2023	762	8

3.2 Topography, Surface Water and Drainage

The Shenandoah S2 well site occurs within a topographic zone classified as laterite plains that predominantly slope in a south and south westerly direction (Tickell, 2003).

Shenandoah S2 well site is situated within the Newcastle Creek Catchment as part of the Georgina Basin Water Management Area (DEPWS, 2022c) (Figure 4). The Georgina Basin Water Management Area covers approximately 120,000 km^2 southeast of the township of Daly Waters and east of the Stuart Highway (DEPWS, 2022c). The Shenandoah S2 area is internally drained by the ephemeral waterway of Newcastle Creek and several small ephemeral creeks and floodplains. Newcastle Creek flows into Lake Woods, which is located south of Newcastle Waters Station, around 90 km south of the Shenandoah S2.



LOCATION

AECOM

www.aecom.com

N

GEOCENTRIC DATUM OF AUSTRALIA 94

0 7.5 15 30

Kilometres

Existing Exploration Well Pads
Proposed Exploration Well Pads
Shenandoah Lease Pad Area
Gathering Line

River Basins
Barkly
Limmen Bight River
Roper River
Wiso
Contours
Populated Place
Tracks
Highway
Permit Areas
Aboriginal Land
Pastoral Lease Boundary
Water Bodies
Bullwaddy Conservation Reserve

Wiso Catchments
Elsey Creek
Lake Woods
Newcastle Creek
Victoria River

Georgina Catchments
Broad Creek
Bundara Creek
Cattle Creek
Elsey Creek
Hodgson River
Limmen River
Monmoona Creek
Newcastle Creek
Roper River
Strangways River
Unnamed

Aquatic ecosystem
Riverine System
Lacustrine System
Palustrine System
Floodplain System

Data sources: Permit Area, Cadastre - NT Gov 2019. Places, Vegetation - Aust Gov 2019 Highways, Roads, Drainage - StreetPro 2019

tamboran

Permit Area Surface Water and Drainage

PROJECT ID	60623736
CREATED BY	CummingsL
LAST MODIFIED	22-May-2024
VERSION	1

Figure 4

Filename: \\na.aecomnet.com\lfs\APAC\Melbourne-AUMEL1\Legacy\Groups\WTR\SpatialSys\Projects\2024\Beetaloo\ArcGIS Pro\02_MapProjects\60623736_Shenandoah_FigueUpdates_v1.aprx

Lake Woods covers an area of inundation of approximately 200 km^2 in normal rainfall years, extending to 900 km^2 in exceptionally wet years, after which it can retain water for several years (AECOM, 2015; Harrison *et al.*, 2009). Lake Woods is described as a major quasi-permanent surface water body in the region, although some semi-permanent and many ephemeral waterholes are located across the permit area (HLA, 2006; DEPWS, 2022a). Lake Woods fills during major flood events of Newcastle Creek and is listed as a wetland of national significance in the Directory of Important Wetlands in Australia (DIWA: NT013 Lake Woods) (DCCEEW, 2023d).

Although Lake Woods is located outside of the exploration permit area, it is fed principally by surface inflow of Newcastle Creek, originating more than 160 km north-east on Amungee Mungee Station (DEPWS, 2022a). During the period of inundation, Lake Woods supports over 100,000 waterbirds including internationally significant numbers of Plumed Whistling-Duck. Numerous bird species nest and feed in the diverse wetland habitat, and the conservation group 'Birdlife International' nominated Lake Woods as an 'Important Bird Area' (IBA). The lake also includes the largest area of lignum swamp in the Northern Territory and in tropical Australia (Harrison *et al.* 2009; DEPWS, 2022a).

DEPWS studies (2022a) have identified over 7,000 records of 81 waterbird species and all large-scale waterbird breeding events and the largest congregation of waterbirds, were from Lake Woods and nearby waterholes on Newcastle Creek.

There are no creeks or waterways intersecting the Shenandoah S2 site.

3.3 Flood Risk

The extent of inundation within the permit area depends on the severity of the wet season and can range from remaining completely dry to widespread flooding. As part of the preparation of the LCA, AECOM assessed the 1% Annual Exceedance Probability (AEP) flood depths and levels to determine the risk of flood inundation during the 100-year flood event from a local or regional flooding for the well site location as presented in Table 5.

Table 5 1% AEP results for Shenandoah S2 well site

Well Site	SRTM Ground Elevation (m AHD)	Maximum Water Depth (m)	Flood Level at Nearest Channel (m AHD)
Shenandoah S2	267.5	-	267.3

The greatest risk of flooding to the proposed exploration well site is from local catchment sheet-flow (rainfall immediately over the area draining to the site). The local catchment runoff from major storm events will be the considering factor for the establishment of well site finish levels and the well site designs will take this into consideration for the final placement in the landscape.

Table 6 provides a summary of the hydraulic assessment outcomes for the proposed Shenandoah S2 well site.

Table 6 Shenandoah S2 well site result summary

Item	Description
Location	Shenandoah S2 (Figure 5**)**
1% AEP Peak Flow	Local Catchment: 26 m^3/s Regional Catchment: 515 m^3/s
Results	Local Catchment: Figure 6 (West to East) Regional Catchment: Figure 7 (Northeast to Southwest)
Results Summary	
Figure 6 and Figure 7 show that the well site has a low risk of inundation in the 1% AEP from both local and regional catchment flood events. This is attributed to the position of the well site on a ridge between two local flow paths which is also well above (17.2 m) the invert of the nearest regional catchment flow path.	

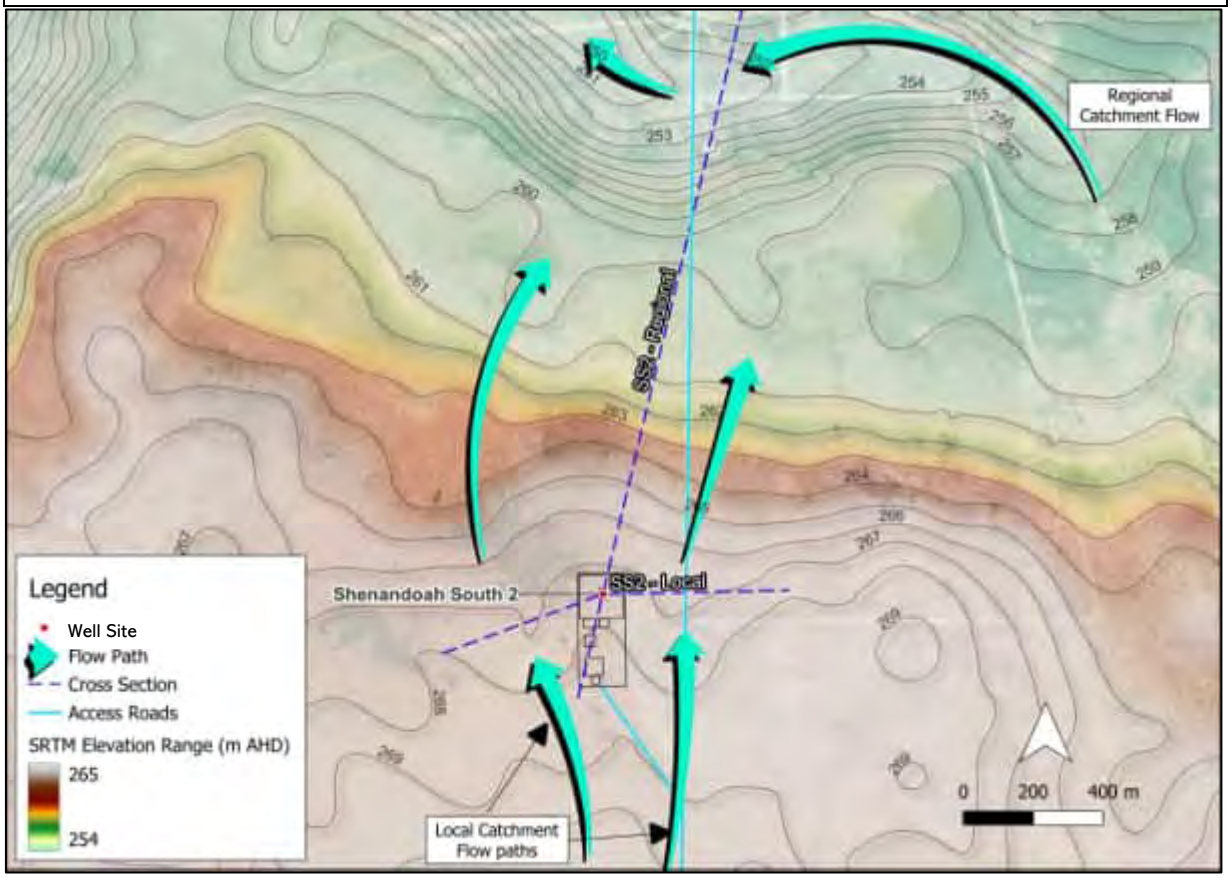


Figure 5 Locality Map - Shenandoah S2

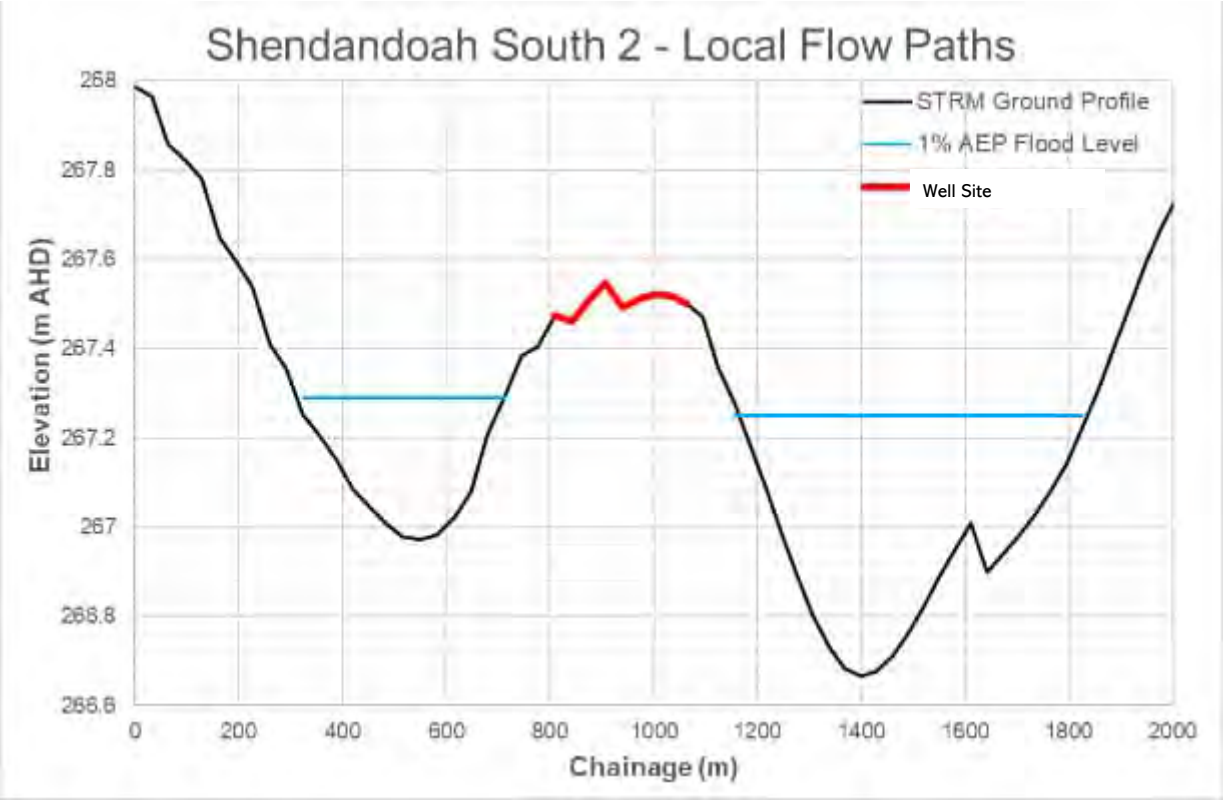


Figure 6 Shenandoah S2 – Cross Section: Local Flow Path

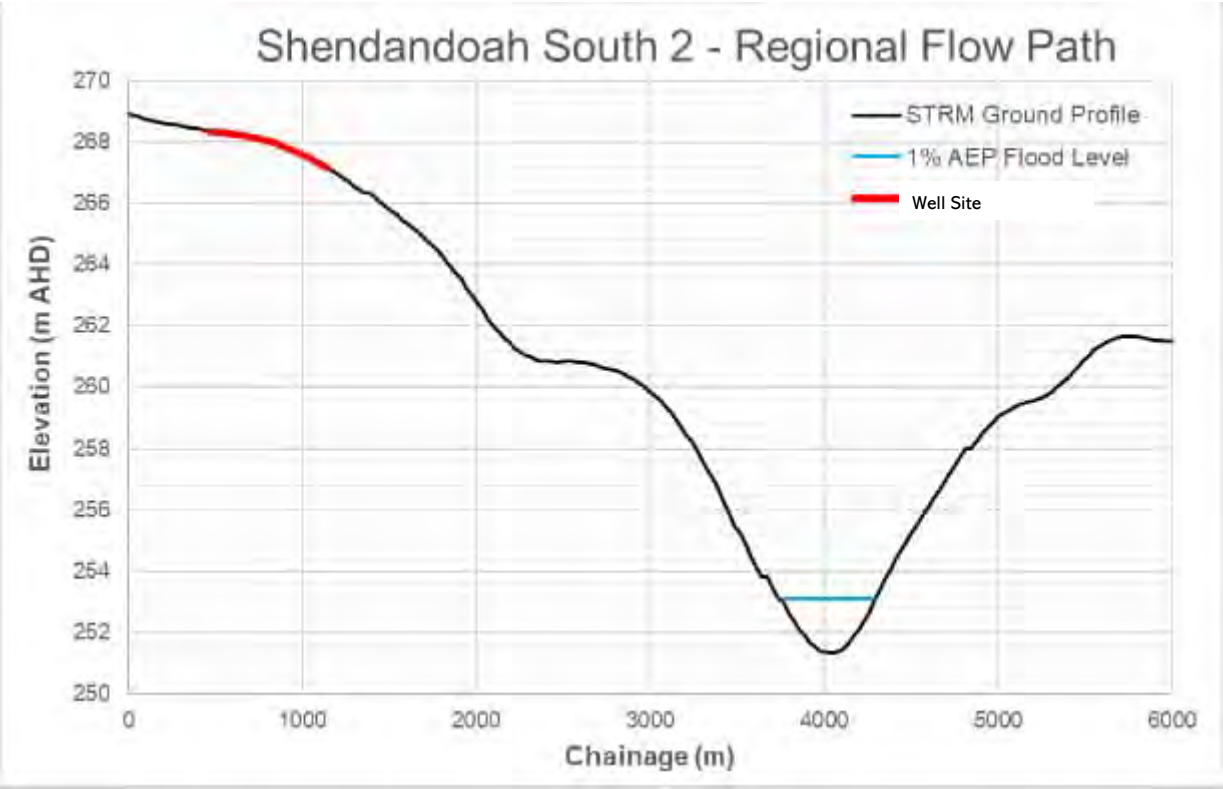


Figure 7 Shenandoah S2 – Cross Section: Regional Flow Path

3.4 Hydrogeology

The Beetaloo Basin consists of a series of stacked sedimentary basins ranging in age from Mesoproterozoic to Cretaceous with a thin Cenozoic cover (DEPWS, 2022c). Beetaloo Basin is characterised by lateritic plains and rises, clay plains, alluvial flood plains, sandstone plains and rises, lateritic plateau and basalt plains and rises. Shenandoah south consist of a thick sequence of sandstone formations and rises that were deposited between 1,500 and 1,430 million years ago (Ma) (Table 7). The sandstone formation is estimated to reach 5,000 m in thickness in the centre of the basin, while the northern and eastern margins have an average depth of approximately 500 m (CloudGMS, 2015).

The sandstone formations are overlain by the Georgina Basin (630 – 497 Ma), which includes widespread basalts and a thick limestone sequence that forms the Cambrian Limestone Aquifer (CLA), which is a significant water supply aquifer in the region. The Georgina Basin is capped by Cretaceous mudstone and sandstone (145 – 66 Ma) and recent alluvial and laterite deposits.

The generalised Hydrostratigraphy of the Beetaloo Basin is presented in Table 7.

Table 7 Summary of Beetaloo Basin Hydrostratigraphy (DEPWS, 2022c; CloudGMS, 2015)

Province	Period/Age	Formation		Aquifer Status	Thickness (m)	Yield (L/s)	Ave EC (µs/cm)
CARPENTARIA BASIN	CRETACEOUS 145 – 66 Ma	Undifferentiated		*Local Aquifer*	0 - 130	0.3 - 4	1,800
GEORGINA BASIN	CAMBRIAN 497-630 Ma	Cambrian Limestone Aquifer (CLA)	Anthony Lagoon Beds	REGIONAL AQUIFER	0 – 200	1 - 10	1,600
			Gum Ridge Formation	REGIONAL AQUIFER	0 – 300	0.3 - >20	1,400
		Antrim Plateau Volcanics		REGIONAL AQUITARD	0 – 440	0.3 - 5	900
		Bukalara Sandstone		*Local Aquifer (not regionally connected)*	0 – 75	0.3 - 5	1,000
BEETALOO BASIN (ROPER GROUP)	NOT KNOWN	Hayfield Mudstone		REGIONAL AQUITARD	0 – 450	-	32,000
		Jamison Sandstone		*Local Aquifer (not regionally connected)*	0 – 150	-	138,000
	MESO-PROTEROZOIC 1,430-1,500 Ma	Kyalla Formation		REGIONAL AQUITARD	0 – 800	-	-
		Moroak Sandstone		*Local Aquifer (not regionally connected)*	0 – 500	0.5 - 5	131,000
		Velkerri Formation		REGIONAL AQUITARD	700 – 900	-	-
		Bessie Ck Sandstone		*Local Aquifer (not regionally connected)*	450	0.5 - 5	-

Across parts of the Beetaloo Basin, undifferentiated Cretaceous deposits form the uppermost aquifer targeted for stock use. Notably, a basal sandstone unit immediately overlying the CLA produces yields of up to 5 L/s. Shallow groundwaters have also been recorded within the permit area between 1 and 2 metres below ground level.

The CLA, comprising the Gum Ridge Formation and the Anthony Lagoon Beds, is an extensive regional aquifer system that forms the principal water resource in the Beetaloo Basin. Limestone in the CLA is commonly fractured and cavernous; regionally bore yields of up to 100 L/s have been recorded from this aquifer. Approximately 80% of groundwater bores drilled in the basin screen the CLA and the aquifer supplies water for the pastoral industry and local communities including Elliot, Daly Waters, Larrimah and Newcastle Waters.

The CLA contains a significant but largely undeveloped groundwater resource with the sustainable yield from the Georgina Basin estimated to be in the order of 100,000 ML/year. Existing groundwater use in the Beetaloo Basin is estimated at 6,000 ML/year.

The regional groundwater flow direction in the CLA is north-west toward Mataranka, where the aquifer discharges into the Roper River and supports significant groundwater dependent ecosystems including the Roper River at Elsey National Park and Red Lily/57 Mile Waterhole. These discharge features occur around 100 km north-west of the Beetaloo Basin. Dry season flow in the Roper River has been gauged at 95,000 – 126,000 ML/year and provides an estimate of the magnitude groundwater discharge from the CLA. Large decadal changes in the discharge to the Roper River suggest that most recharge input occurs close to the discharge zone (i.e. beyond the Beetaloo Basin region). Groundwater recharge mechanisms to the CLA are poorly characterised but are likely to be dominated by infiltration through sinkholes and preferential recharge through soil cavities.

Limited information exists on the hydrogeological characteristics of the Roper Group sequence as it occurs at depth within the Beetaloo Basin. Sandstone dominated formations may behave as aquifers, however, drilling results suggest these formations have limited permeability and will only form marginal, very local scale aquifers. Groundwater in the Roper Group is highly saline and contrasts with the shallower, utilised aquifers in which groundwater is generally of drinking water quality.

The Velkerri Formation represents the primary unconventional gas target in the Beetaloo Basin, although small hydrocarbons intersections have been encountered in other formations within the Roper Group. Vertical pressure gradients between the Roper Group and the CLA are not well characterised, however, previous exploration well formation tests indicate there is an upward pressure gradient from the Roper Group to the CLA. Over much of the basin the CLA is separated from these formations by multiple aquitards including the Antrim Plateau Volcanics and Hayfield Mudstone.

The Tamboran permit area currently falls within the Daly Roper Beetaloo Water Control District, that encompasses 175,580 km^2 and includes the Roper River and its tributaries as well as the Beetaloo Sub-basin (DENR, 2018). Legislation in Water Control Districts covers all aspects of sustainable water management, including the investigation, use, control, protection and allocation of water resources. Through the NT *Water Act*, water control districts and water allocation plans, allocation of water to various declared beneficial uses, including agriculture, aquaculture, public water supply, riparian and industry while ensuring that adequate provisions are made to maintain cultural and environmental requirements. Water control districts are geographical areas declared under the *Water Act* by the minister to allow for intensive management of water resources. Tamboran have an existing water extraction licence from DEPWS Water Resource Division in accordance with the *Water Act 1992* (Cloud GMS, 2015).

There are eight groundwater bores located within 12 km of the Shenandoah S2. Four of the bores are associated with Tamboran activities at Kyalla 117 N2 and Carpentaria Highway and the remaining four are associated with Stuart Highway Roadside bores (2 bores) or pastoral bores (2 bores).

3.5 Land Systems

Land systems are defined because of their distinct differences from the surrounding areas and by the recurring pattern of geology, topography, soils and vegetation. Land system mapping for the project area is derived from *Land Systems of the Southern Part of the NT*, which is a compilation of three existing land system surveys and the Atlas of Australian Soils (scale 1:1,000,000). It covers the southern part (approximately 70%) of the Northern Territory. Published maps were made digital and edited to accommodate overlaps, gaps and mismatching boundaries. Where possible, the land system descriptions have been extrapolated into areas covered by the broader scale Atlas mapping (DLRM, 2013).

The Shenandoah S2 well site occurs within the Beetaloo Land System, which is classified as lateritic plains and rises. This land system is characterised by plains and rises associated with deeply weathered profiles (laterite) including sand sheets and other depositional products, sandy and earth soils.

The land system for the Shenandoah S2 is summarised in Table 8.

Table 8 Beetaloo land system details

Land System	Geological Zone	Class	Description
Beetaloo	Sturt Plateau	Lateritic plains and rises	Plains and rises associated with deeply weathered profiles (laterite) including sand sheets and other depositional products; sandy and earth soils

3.6 Soils

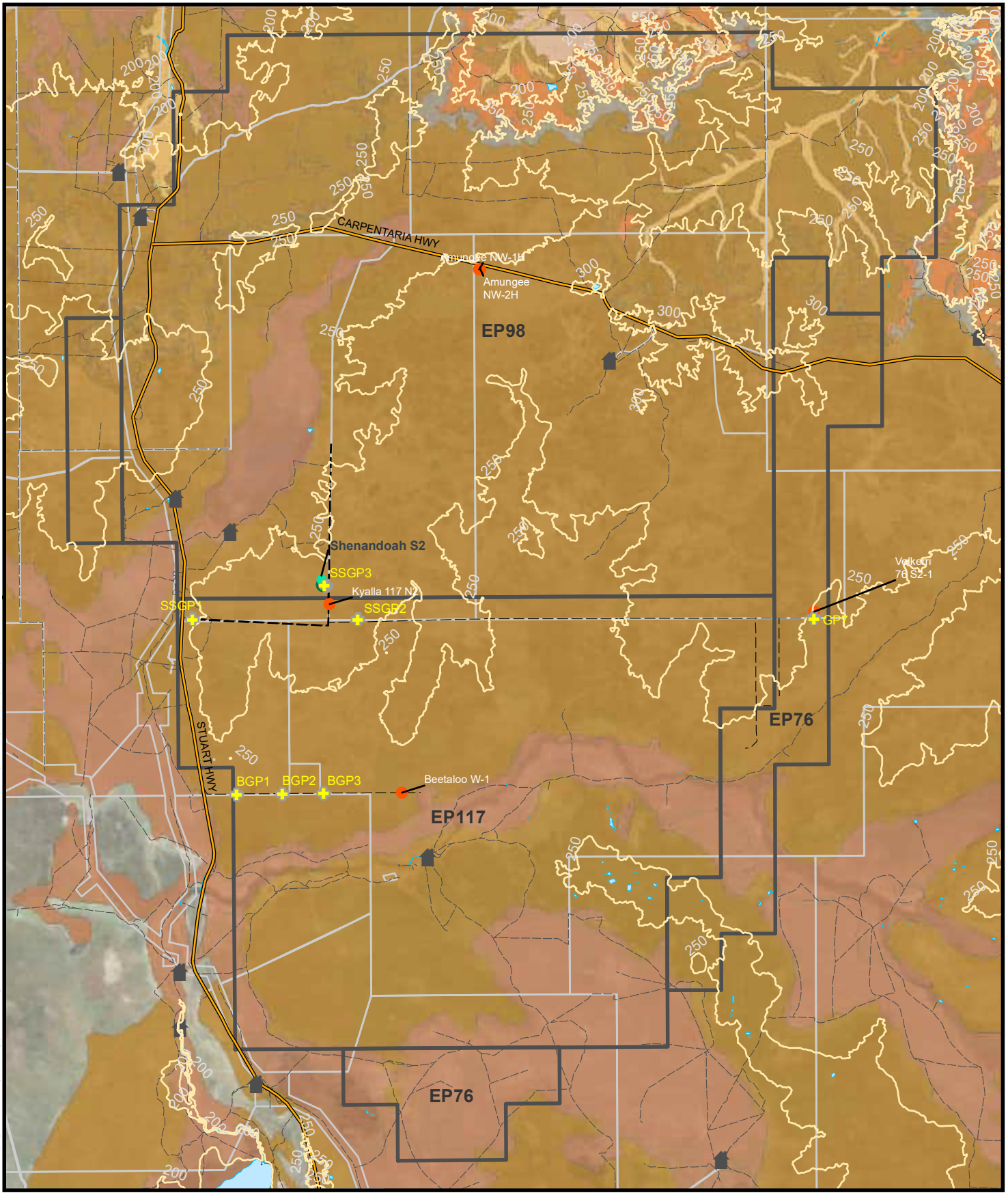
Soils within the Sturt Plateau have been derived from ancient rock formations and ancestral soils that were formed during earlier weathering cycles. The soils have been deeply weathered, leached and are relatively infertile because they have not been enriched by any recent geological events (Orr & Holmes, 1984). The soil types located within the plateau range from the very strongly leached lateritic soils of the Tertiary land surface to the calcareous desert soils and desert loams in the southern drier areas.

The lateritic plains and rises, encompass the entire Shenandoah South E&A Program area, including Shenandoah S2, and are classed as very strongly leached soils of the Tertiary land surface. The primary soil type in this area are Kandosols as per the Australian Soil Classification Map (Richards & Bond, 2023).

A soil assessment was completed at the Shenandoah S2 site. The result of the assessment is presented in Figure 9. The soils within the Shenandoah S2 site are predominantly a reddish sandy loam. Soils at these sites have a neutral pH then the sandy loams. Soil material structure samples were collected during the field work. Soil lab results are provided in Appendix A.

Table 9 Proposed Shenandoah S2 well site soil summary

Horizon	Depth (m)	Texture	Colour	Coarse fragments	pH	EC (µS/cm)	Moisture	Emerson class no.	Photo
Shenandoah South 2									
A	0-0.2	Loamy Sand	5YR – 3/4 Pale Brown	No Coarse Fragments	5.8	24	Dry	3	
B	0.2-0.7 Did not hit refusal, deep soil >0.7m	Sandy Loam	5YR 3/3 Dark Reddish Brown	65% fines, 20% 1-2 mm subangular ironstone, 15% 2-5 mm subangular ironstone	6.3	13	Dry	6	



LOCATION

AECOM

www.aecom.com

N

GEOCENTRIC DATUM OF AUSTRALIA 94

0 7.5 15 30

Kilometres

- Existing Exploration Well Pads
- Proposed Exploration Well Pad
- Gravel Pits
- Proposed Seismic Lines
- Shenandoah Lease Pad Area
- Access Tracks
- Contours
- Populated Place
- Tracks
- Highway
- Permit Areas
- Pastoral Lease Boundary
- Water Bodies

Landscape Class

- lateritic plains and rises
- clay plains
- alluvial floodplains
- sandstone plains and rises
- lateritic plateaux
- basalt plains and rises

Data sources:
Permit Area, Cadastre - NT Gov 2019.
Places, Vegetation - Aust Gov 2019
Highways, Roads, Drainage - StreetPro 2019

tamboran

Permit Area Land Systems Landscape Class

PROJECT ID	60623736
CREATED BY	sam.schroder
LAST MODIFIED	20-Mar-2024
VERSION	1

Figure 8

Filename: \\na.aecomnet.com\lfs\APAC\Melbourne-AUMEL1\Legacy\Groups\WTR\SpatialSys\Projects\2023\Beetaloo\02_MXD\LCA_Tamboran_Oct_2023\F4_Landscape_Class.mxd

3.6.1 Erosion Susceptibility

Soil erosion susceptibility varies throughout the permit area, dependent upon soil types, slope and extent of ground disturbance. Apart from the erosive impact of climatic conditions, soil erosion is influenced mainly by the inherent properties of the soils and the processes which occurred during the formation of the landscapes (Aldrick & Wilson, 1990).

Erosion will occur in the permit area if the land is used beyond its capacity, as is seen if land is overstocked or vehicle movements not controlled, for example. The location of proposed well sites and seismic lines have been examined to determine the risk of erosion occurring. Factors considered include the following:

Soil type – soils with higher clay content are prone to generation of bulldust and are easily eroded by wind and water. The surface soils at the well site had low clay content in the upper 0.2 m, generally showing loamy sands (5-10% clay). Gravelly soils tend to be more robust to disturbance on the scale expected during the exploration program. The well site area was found to have high gravel content and generally non-dispersive soils. Shenandoah S2 showed no surface gravels, Emerson class number 3.

- Slope – the slope of the site will determine the risk of erosion during rainfall events, with steeply inclined areas a higher risk than small undulations in the landform. Shenandoah S2 well site area is considered flat with slopes of ≤1%.
- Aspect – the position of the access track and well sites in relation to the direction of the contour should be considered and creation of tracks across (as opposed to parallel with) the contour should be avoided.
- Rainfall – Table 10 presents the erosion risk rating based on average monthly rainfall using the rating system provided in the IECA (2008) for Daly Waters Aerodrome (located 62km north of Shenandoah S2). Where possible, construction activities for the exploration area will be planned for completion prior to the wet season to minimise the risk of erosion resulting from rainfall impacts.

Table 10 Erosion Risk Rating based on average monthly rainfall at Daly Waters Aerodrome

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall (mm)	163.2	182.7	107.5	20.7	6.4	2.8	1.7	0.3	1.9	21.8	49.4	118.1
Erosion Risk	H	H	H	VL	VL	VL	VL	VL	VL	VL	M	H

H = High (100+ to 225 mm); M = Moderate (45+ to 100 mm); L = Low (30+ to 45 mm); VL = Very Low (0 to 30 mm) Data sourced from Bureau of Meteorology, Climate Averages for Station 014626 Daly Waters Aerodrome recorded from 1939-2022.

Table 11 Erosion Risk Rating based on average monthly rainfall at Newcastle Waters

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall (mm)	125.0	130.4	82.3	19.0	7.3	4.8	2.7	1.2	4.8	18.2	39.1	75.0
Erosion Risk	H	H	M	VL	VL	VL	VL	VL	VL	VL	L	M

H = High (100+ to 225 mm); M = Moderate (45+ to 100 mm); L = Low (30+ to 45 mm); VL = Very Low (0 to 30 mm) Data sourced from Bureau of Meteorology, Climate Averages for Station 015086 Newcastle Waters recorded from 1889-2022.

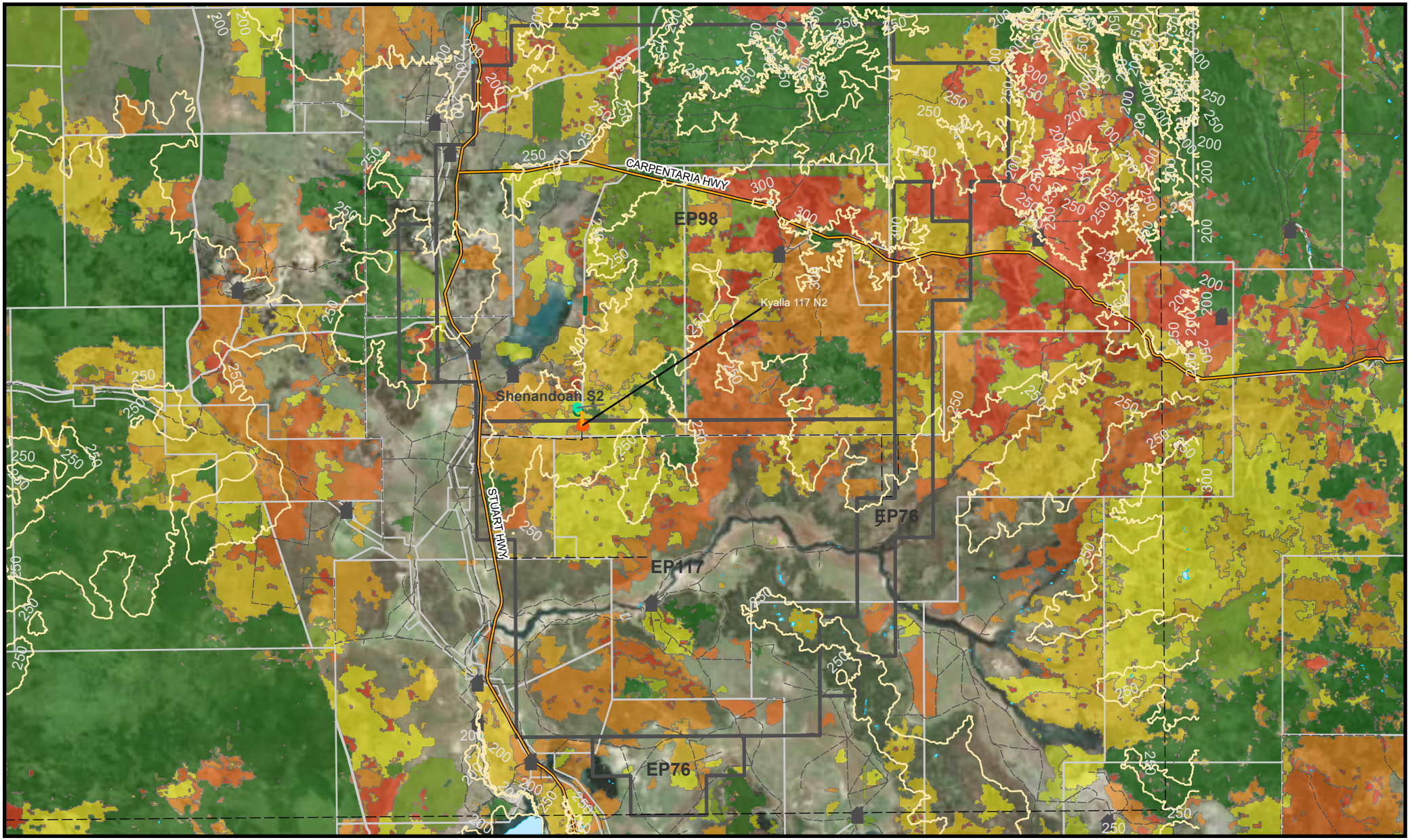
3.7 Bushfire

Fire is a natural occurrence in most Australian ecosystems and plays an important role in their ecology. Fire management practices by the Pastoralists, generally exclude fire from the Mitchell grasslands (dominated by *Astrebla* spp.) to maintain forage throughout the dry season (HLA, 2005). Mitchell grasslands are located west of the Shenandoah South E&A program in the floodplain area. Fires are more frequent in the Sturt Plateau in the Eucalypt/Corymbia and Acacia woodlands where Shenandoah South E&A program is located.

Historically most high intensity fires within EP98 and 117 occur during the dry season fires (June to September) (HLA, 2005). Wet season fires (October to May) have occurred within the permit area. These fires are likely to be patchy and of lower intensity, depending on the state of curing of the fuel load.

Fire sensitive Bullwaddy and Lancewood communities are located throughout the permit area. The impacts of hot fires can impact flora and fauna species and reduce habitat quality. Research suggests that hot fires may impact fauna diversity and in particular diurnal reptiles (Legge *et al*., 2008).

The LCA completed at Shenandoah S2 which indicated low intensity fire events greater than 2 years ago at Shenandoah S2. Fire data was acquired from the NAFI site and queried for the well site are area. Ten-year fire data (2014 to 2023) shows a large portion of the area has not been impacted by fire for some time. Figure 9 shows the fire frequency within the exploration areas over the past 10 years (2014 to 2023). Fire has occurred 6 to 7 times at Shenandoah S2 within the last 10 years.



LOCATION

AECOM
www.aecom.com

N

GEOCENTRIC DATUM OF AUSTRALIA 94

0 7.5 15 30

Kilometres

- Proposed Exploration Well Pads
- Shenandoah Lease Pad Area
- Contours
- Populated Place
- Tracks
- Highway
- Gathering Line
- Permit Areas
- Pastoral Lease Boundary
- Water Bodies

Years Burnt 2014 - 2023

1 2 3 4 5 6 7 8 9 10 11

Data sources:
Permit Area, Cadastre - NT Gov 2019.
Places, Vegetation - Aust Gov 2019

tamboran

Permit Area Annual Fire Frequency
10 year, 2014 - 2023

PROJECT ID	60623736
CREATED BY	CummingsL
LAST MODIFIED	22-May-2024
VERSION	1

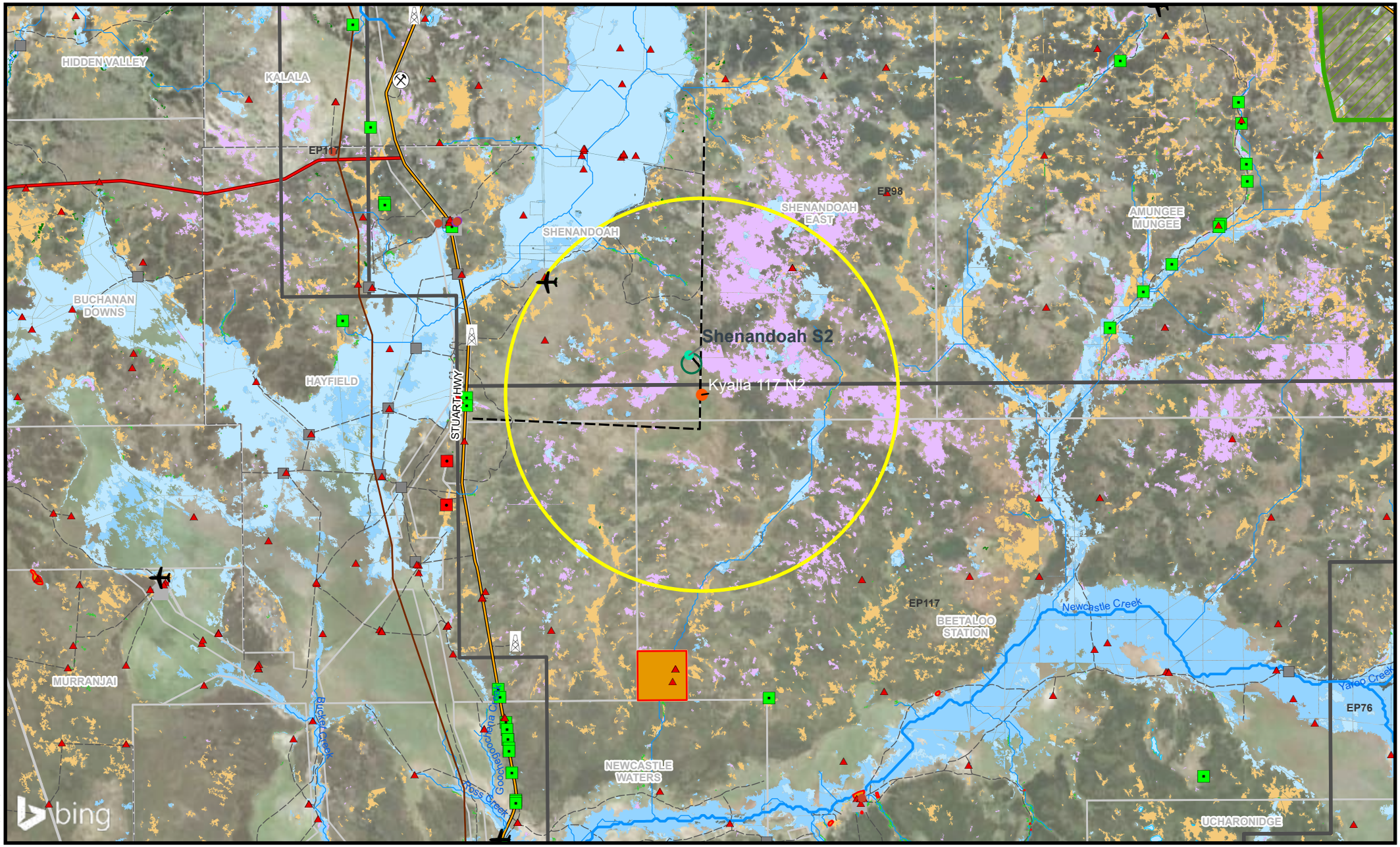
Figure
9

3.8 Land use and sensitive receptors

Approximate separation distances from the Shenandoah S2 project area to the nearest environmental and community receptors is summarised in Table 12. Sensitive receptors for the Shenandoah E&A area are illustrated in Figure 10.

Table 12 Environmental and community receptors – Shenandoah S2 well site

Receptor	Nearest pastoralist bore	Nearest homestead – Hayfield Station	Nearest community – Dunmarra	Nearest Indigenous community – Jingaloo	Stuart Highway	Carpentaria Highway	Frew Ponds Reserve	Bullwaddy Conservation Reserve	Lake Woods	Nearest mapped major watercourse – centre point
Distance	16.3 km north-west	17 km south-east	67 km north-west	35 km south	22 km west	57 km north	32 km south-west	63 km north-east	100 km south	27 km west



AECOM
www.aecom.com

GEOCENTRIC DATUM OF AUSTRALIA 94

1:506,919 (when printed at A4)

0 5 10 20

Kilometres

- Proposed Exploration Well Pads
- Existing Exploration Well Pads
- Shenandoah Lease Pad Area
- 20km buffer
- Access Tracks
- Populated Place
- Aircraft Facility
- Tower
- Mine
- Yard
- Tracks
- Highway
- Gas Pipeline
- Permit Areas
- Aboriginal Land
- Aboriginal Communities
- Pastoral Lease Boundary
- Pastoralist Bores
- Creek
- River
- Water Bodies
- Bullwaddy Conservation Reserve

Threatened Flora and Fauna
- CR - Critically Endangered
- VU - Vulnerable

Heritage
- Historic Heritage Sites
- Archaeological Sites

Significant vegetation
- Riparian
- Riparian/wetland
- Wetland
- Wetland/floodplain
- Floodplain
- Floodplain/drainage depression
- Run-on

tamboran

ENVIRONMENTAL AND COMMUNITY RECEPTORS AND FEATURES OF INTEREST

PROJECT ID	60623736
CREATED BY	sam.schrider
LAST MODIFIED	31-May-2024
VERSION	1

Figure 10

A4 size

Filename: \\na.aecomnet.com\ifs\APAC\Melbourne-AUMEL1\Legacy\Groups\WTR\SpatialSys\Projects\2024\Beetaloo\ArcGIS Pro\02_MapProjects\60623736_Shenandoah_FigueUpdates_v1.aprx

4.0 Natural Environment

4.1 Bioregions

The Interim Biogeographic Regionalisation of Australia (IBRA) classifies the Shenandoah S2 well site as occurring within the Sturt Plateau Bioregion. The Sturt Plateau Bioregion comprises undulating plains on sandstone, with predominantly neutral sandy red and yellow earth soils. Dominant vegetation is eucalypt woodland (dominated by variable-barked bloodwood *Eucalyptus dichromophloia*) with spinifex understorey, as well as extensive areas of Lancewood (*Acacia shirleyi*) - Bullwaddy (*Macropteranthes kekwickii*) vegetation association and associated fauna, including the Spectacled Hare-Wallaby (*Lagorchestes conspicillatus*). Land condition in the bioregion is moderate to good but is threatened by impacts from weeds, feral animals, pastoralism and changed fire regimes (Baker *et al*, 2005).

4.2 Vegetation Communities

The SREBA Terrestrial Ecosystems Baseline Report identified 51 vegetation communities and 21 broad vegetation groups (BVG) comprising the final vegetation classification for the study area (Young *et al.*, 2022). Within the broader Shenandoah South E&A Program 21 broad vegetation communities are noted, with four of these occurring at the Shenandoah S2 (refer Figure 11).

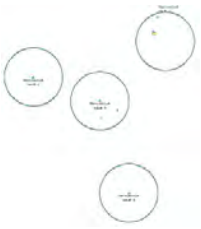
Significant vegetation communities listed by the SREBA Baseline Report were identified in the Shenandoah South E&A area. These include wetland, floodplains/drainage depressions and run-on areas. The planned Shenandoah S2 well site is shown to be outside these areas (refer Figure 12. Based on the SREBA (Young *et al.*, 2022) definition of significant vegetation, it is considered that the significant vegetation classification within the Shenandoah South E&A Program area are not high value wetlands and have moderate ecological values that are considered not sensitive to negative impacts from adjacent land use due to their relatively large spatial extent.

The field assessment undertaken in December 2022 and March – April 2023 confirmed that the main vegetation communities identified within the Shenandoah South E&A area consists of woodlands, typically dominated by bloodwoods (*Corymbia* spp.) and Eucalypt and patches of tall shrubland / woodland of Lancewood (*Acacia shirleyi*) and Bullwaddy (*Macropteranthes kekwickii*) with open grassland understorey (AECOM, 2022).

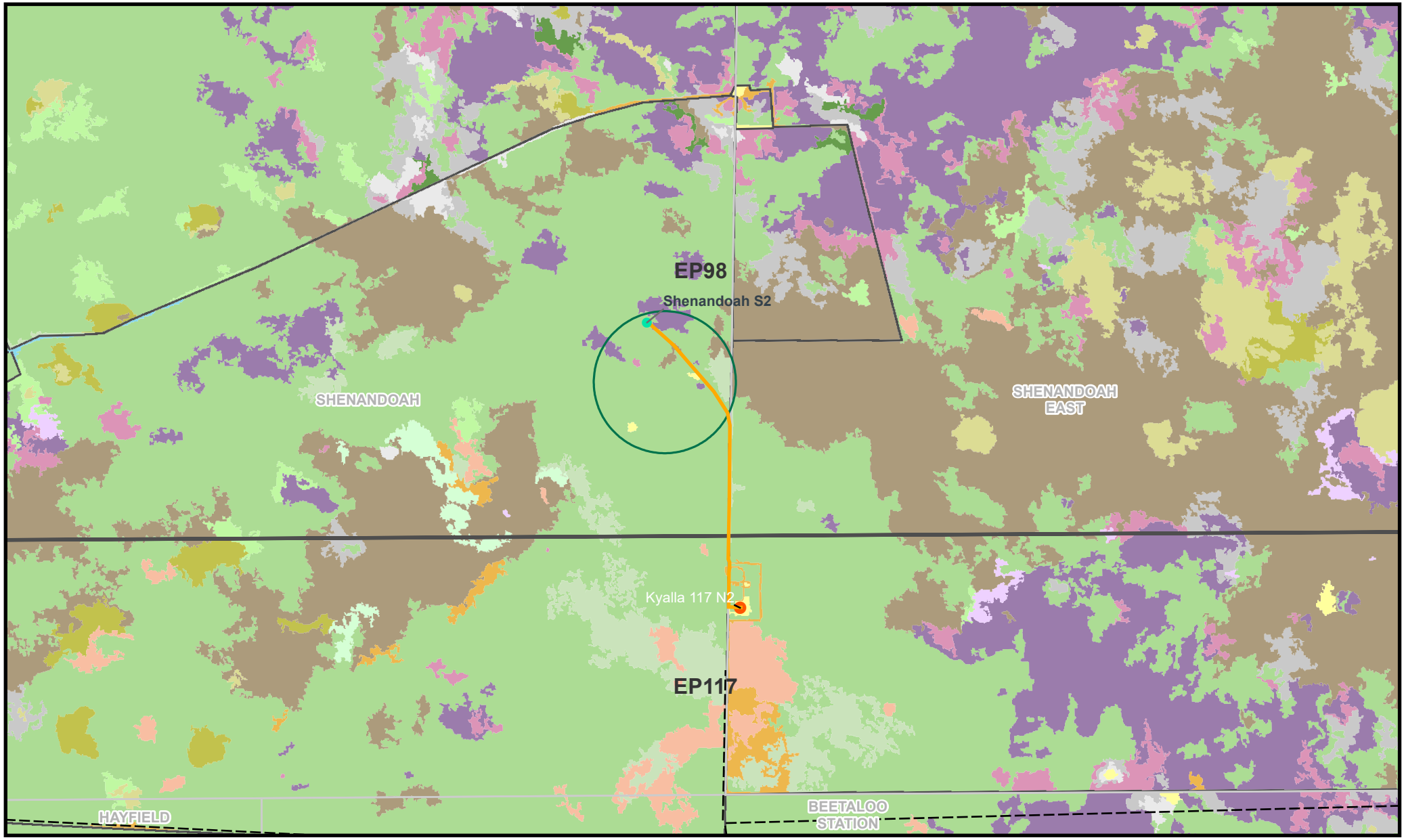
The survey of the Shenandoah S2 site identified four vegetation communities present. The vegetation communities are described in Table 13 along with their presence within the wider Shenandoah South E&A Program.

Table 13 Vegetation community description – Shenandoah S2

Vegetation Community	Description	Survey Sites	Photo Reference
2a 	*Corymbia dichromophloia* ± *Erythrophleum chlorostachys* mid high open woodland, over *Acacia difficilis* ± *Terminalia canescens, Erythrophleum chlorostachys* mid high open shrubland, over *Triodia bitextura, Aristida hygrometrica, Chrysopogon fallax* mid high hummock grassland	**No of sites:** (46) Shen S A, Ground 8, Ground 16, Ground 17, Ground 24, Ground 40, Ground 41, Ground 43, Ground 60, Ground 61, Ground 66, Ground 68, Air 1, Air 2, Air 4, Air 5, Air 6, Air 7, Air 11, Air 12, Air 19, Air 20, Air 21, Air 22, Air 23, Air 25, Air 28, Air 34, Air 35, Air 36, Air 37, Air	 **Plate 1** **Open woodland dominated by *Corymbia dichromophloia*, ± *Erythrophleum chlorostachys***

Vegetation Community	Description	Survey Sites	Photo Reference
		Air 36, Air 37, Air 38, Air 39, Air 42, Air 46, Air 47, Air 49, Air 58, Air 62, Air 63, Air 64, Air 65, Shen S2, 3, 4, 5	
2b 	Acacia shirleyi, Corymbia dichromophloia ± Eucalyptus leucophloia, Corymbia polycarpa mid high open woodland, over Macropteranthes kekwickii, Petalostigma pubescens, Hakea arborescens mid high open shrubland, over Chrysopogon fallax, Mnesithea formosa, Eriachne ciliata mid high tussock grassland	(14) Shen S C, Air 3, Air 15, Air 18, Air 26, Air 30, Air 32, Air 33, Air 45, Air 48, Air 51, Air 56, Air 67, Air 171, Shen S 4	 **Plate 2** ***Acacia shirleyi* mid high open woodland**
3a 	*Corymbia polycarpa, Eucalyptus chlorophylla, Acacia shirleyi* mid high open woodland, over *Acacia difficilis, Macropteranthes kekwickii, Erythrophleum chlorostachys* mid high open shrubland, over *Aristida* sp1, *Aristida sp*3 mid high open tussock grassland	(4) Shen S B, Ground 27, Air 52, Air 53	 **Plate 3** ***Corymbia polycarpa, Eucalyptus chlorophylla, Acacia shirleyi* mid high open woodland**
4d 	*Eucalyptus camaldulensis* low woodland over *Melaleuca viridiflora* sparse shrubland over open tussock grassland	(1) Ground 75 (north)	 **Plate 4** ***Eucalyptus camaldulensis low woodland***

Detailed vegetation community descriptions are presented in (Appendix B) and shown in Figure 13.



AECOM

www.aecom.com

N

GEOCENTRIC DATUM OF AUSTRALIA 94

0 1 2

Kilometres

- Existing Exploration Well Pads
- Proposed Exploration Well Pads
- Shenandoah Lease Pad Area
- Gathering Line
- Permit Areas
- Pastoral Lease Boundary

SREBA Broad vegetation group

- Corymbia/Eucalyptus open woodland on sandy loam
- Corymbia/Eucalyptus woodland (run-on areas and heavier soils)
- Corymbia bella woodland on alluvial plains
- Eucalyptus miniata open woodland on loamy sand
- Riparian woodland (ephemeral streams)
- Snappy gum low open woodland
- Lancewood forest
- Bullwaddy shrubland and woodland
- Bauhinia and Corymbia open woodland on sandy clay
- Eucalyptus chlorophylla low open woodland
- Silver box low open woodland
- Coolabah low open woodland on clay
- Coolabah, Lophostemon and Gutta Percha swamps
- Melaleuca low open woodland on floodplains and drainage depressions
- Tussock grassland
- Corymbia/Eucalyptus woodland on sandstone
- Acacia shrubland and hummock grassland on sandplains
- Track

Data sources:
SREBA 2023, Permit Area, Cadastre - NT Gov 2019. Places, Highways, Roads, Drainage - StreetPro 2019.

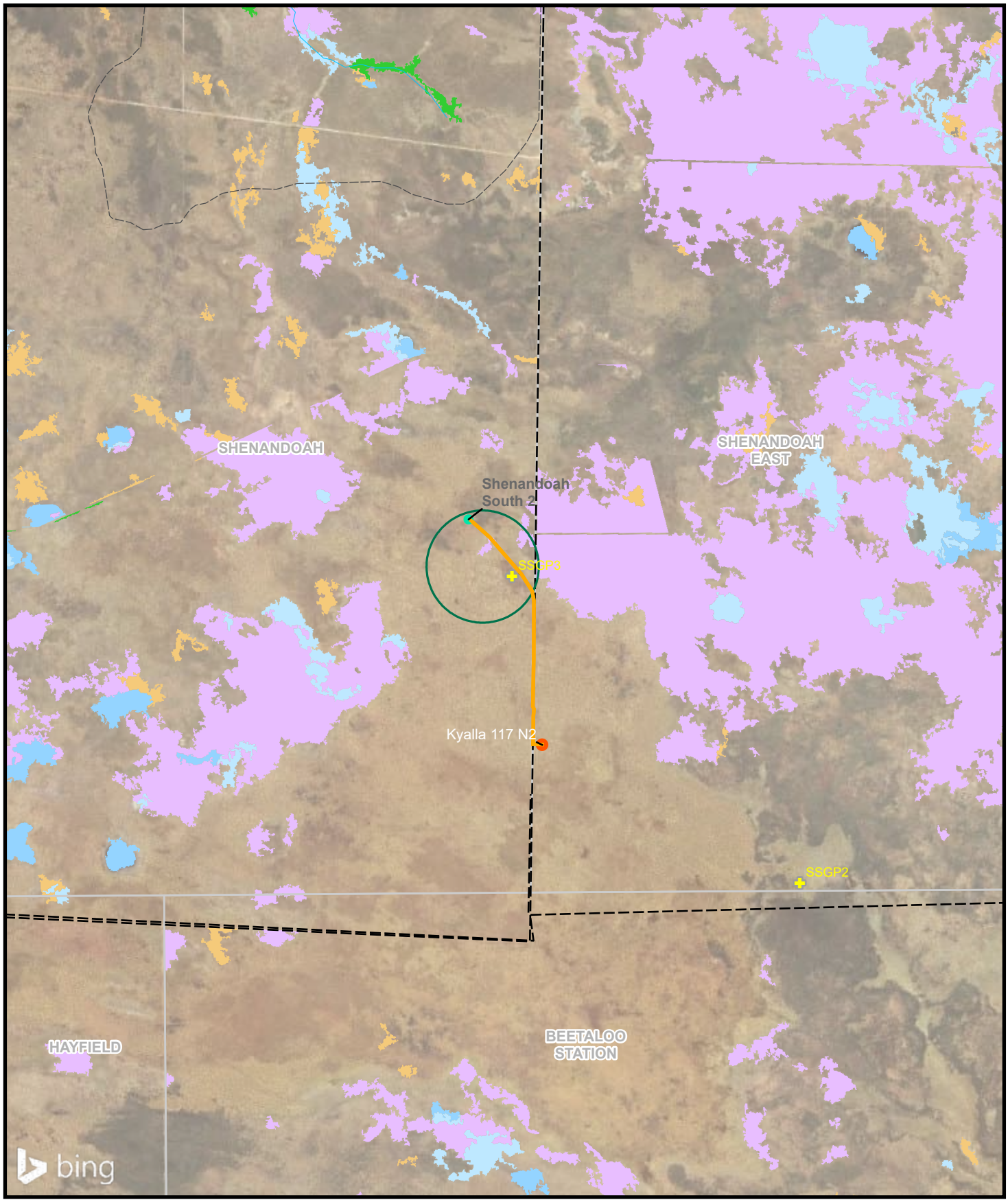
tamboran

Shenandoah South Project Area Vegetation Groups

PROJECT ID	60623736
CREATED BY	sam.schroder
LAST MODIFIED	31-May-2024
VERSION	1

Figure 11

Filename: \\na.aecomnet.com\ifs\APAC\Melbourne-AUMELT\Legacy\Groups\WTR\SpatialSys\Projects\2024\Beetaloo\ArcGIS Pro\02_MapProjects\60623736_Shenandoah_FigueUpdates_v1.aprx



AECOM

www.aecom.com

LOCATION

N

GEOCENTRIC DATUM OF AUSTRALIA 94

0 1 2 4

Kilometers

- Proposed Exploration Well Pad
- Existing Exploration Well Pads
- Gravel Pits
- Shenandoah Lease Pad Area
- Shenandoah South Well Pad Access Track
- Access Tracks
- Tracks
- Gathering Line
- Pastoral Lease Boundary

SREBA Significant vegetation

- Riparian
- Wetland/floodplain
- Floodplain
- Floodplain/drainage depression
- Run-on

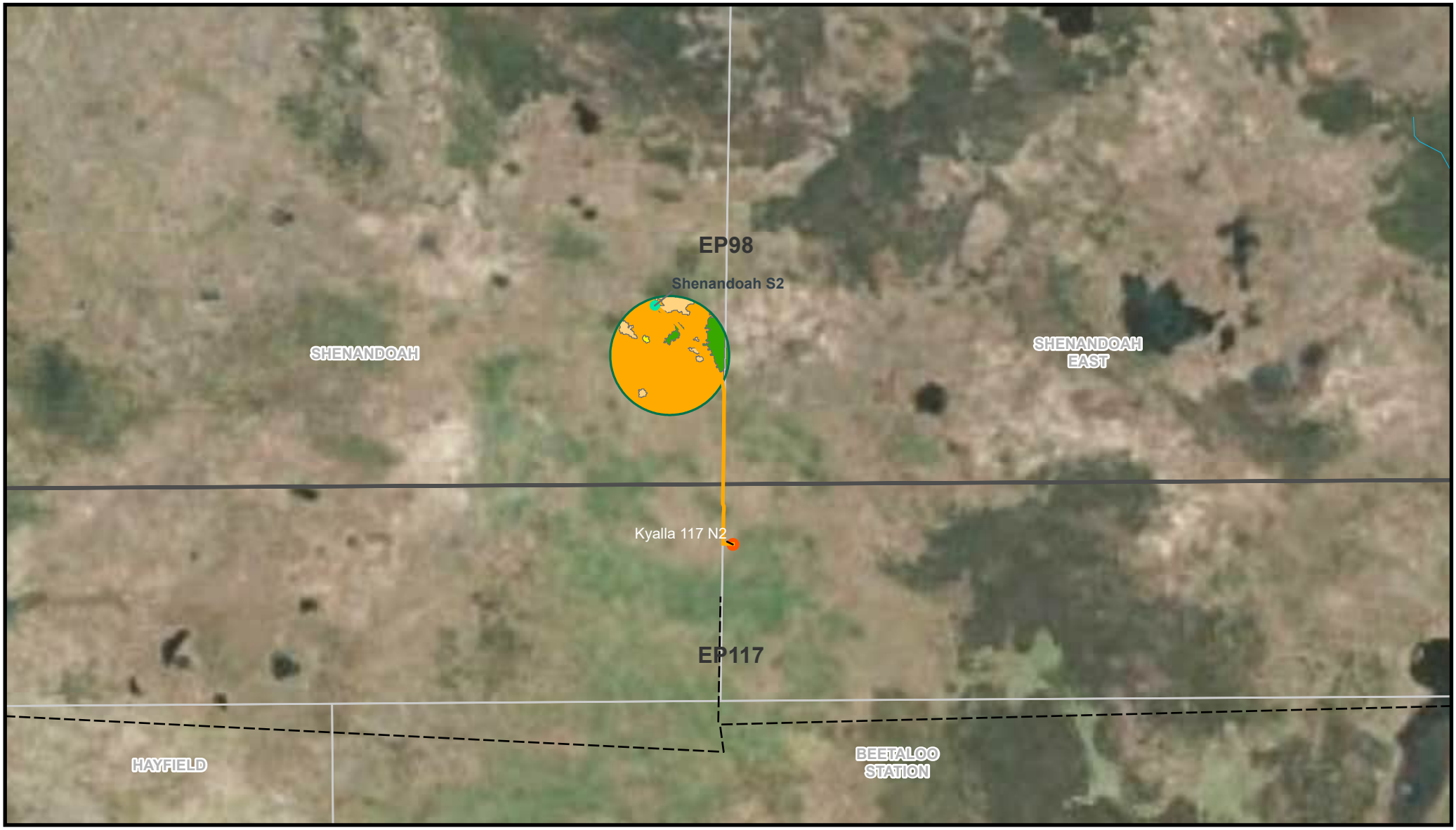
Data sources:
Permit Area, Cadastre - NT Gov 2019.
Places, Vegetation - Aust Gov 2019
Highways, Roads, Drainage - StreetPro 2019

tamboran

Significant Vegetation

PROJECT ID	60623736
CREATED BY	sam.schroder
LAST MODIFIED	31-May-2024
VERSION	1

Figure 12



2a - Corymbia dichromophloia ± Erythrophleum chlorostachys open woodland over Acacia difficilis ± Terminalia canescens, Erythrophleum chlorostachys open shrubland over hummock grassland
2b - Acacia shirleyi, Corymbia dichromophloia ± Eucalyptus leucophloia, open woodland over Macropteranthes kekwickii, Petalostigma pubescens, Hakea arborescens open shrubland over tussock grassland
3a - Eucalyptus chlorophylla, Corymbia polycarpa ± Corymbia confertiflora open woodland over Erythrophleum chlorostachys, Acacia holosericea, Acacia difficilis open shrubland over tussock grassland
4d - Eucalyptus camaldulensis low woodland over Melaleuca viridiflora sparse shrubland over open tussock grassland

AECOM
www.aecom.com

N

GEOCENTRIC DATUM OF AUSTRALIA 94

0 0.5 1 2

Kilometres

- Existing Exploration Well Pads
- Proposed Exploration Well Pads
- Shenandoah Lease Pad Area
- Gathering Line
- Permit Areas
- Pastoral Lease Boundary

LOCATION

Data sources: SREBA 2023, Permit Area, Cadastre - NT Gov 2019. Places, Highways, Roads, Drainage - StreetPro 2019.

tamboran

Shenandoah South
Project Area
Vegetation Groups

PROJECT ID	60623736
CREATED BY	CummingsL
LAST MODIFIED	23-May-2024
VERSION	1

Figure 13

Filename: \\na.aecomnet.com\ifs\APAC\Melbourne-AUMEL1\Legacy\Groups\WTR\SpatialSys\Projects\2024\Beetaloo\ArcGIS Pro\02_MapProjects\60623736_Shenandoah_FigueUpdates_v1.aprx

4.3 Flora

A search of the DCCEEW Protected Matters database of nationally significant fauna (PMST) and the NT Government flora atlas database was undertaken for the exploration area, with a 10 km buffer applied. No threatened vegetation communities are listed as likely to occur within the Shenandoah S2 well site area.

The SREBA Terrestrial Ecosystem Report (Young *et al.*, 2022) indicated that the flora surveys completed over 2021-2022 contributed 15,419 new plant records within the Beetaloo sub-basin.

Field survey undertaken during April 2023 recorded 1,372 individual flora species. The survey focused on recording dominant species to describe vegetation communities rather than undertake a comprehensive floristic assessment.

4.3.1 Threatened Flora

Initial desktop analysis of flora in the region indicated that no threatened species are likely to occur in the project area. In 2022 *Carex fascicularis* (Tassel Sedge) was recorded in a seasonal wetland adjacent to the Stuart Highway, approximately 20 km south of the project area (DEPWS, 2021a). This species listed as Vulnerable under the TPWC Act.

Carex fascicularis is an erect densely tufted perennial sedge to 1 m with trigonous culms and short rhizome. The species is common in south-eastern Australia and was previously known from a single population in the West MacDonnell Ranges. The scarcity of *Carex fascicularis* in the NT is likely due to the absence of suitable habitat, which comprises swampy areas in mesic and sub-coastal regions throughout its range (DEPWS, 2021a).

The species may occur within swamps and springs in the project area. Avoidance and or tread lightly approach of these habitats, will minimise impacts on this species by the Shenandoah South E&A Program. It is not considered likely *Carex fascicularis* occurs in the Shenandoah S2 well site area.

4.4 Weeds

Previous surveys within the Tamboran Permit Areas have recorded a low number and density of weed species, indicating that land condition is generally good. Three declared weed species, *Calotropis procera* (Rubber bush), *Parkinsonia aculeata* (Parkinsonia) and *Mesosphaerum suaveolens* (Hyptis), have been recorded during previous surveys. No weeds were detected within the Shenandoah South E&A Program during December 2022 and April 2023 (Figure 14).

Table 14 provides a list of weed species that are known to occur or likely to occur Shenandoah South E&A Program area based on a desktop review of the following sources:

- Tennant Creek Regional Weeds Strategy (DEPWS, 2021b),
- Katherine Regional Weeds Strategy (DEPWS, 2021c).
- Mapping data provided by the Weed Management Branch, DEPWS.
- Weed Management Planning Guide – Onshore Petroleum Projects (DENR, 2019).
- Department of Climate Change, Energy, the Environment and Water (DCCEEW) EPBC Act Protected Matters Report database.
- Previous data collected by AECOM in the permit area.

There are four classes of weeds under the NT *Weed Management Act 2001*, which was amended in May 2022. The classes are described as:

a. it is necessary to eradicate the plant

b. it is necessary to prevent the growing and spreading of the plant

c. it is necessary to prevent the introduction of the plant into the Territory or a part of the Territory

d. it is necessary to prevent the plant being spread by the actions of persons.

Based on the available data the current status for the weeds likely to occur within the Shenandoah South E&A Program area, there is no Class D status.

Table 14 NT Listed Weeds known or likely to occur within Shenandoah South E&A Program

Scientific Name	Common Name	Status
Alternanthera pungens	Khaki Weed	Class B and C
Andropogon gayanus	Gamba Grass	Class A and C, WoNS
Azadirachta indica	Neem	Class B and C
Calotropis procera	Rubber Bush	Class B and C (south of 16°30' S latitude)
Cenchrus ciliaris	Buffel Grass	Not declared in NT
Cenchrus echinatus	Mossman River Grass	Class B and C
Datura ferox	Fierce Thornapple	Class A and C
Mesosphaerum suaveolens	Hyptis	Class B and C
Jatropha gossypiifolia	Bellyache Bush	Class B and C, WoNS
Parkinsonia aculeata	Parkinsonia	Class B and C, WoNS
Sida acuta	Spinyhead Sida	Class B and C
Sida cordifolia	Flannel Weed	Class B and C
Sida rhombifolia	Paddy's Lucerne	Class B and C
Tamarix aphylla	Athel Pine	Class B and C, WoNS
Themeda quadrivalvis	Grader Grass	Class B and C, WoNS
Tribulus terrestris	Caltrop	Class B and C
Vachellia nilotica	Prickly Acacia	Class A and C, WoNS

In addition to the species listed in Table 15, a range of grassy weeds are known to occur along road corridors throughout the region. This includes Buffel Grass which was originally introduced for livestock feed and soil stabilisation but has subsequently shown to alter fire regimes and impact biodiversity.

The *Katherine Regional Weeds Strategy 2021-2026* (DEPWS, 2021c) provides strategic approach to reduce the adverse impact of weeds in the Katherine Region. The plan includes a list of weed species that require priority management attention. The nine priority weed species are listed in Table 24. If located, the program EMP requires the Weed Management Branch to be contacted for identification and disposal.

Table 15 Priority weed species identified for the Katherine Region (DEPWS, 2021c)

Scientific Name	Common Name	Declaration
Vachellia nilotica	Prickly Acacia	Class A
Prosopis spp.	Mesquite	Class A
Parthenium hysterophorus	Parthenium	Class A, WoNS
Mimosa pigra	Mimosa	Class A
Cryptostegia grandiflora	Rubber vine	Class A, WoNS

Scientific Name	Common Name	Declaration
Salvinia molesta	Salvinia	Class B
Cylindropuntia spp.	Rope cactus	Class A
Hyparrhenia rufa	Thatch grass	Class A
Sporobolus spp.	Giant rats tail grass	Not Declared

The *Tennant Creek Regional Weeds Strategy* and *Katherine Regional Weeds Strategy* also identifies three alert weed species that potentially occur within the Tamboran permit areas (Table 16). Alert weeds have been identified as the principal threatening weeds to specific regions of the NT.

Table 16 Alert weed species in the Katherine and Tennant Creek regions (DEPWS, 2021b; DEPWS, 2021c).

Scientific name	Common name	Declaration
Themeda quadrivalvis	Grader Grass Class B	Class B
Parthenium hysterophorus	Parthenium	Class A and C, WoNS
Chromolaena odorata	Siam weed	Class C

Weed surveys undertaken during May 2022 field survey focused on the edge of tracks, disturbance areas and along the Stuart and Carpentaria Highways. The following weeds were recorded during the field survey which pose a hygiene and biosecurity risk to the exploration program:

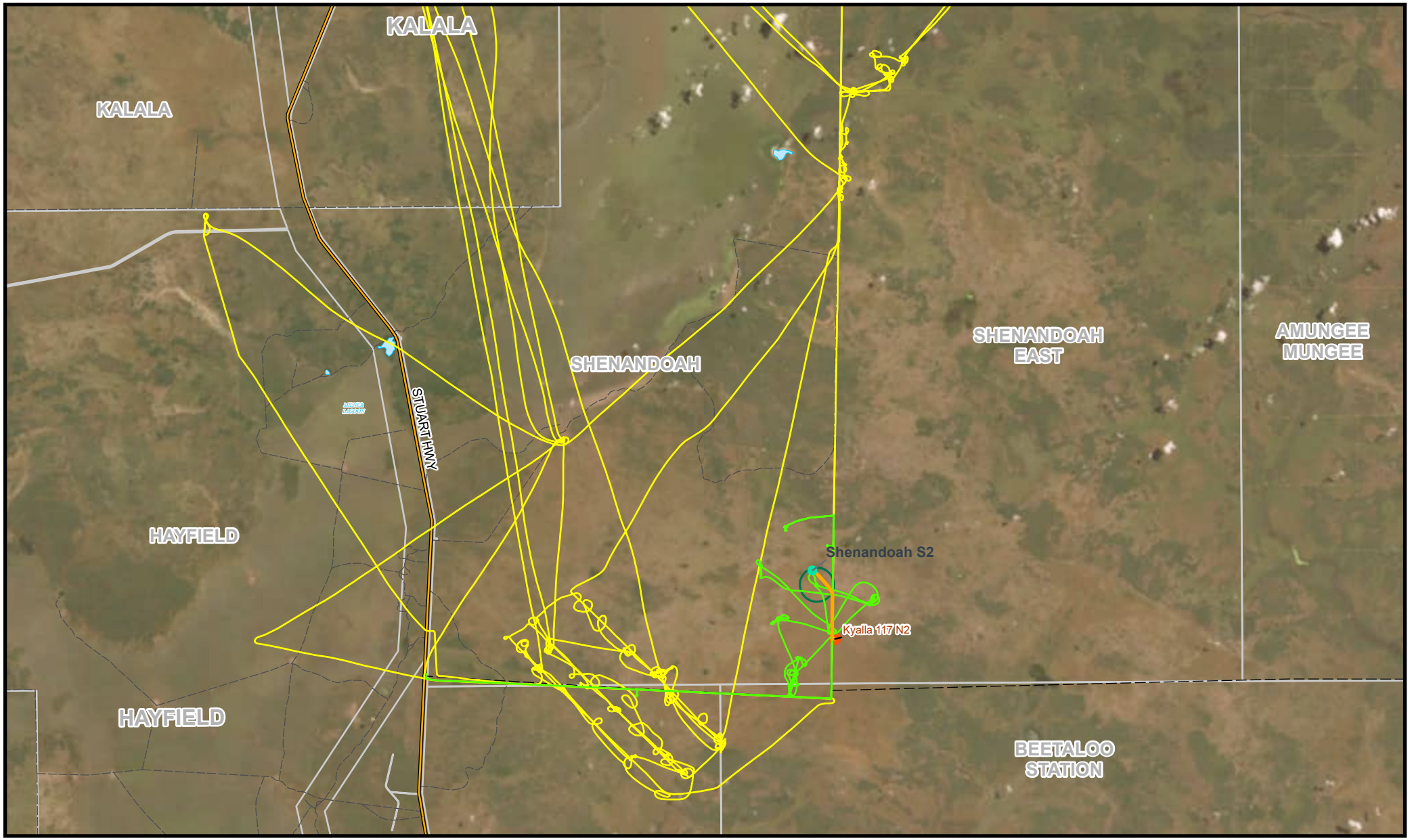
- Hyptis (*Mesosphaerum suaveolens*) – Class B
- Sida (*Sida acuta*) - Class B
- Annual Mission grass (*Cenchrus pedicellatus*) - Environmental weed of concern

The class B weed Hyptis was observed along the Carpentaria Highway and along fence line tracks. Sida was observed predominantly in areas heavily disturbed by cattle, such as where drinking troughs were located.

In the last 12 months, observations along the Stuart Highway between Katherine and Mataranka, have identified an erect woody shrub that has appeared. It is believed this species has potential to become weedy and should be treated by Tamboran as a weed to avoid spreading within the Permit area.

- Kapok bush (*Aerva javanica*) – Not declared (Plate 5).

Plate 5 Kapok bush (*Aerva javanica*) spread on a site near Katherine, NT



AECOM

www.aecom.com

N

GEOCENTRIC DATUM OF AUSTRALIA 94

0 1 2 4

Kilometres

- Proposed Exploration Well Pads
- Shenandoah Lease Pad Area
- Tracks
- Highway
- Water Bodies
- Pastoral Lease Boundary
- March 2023 weed survey track
- December 2022 weed survey track
- Gathering Line

LOCATION

Data sources:
Permit Area, Cadastre - NT Gov 2019.
Places, Vegetation - Aust Gov 2019
Highways, Roads, Drainage - StreetPro

tamboran

Weed Survey

PROJECT ID	60623736
CREATED BY	CummingsL
LAST MODIFIED	22-May-2024
VERSION	1

Figure 14

Filename: \\na.aecomnet.com\ifs\APAC\Melbourne-AUMEL1\Legacy\Groups\WTR\SpatialSys\Projects\2024\Beetaloo\ArcGIS Pro\02_MapProjects\60623736_Shenandoah_FigueUpdates_v1.aprx

4.5 Fauna and Habitat

A search of the Department of Environment, Parks and Water Security (DEPWS) Natural Resource Maps database reveals that a total of 88 fauna species have been recorded within 5 km of the Shenandoah South E&A Program, which includes Shenandoah S2, comprising 76 species of bird, eight reptiles and four mammals.

The recent Strategic Regional Environmental and Baseline Assessment for the Beetaloo Sub-basin (SREBA) surveys identified 354 vertebrate species have been recorded within the region consisting of 202 bird species, 99 reptile species and 39 mammal species and 14 amphibians (Young *et al.*, 2022).

A full list of recorded species is provided – Appendix C (Flora Atlas records) and Appendix D (Fauna Atlas records).

The Shenandoah South E&A Program primarily comprises open woodland consisting of mixed Eucalyptus/Corymbia species with a mixed tussock grass understorey. Often, scattered stands of Bullwaddy/Lancewood communities occur across the proposed sites and individuals of both species are dispersed throughout. In the wider landscape, including proposed access tracks, additional vegetation types include those associated with drainage lines, grasslands/floodplains and *Acacia sp.* shrublands.

*Eucalypt*us/*Corymbia* sp. woodland provides habitat for a range of species. The proposed site has high native grass cover and included numerous species suitable for granivorous birds (seed eaters). Dense leaf litter and numerous logs provide suitable refuge and foraging sites for fauna such as reptiles. Although most of the species found in this vegetation type are widespread in the tropical savannas of the Northern Territory, some such as the threatened Northern Shrike-tit (*Falcunculus whitei*) are rare and known to utilise this habitat (Ward, 2008). Many of the sites have a high density of hollow-bearing trees that provide important habitat for many fauna species. Avoiding clearing large hollow-bearing trees will reduce the impact to native wildlife within the permit area.

The Lancewood/Bullwaddy vegetation community provides shady habitat for fauna within a hot arid landscape, including species species as the Spectacled Hare-Wallaby (*Lagorchestes conspicillatus leichardtii*) and the Northern Nailtail Wallaby (*Onychogalea unguifera*) (PWCNT, 2005).

No fauna sightings to enable identification were recorded within the Shenandoah South E&A Program during the April 2023 field survey. Incidental fauna sightings during the December 2022 field survey identified a total of nine birds and one reptile (Plate 6). Table 26 provides summary of the incidental fauna observations.

Table 17 Incidental fauna observations

Scientific Name	Common name	Survey Site/s Identification
Birds		
Artamus personatus	Masked Woodswallow	Kyalla 117 N1
Cracticus nigrogularis	Pied Butcherbird	Kyalla 98 S1, Kyalla 98 S2, Shenandoah Pad 5, Shenandoah South 3
Dacelo leachii	Blue-winged Kookaburra	Kyalla 117 N1
Merops ornatus	Rainbow Bee-eater	Kyalla 98 S1
Oreoica gutturalis	Crested Bellbird	Kyalla 117 N1
Pachycephala rufiventris	Rufous Whistler	Kyalla 98 S1, Kyalla 98 S2, Kyalla 117 N1, Shenandoah South 2
Pardalotus striatus	Striated Pardalote	Shenandoah South 3
Pomatostomus temporalis	Grey-crowned Babbler	Kyalla 98 S1
Todiramphus sanctus	Sacred Kingfisher	Shenandoah South 3
Reptiles		
Diporiphora magna	Yellow-sided Two-lined Dragon	Kyalla 117 N1

Plate 6 ***Diporiphora magna*** **at Kyalla 117 N1**

4.5.1 Threatened Fauna

A search of the DCCEEW Protected Matters database of nationally significant fauna (PMST) and records from the NT Government Fauna Atlas database (DEPWS, 2023) was undertaken at 10 km and 50 km of the proposed Shenandoah South E&A Program. The search results indicate the potential presence of 18 fauna species listed as threatened under the EPBC Act and/or the TPWC Act at the 50 km. These included ten birds, five mammals, two reptiles and one shark.

The likelihood of occurrence assessment is based on the availability of suitable habitat within the permit area, records in the vicinity and distributional data. Therefore, many of the threatened and migratory fauna species indicated in databases as ‘occurring’ or ‘likely to occur’ have been assessed as unlikely to occur within the project area. A conservative approach has been taken to assess species presence at the S2 site, as the area has not been subject to intensive survey and some species are very cryptic.. A full description of each species, their distribution and habitat associations are outlined in Table 27 below.

Table 18 EPBC and TPWC Listed Threatened Species and Likelihood of Occurrence at the Tamboran Shenandoah South 2 well site

Species	Status		Distribution	Habitat	Likelihood
	EPBC	TPWC			
Birds					
Curlew Sandpiper *Calidris ferruginea*	Marine Migratory CE	VU	In the NT this species occurs around Darwin, north to Melville Island and Cobourg Peninsula, and east and south-east to Gove. It has been recorded inland from Victoria River Downs and around Alice Springs (Higgins & Davies, 1996).	Coastal habitats, inland it has been found around lakes, dams and ephemeral/permanent waterholes.	Unlikely No suitable habitat within project area
Red Goshawk *Erythrotriorchis radiatus*	EN	VU	Found across most of Northern Australia, in the NT most records are from the Top End but there are records from central Australia (Pizzey & Knight, 2012).	Red Goshawks occupy a range of habitats, often at ecotones, including coastal and sub-coastal tall open forest, tropical savannahs crossed by wooded or forested watercourses. In the NT, it inhabits tall open forest/woodland as well as tall riparian woodland (Aumann & Baker-Gabb, 1991).	Unlikely No records and no suitable breeding habitat within the project area
Gouldian Finch *Erythrura gouldiae*	EN	VU	Formerly widespread across northern Australia. In the NT they are found in the Top End south past Daly Waters (Palmer *et al*., 2012).	Gouldian Finches occupy different habitat types in the breeding and non-breeding season. Breeding habitat consists of hillsides with suitable nesting trees. Outside of the breeding season they are found in lowland drainages to feed on suitable perennial grasses (Dostine & Franklin, 2002).	Possible The closest record occurs 75 km east of the project area. Suitable foraging habitat is present
Grey Falcon *Falco hypoleucos*	VU	VU	This species has a widespread distribution and records occur throughout the NT. However, most records are from arid and semi-arid regions (Pizzey & Knight, 2012).	Grey Falcon is typically found on inland drainage systems in lightly treed lowland plains, pastoral lands, timbered watercourses and, occasionally, the driest deserts (DEPWS, 2021d).	Possible The species may forage within the project area but is unlikely to breed

Species	Status		Distribution	Habitat	Likelihood
	EPBC	TPWC			
Northern Shrike-tit *Falcunculus whitei*	VU	NT	This species has been recorded from widely scattered localities from near Timber Creek to the east Gulf Country, north to Kakadu National Park and in north-eastern Arnhem Land (DEPWS, 2021e).	Occupies wet and semi-arid melaleuca and eucalypt open woodlands. May be associated with bloodwoods with flaky bark and ironwood (Ward, 2008).	Possible No records in the vicinity of the project area. Sub-optimal habitat is present. Call-playback surveys failed to detect the species
Painted Honeyeater *Grantiella picta*	VU	VU	This species is migratory based on seasonal variation in occurrence. They breed on the inland slopes of the Great Dividing Range. After the breeding season they sometimes occur in the north-eastern NT, south of the Roper River (Garnett & Baker, 2021).	Painted Honeyeater inhabits woodlands dominated by Acacia and/or Eucalyptus species and open forests but prefers habitats with abundant mature trees that host mistletoes. The species specialises on the fruit of mistletoes although it may also forage on nectar and insects (Garnett *et al.*, 2011).	Possible No recent records occur close to the project area; however suitable habitat is present
Night Parrot *Pezoporus occidentalis*	EN	EN	Night Parrot was once widespread across arid and semi-arid regions. Recent confirmed records of the species come from widely separated locations in western Queensland and Western Australia (DEPWS, 2021f).	This species occupies spinifex grasslands in stony or sandy areas, in ephemeral herblands, samphire and chenopod shrublands on floodplains (DEPWS, 2021f).	Unlikely Suitable habitat does not occur within the project area. No recent records occur within the area
Princess Parrot, Alexandra's Parrot *Polytelis alexandrae*	VU	VU	This species irregularly occurs across the arid zone from near Oodnadatta in South Australia, west to near Coolgardie and the east Murchison River in Western Australia, and north to near the Fitzroy River in Western Australia and to Howell Ponds in the Northern Territory (Higgins 1999; Baxter & Henderson 2000)	Princess Parrot is usually recorded from shrubland in swales between sand dunes, with occupied sites typically having a variety of shrubs (including Grevillea, Hakea, Cassia and Eremophila species) among scattered emergent trees, with a ground-cover of spinifex Triodia species.	Unlikely No recent records occur close to the project area. Suitable habitat limited.

Species	Status		Distribution	Habitat	Likelihood
	EPBC	TPWC			
				The species occurs less often in woodland. The princess parrot forages on the ground and in flowering shrubs and trees (Higgins, 1999; DEPWS, 2021g)	
Australian Painted Snipe *Rostratula australis*	EN	VU	Records of the species occur across the NT. More recent records come from McMinns Lagoon near Darwin, Yellow Waters in Kakadu, the Sturt Plateau, the Barkly and the Tanami (DEPWS, 2021h).	Australian Painted Snipe prefers a habitat of recently flooded temporary vegetated wetlands during the non-breeding period and brackish temporary freshwater wetlands with minimum vegetation during breeding periods. Birds usually forage in thick, low vegetated areas during the day (Curtis *et al*., 2012).	Unlikely Suitable habitat does not occur within the project area
Masked Owl (northern) *Tyto novaehollandiae kimberli*	VU	VU	The subspecies occurs in northern Australia, although its distribution is not well known. In the NT, occurs from Cobourg south to Katherine and the VRD and east to the McArthur River (DEPWS, 2021m).	This species inhabits tall open eucalypt forest in the NT, especially those associated with *Eucalyptus miniata* and *E. tetrodonta (*Woinarski *et al.*, 2007*)*. Also found in riparian and monsoonal forest and rainforest (DEPWS, 2021m).	Unlikely No recent records occur close to the project area and suitable habitat is not present
Mammals					
Northern Quoll *Dasyurus hallucatus*	CE	EN	The species once occurred throughout most of Northern Australia although it is has declined across much of its range (Woinarski & Hill, 2012). In the NT it is found in the Top End as far southeast as Borroloola.	Northern Quolls do not have highly specific habitat requirements although the most suitable appear to be rocky habitats. They occur in a variety of habitats across their range, including open forest and woodland. Daytime den sites provide important shelter. Shelter sites include rocky outcrops, tree hollows, hollow logs, termite mounds, goanna burrows and human dwellings (Woinarski & Hill, 2012).	Unlikely No recent records, occur in the vicinity of the project area and habitat is sub-optimal

Species	Status		Distribution	Habitat	Likelihood
	EPBC	TPWC			
Ghost Bat *Macroderma gigas*	VU	NT	The species' range in northern Australia is from relatively arid conditions in the Pilbara region of Western Australia to humid rainforests of northern Queensland. A large colony occurs in a series of gold mine workings at Pine Creek, NT. This species has also been recorded throughout the mainland Top End north of approximately 17° latitude (DEPWS, 2021i).	The distribution of Ghost Bats is influenced by the availability of suitable caves and mines for roost sites. The species often roosts in a deep crack or cave during the day (DEPWS, 2021i).	Unlikely Suitable habitat does not occur within the project area
Greater Bilby *Macrotis lagotis*	VU	VU	This species occurs in south-western Queensland and in arid north-western Australia (Western Australia and Northern Territory). This species was previously widespread in arid and semi-arid Australia (Pavey, 2006). The most northern records are from Newcastle Waters and Wave Hill (Southgate & Paltridge, 1998).	In the NT, this species is found on sandy soils dominated by spinifex. It also occurs in hummock grassland associated with low lying drainage systems and alluvial areas (Pavey, 2006). Recent surveys in the Beetaloo region have recorded Greater Bilby in Eucalyptus and Corymbia woodlands mixed tussock and hummock grasses in sandy/loam soils (Davis *et al*., 2021).	Unlikely No recent records, occur in the vicinity of the project area and suitable habitat is not present
Bare-rumped Sheath-tailed Bat *Saccolaimus saccolaimus nudicluniatus*	VU	DD	Wide distribution from India through south-eastern Asia to the Solomon Islands, including north-eastern Queensland and the NT. Records of the species in the NT are sparsely scattered across the Top End (DEPWS, 2021j).	Previous specimens have been collected from Open *Pandanus* woodland fringing the sedgelands of the South Alligator River in Kakadu National Park, and from eucalypt woodlands and forests from coastal and adjacent inland areas (DEPWS, 2021j).	Unlikely No recent records, occur in the vicinity of the project area and habitat is not suitable

Species	Status		Distribution	Habitat	Likelihood
	EPBC	TPWC			
Common Brushtail Possum *Trichosurus vulpecula arnhemensis*	VU	NT	The Common Brushtail Possum (northern subspecies) occurs discontinuously from the Gulf of Carpentaria hinterland near Borroloola, NT westward to the Kimberley, WA (TSSC, 2021).	The species occurs mainly in tall eucalypt open forests with large hollow-bearing trees, particularly where the understorey includes some shrubs that bear fleshy fruits (TSSC, 2021).	Possible Recent records of the species occur at nearby Kalala Station and suitable habitat occurs within the project area
Pale Field-rat *Rattus tunneyi*	-	VU	Pale Field-rat inhabits higher rainfall areas of northern and eastern Australia, including the Top End of the NT (Menkhorst & Knight, 2011).	This species favours dense vegetation found along rivers where it occupies burrows in loose colonies (Cole & Woinarski, 2002). Pale Field-rat occurs within a variety of habitats including woodlands if a dense understorey of grasses is present (Menkhorst & Knight, 2011)	Possible One record from 1999 occurs approximately 55 km from the project area. Suitable habitat occurs within the project area
Reptiles					
Plains Death Adder *Acanthophis hawkei*	VU	VU	Fragmented populations of the plains death adder are known to occur in the Mitchell Grass Downs of western Queensland, the Barkly Tableland on the Northern Territory / Queensland border and east of Darwin in the Northern Territory.	Suitable habitat for the plains death adder consists of flat, treeless, cracking-soil riverine floodplains (Cogger, 2000).	Possible No recent record within the vicinity of the project area.
Gulf Snapping Turtle *Elseya lavarackorum*	-	EN	Gulf Snapping Turtle is restricted to rivers draining into the Gulf of Carpentaria, including the Calvert and Nicholson River systems (DEPWS, 2021k)	The species occurs in deep pools in the upper catchments of permanently flowing spring-fed river systems, particularly in areas with intact riparian vegetation (DEPWS, 2021k).	Unlikely No rivers or large permanent water bodies occur within the project area

Species	Status		Distribution	Habitat	Likelihood
	EPBC	TPWC			
Northern Blue-tongue Skink *Tiliqua scincoides intermedia*	CE	-	The northern blue-tongue skink occurs across northern Australia from Eighty Mile Beach in Western Australia (WA), across the southern Kimberley and Top End of the Northern Territory (NT), to approximately the Gregory Downs / Cloncurry area in western Queensland (DCCEEW, 2023a).	The northern blue-tongue skink occurs in a wide variety of ecosystems, including riparian forest, vine scrub, monsoon rainforest, pandanus-lined gorges, melaleuca forest, eucalypt woodland and savanna, sparse and dense shrubland, and spinifex and tussock grassland. GPS tracking has shown that northern blue-tongue skinks move widely across savanna landscapes in the wet-season, but they spend most (~ 95 %) of their time in small, fragmented patches of relatively dense vegetation that provide cool, shaded, and damp conditions (DCCEEW, 2023a).	Possible Recent records occur nearby and suitable habitat occurs within the project area.
Mertens' Water Monitor *Varanus mertensi*	EN	VU	Mertens' Water Monitor has a broad distribution that encompasses coastal and inland waters across the far north of Australia. In the NT, the species has been recorded across most of the Top End and the Gulf region (DEPWS, 2021l).	Mertens' Water Monitor is highly aquatic and rarely ventures more than 5-10 m from the edge of water. The species has been recorded in the following habitat: • Perennial and semi-permanent pools, including springs, seeps, swamps, creeks and gorges, • The margins of permanent streams, rivers and lakes, • Floodplain billabongs, lagoons, swamps and soaks, • Perennial waterholes in woodlands, • Man-made irrigation channels and the margins of dams (DCCEEW, 2023b).	Possible Sparse records at similar latitudes occur across the NT, and suitable habitat is sparsely distributed across the project area.

Species	Status		Distribution	Habitat	Likelihood
	EPBC	TPWC			
Mitchell's Water Monitor *Varanus mitchelli*	CE	VU	Mitchell's water monitor occurs across the wet-dry tropics of northern Australia from the far west Kimberley of WA across the Top End of the NT to far northwest Queensland (DCCEEW, 2023c).	Mitchell's water monitor inhabits freshwater and saline wetlands that range from seasonal gorges in upper catchments to large rivers and coastal floodplains. It is recorded from rivers, creeks, gorges, springs, lagoons, swamps, mangroves, and foreshores (DCCEEW, 2023c).	Unlikely No recent records occur at similar latitudes and the project area appears to be south of the species current distribution.
Yellow-spotted Monitor *Varanus panoptes*	-	VU	Occurs across a broad geographic range across northern Australia. In the NT most records are from the Top End but occurs as far south as Renner Springs (Ward *et al.*, 2012).	Occupies a variety of habitats including coastal beaches, floodplains, grasslands and woodlands (Ward *et al*., 2012).	Possible 2017 records occur approximately 20 km from the project area and suitable habitat is present.
Shark					
Largetooth Sawfish *Pristis pristis* *(previously known as the Freshwater Sawfish)*	VU	VU	Largetooth Sawfish may potentially occur in all large rivers of northern Australia from the Fitzroy River, Western Australia, to the western side of Cape York Peninsula, Queensland. They generally occur in muddy or sandy bottoms of shallow coastal waters, estuaries, river mouths and freshwater rivers and waterholes (DCCEEW, 2015).	This species in northern Australia appears to be confined to freshwater drainages and the upper reaches of estuaries, occasionally being found as far as 400 km from the sea (Thorburn *et al.* 2007; Whitty *et al*. 2008).	Unlikely No rivers or large permanent water bodies occur within the project area.

VU = Vulnerable, EN = Endangered, CE = Critically Endangered, NT = Near Threatened, DD = Data Deficient

No habitat that can be classified as critical to the survival of threatened fauna was identified within the Shenandoah E&A area. However, some species may occur and are known to occur in the wider landscape. Threatened species that potentially occur include:

- Gouldian Finch *Erythrura gouldiae* (Endangered EPBC Act, Vulnerable TPWC Act)
- Grey Falcon *Falco hypoleucos* (Vulnerable EPBC Act and TPWC Act)
- Northern Shrike-tit *Falcunculus whitei* (Vulnerable EPBC Act)
- Painted Honeyeater *Grantiella picta* (Vulnerable EPBC Act and TPWC Act)
- Pale Field-rat *Rattus tunneyi* (Vulnerable TPWC Act)
- Common Brushtail Possum (northern) *Trichosurus vulpecula arnhemensis* (Vulnerable EPBC Act)
- Plains Death Adder *Acanthopsis hawkei* (Vulnerable EPBC ACT and TPWC Act)
- Northern Blue-tingue Skink Tiliqua scincoides intermedia (Critically Endangered EPBC Act)
- Yellow-spotted Monitor *Varanus panoptes* (Vulnerable TPWC Act).

As records of species may be limited in remote areas the precautionary principle has been applied. There are some species that have been assessed as possibly occurring even though their primary habitat is not found within the proposed sites or access tracks. These include species that are associated with ephemeral wetlands, low lying areas that may be seasonally inundated and creeks. During the wet and early dry season these areas may sustain threated species such as wetland birds (including migratory species).

The following provides summary of each threatened species that may potentially occur within the Shenandoah South E&A Program area.

Gouldian Finch

Research has shown that critical components of suitable habitat for the Gouldian Finch include suitable nesting trees during the breeding season (particularly *Eucalyptus tintinnans*, *E. brevifolia* or *E. leucophloia*), a water source and a diverse range of favoured annual and perennial grasses (Dostine & Franklin, 2002).

No nesting habitat was recorded during the surveys, and it is unlikely this species breeds in close vicinity to the exploration areas within the Shenandoah South E&A Program area. During the wet season, Gouldian Finches move from breeding habitat on hillsides with suitable trees down to lower lying areas where they forage on perennial grasses such as *Triodia sp.*, *Alloteropsis semialata*, and *Chrysopogon fallax* (Palmer *et al*. 2012). Some of the perennial grasses were recorded during recent surveys so potential foraging habitat is present; however, there are limited records in the vicinity.

The proposed exploration area, gravel pits and vegetation sites were surveyed for Gouldian Finch, congruent with the Northern Shrike-tit surveys. Call playback was not undertaken for Gouldian Finch. Primary nesting trees such as *Eucalyptus brevifolia*, *Eucalyptus leucophloia* and *Eucalyptus tintinnans* were not observed in the area. Corymbia and Eucalyptus trees that are potentially suitable for nesting and perennial grasses suitable for feeding were observed at several sites. Habitat in the Shenandoah South E&A Program area was moderately suitable for Gouldian Finch but critical habitat was absent. No Gouldian Finch were observed during the bird surveys.

The SREBA species distribution model for Gouldian Finch indicates a low probability of the species occurring throughout most of the project area, as displayed in Figure 27 (Young *et al.*, 2022).

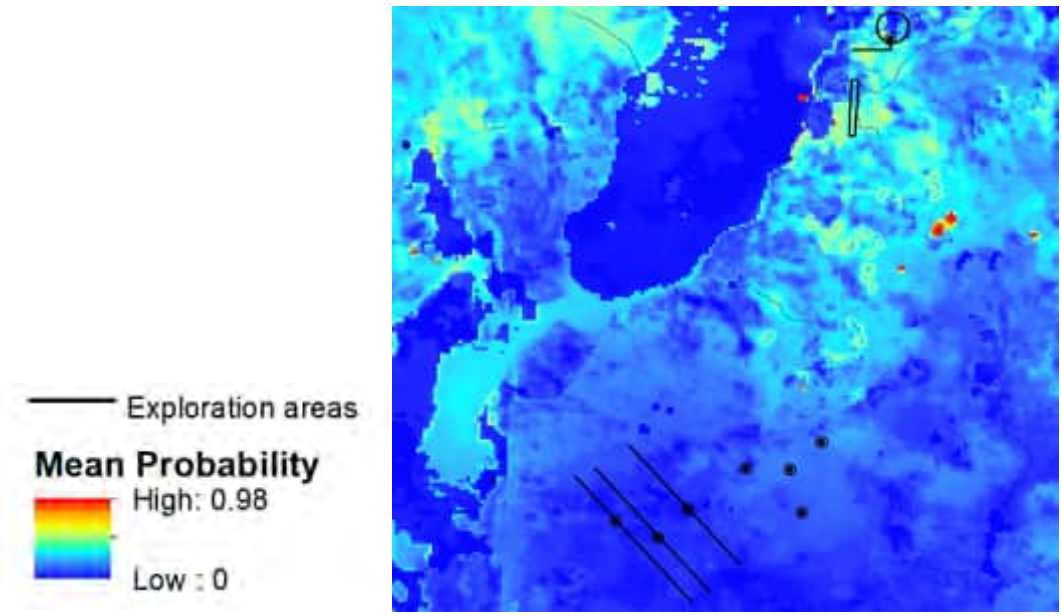


Figure 15 Mean probability of presence of Gouldian Finch within the exploration areas (Young *et al.*, 2022)

Grey Falcon

The Grey Falcon (*Falco hypoleucos*) is a widespread species listed as Vulnerable in the NT and possibly occurs in the study area. The species occurs in low densities throughout arid and semi-arid areas of Australia (DEPWS, 2021d; BirdLife International, 2024). The species is known to nest on repeater towers in the region, including one site located approximately 100 km south-west of Shenandoah South E&A Program where the species bred in 2014 (Jonny Schoenjahn, *pers comm*., 15 December 2022). The species is also known to nest in the tallest trees along watercourses, such as Red River Gums (*Eucalyptus camaldulensis*) (TSSC, 2020). Grey Falcon may forage within the Shenandoah South E&A Program but is unlikely to be impacted by project activities because it is unlikely suitable nesting trees would be cleared.

One repeater tower located within the exploration area next to the Carpentaria Highway was surveyed for Grey Falcon. The species was not detected.

While the risks to Grey Falcon are low, impacts can be reduced by avoiding impacts to known habitat trees (i.e. Red River Gums) which are located along watercourses throughout the region.

Northern Shrike-tit

The Northern Shrike-tit lives in dry Eucalypt forests and woodlands where it feeds on insects from the canopy and also under bark. It has been recorded in wet Melaleuca open woodlands and woodlands dominated by Nutwood (*Terminalia arostrata*) and Bloodwoods with flaky bark and ironwood (Ward, 2008). In the NT, nesting has been recorded from September through to January and nests are built in terminal branches at the top of trees (Ward *et al*., 2009). The stronghold of this species is north of the Shenandoah E&A area, with NR Maps showing only four records south of -16.25° latitude. Targeted surveys by the NT Government in the Beetaloo Basin failed to detect the species south of -16.0° latitude despite significant survey effort (>30 call playback surveys) (Young *et al*., 2022).

Although it is possible the Northern Shrike-tit may be present in the area, it is unlikely to represent an important area for this species.

During the May 2022 and April 2023 field survey call-playback was undertaken for Northern Shrike-tit. Call-playback was undertaken for approximately 5 minutes at all of the proposed exploration well site areas. Following 5 minutes of call playback the area was surveyed for approximately 10 minutes with binoculars. The search area was within 50 m of where call playback was undertaken, covering an approximate 0.8 ha search area. No Northern Shrike-tits have been observed during these surveys.

The targeted call-playback surveys failed to detect the bird at the exploration well site areas or the vegetation assessment sites.

Painted Honeyeater

The Painted Honeyeater (*Grantiella picta*) has been known to occur in the region, however, given it does not breed in the NT it would only be present intermittently for foraging. Suitable habitat for the species potentially occurs within the Shenandoah South E&A Program. The area proposed for clearance is relatively small compared to available suitable habitat within the region.

Pale Field-rat

The Pale Field-rat occurs in a wide range of habitats, including tall grasslands and woodlands (Cole & Woinarski, 2002). There are no recent records of the species within the region; however, this may reflect a lack of survey effort. Suitable habitat for the species occurs within the Shenandoah South E&A Program area. The proposed area of impact is relatively small compared to available suitable habitat within the region.

Common Brushtail Possum

Recent surveys have detected Common Brushtail Possum (*Trichosurus vulpecula arnhemensis*) on Kalala Station (NTG Flora & Fauna, *pers comm.*, 15 December 2022). Suitable woodland habitat is contiguous through the landscape; therefore the species potentially occurs within the Shenandoah South E&A Program. Given the large amount of suitable habitat within the region comparative to the project footprint the risk to regional populations of the species is small.

Plains Death Adder

Suitable habitat for the Plains Death Adder consists of flat, treeless, cracking-soil riverine floodplains (Cogger, 2000). A population of the species occur in the Barkly Tableland from the Northern Territory to central-western Queensland. In the Beetaloo Basin Records of the species occur close to Lake Woods, Lake Sylvester and Lake Tarrabool. The species may occur within the project area, particularly following heavy wet season rainfall.

Northern Blue-tongue Skink

The Northern Blue-tongue Skink occurs in a wide variety of vegetation communities, eucalypt woodland and savanna, sparse and dense shrubland, and spinifex and tussock grassland. Areas of dense vegetation that provide cool and moist conditions within hot, dry, and flammable landscapes are critical habitat for the survival of the species, as such habitat provides the Northern Blue-tongue Skink with food, water and protection from environmental exposure and predation. Examples of such habitat includes rainforest and vine thicket, riparian forests, well-vegetated creeks and drainage lines, well-vegetated swamps and springs, and dense thickets within floodplains, grasslands, shrublands, savannas and woodlands (DCCEEW, 2023a).

Several recent (2020-2022) records of the species occur within 100 km, and suitable habitat occurs within the project area. The Northern Blue-tongue Skink was recently listed as Critically Endangered under the EPBC Act in December 2023, therefore the species has not been assessed under the SREBA assessments.

Yellow-spotted Monitor

The Yellow-spotted Monitor (*Varanus panoptes*) occurs across northern Australia where it occupies a variety of habitats, including grasslands and woodlands (Ward *et al*., 2012). Most records of this species are from the Top End, though it has been recorded in the Barkly Tablelands. The species likely occurs close to wetlands and riparian habitats within the permit areas; however, such habitat won't be impacted by proposed activities.

The SREBA Terrestrial Ecosystem Report developed a species distribution for Yellow-spotted Monitor that indicated low-high probability for the species throughout the north of the project area, while the probability is low in most parts of the south of the project area, as displayed in Figure 28 (Young *et al.*, 2022).

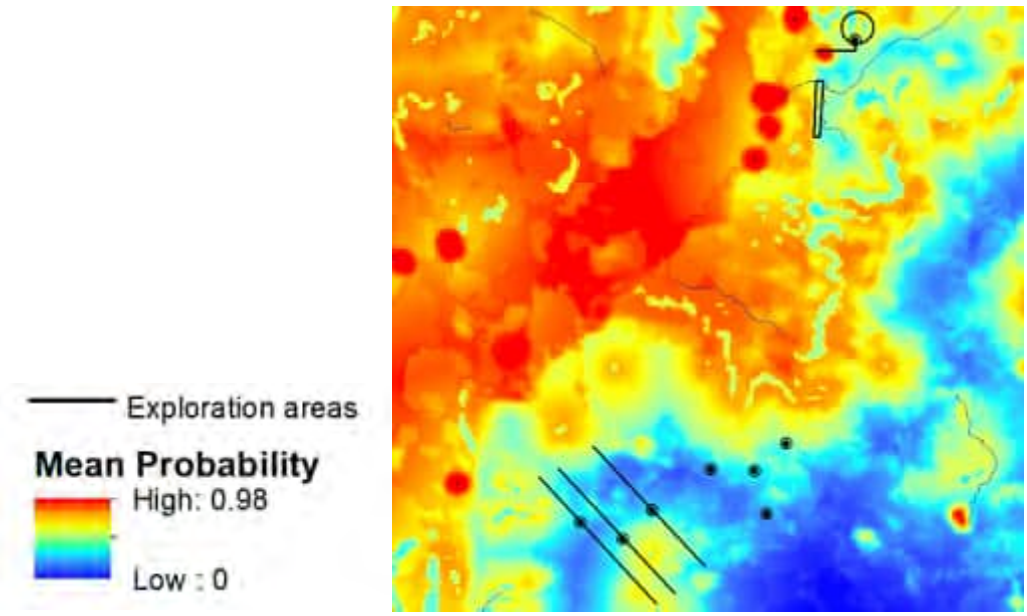


Figure 16 Mean probability of presence of Yellow-spotted Monitor within the exploration area (Young *et al*., 2022)

4.5.2 Migratory and Marine Species

The EPBC Protected Matters database Appendix E) indicated the potential presence of 13 Migratory and 18 Marine listed species within the Shenandoah South E&A Program area (Table 28). Of these species, three are considered likely to occur, nine possibly occur and eight are unlikely to occur within the Shenandoah South E&A Program. Several migratory wetland bird would possibly occur within the area in ephemeral wetlands that would fill up following wet season rainfall. The Shenandoah South E&A Program does not contain critical habitat for any Migratory or Marine listed species.

Table 19 Migratory listed species potentially occurring within the Shenandoah South E&A Program Area

Scientific Name	Common Name	EPBC Act	Likelihood of Occurrence
Actitis hypoleucos	Common Sandpiper	Migratory, Marine	Possible
Anseranas semipalmata	Magpie Goose	Marine	Possible
Apus pacificus	Fork-tailed Swift	Migratory, Marine	Likely
Bubulcus ibis (Ardea ibis)	Cattle Egret	Marine	Likely
Calidris acuminata	Sharp-tailed Sandpiper	Migratory, Marine	Possible
Calidris ferruginea	Curlew Sandpiper	Migratory, Marine	Possible
Calidris melanotos	Pectoral Sandpiper	Migratory, Marine	Possible
Cecropis daurica	Red-rumped Swallow	Migratory, Marine	Unlikely
Charadrius veredus	Oriental Plover	Migratory, Marine	Possible
Chalcites osculans (Chrysococcyx osculans)	Black-eared Cuckoo	Marine	Possible
Cuculus optatus	Oriental Cuckoo	Migratory	Possible
Glareola maldivarum	Oriental Pratincole	Migratory, Marine	Possible
Haliaeetus leucogaster	White-bellied Sea-eagle	Marine	Unlikely
Hirundo rustica	Barn Swallow	Migratory, Marine	Unlikely
Merops ornatus	Rainbow Bee-eater	Marine	Likely
Motacilla cinerea	Grey Wagtail	Migratory, Marine	Unlikely

Scientific Name	Common Name	EPBC Act	Likelihood of Occurrence
Motacilla flava	Yellow Wagtail	Migratory, Marine	Unlikely
Pristis pristis	Freshwater Sawfish	Migratory	Unlikely
Rostratula australis (Rostratula benghalensis)	Australian Painted Snipe	Migratory, Marine	Unlikely

4.5.3 Feral Animals

Feral animals known to occur within the region include:

- Pig (*Sus scrofa*)
- Wild dog (*Canis lupus familiaris*)
- Feral cat (*Felis catus*)
- Cane toad (*Bufo marinus*)
- Horse (*Equus caballus*)
- Donkey (*Equus asinus*)
- Water buffalo (*Bubalus bubalis*)
- Camel (*Camelus dromedarius*)
- Black rat (*Rattus rattus*)
- Domestic cattle (*Bos Taurus*)

During December 2022 and April 2023 field survey evidence of current cattle grazing or grazing within the last 1 to 2 years was recorded at the majority of assessed sites.

The cane toad is known to be present in the project area and the Commonwealth DCCEEW recognises this species as a ‘key threatening process’ related to their impacts on biodiversity through predation, competition, land degradation and poisoning. In the NT, the cane toad has been implicated in the decline of several species including a large number of reptiles such as the Plains Death Adder (*Acanthophis hawkei*), King Brown Snake (*Pseudechis australis*) and Varanus monitors (Smith & Phillips, 2006).

Pest predators such as cats likely occur within the project area, though their abundance is difficult to assess due to their cryptic nature. Introduced predators such as cats can impact many vertebrates (Dickman, 1996 & 2009). One of the primary concerns of introduced predators are the impacts on reptiles and ground-dwelling birds. Feral cats are also believed to be one of the factors that have led to the decline of the threatened ground-dwelling Partridge Pigeon (Woinarski *et al*. 2007).

There is potential for pest species to be attracted to the Shenandoah South E&A program area due to increased site activities causing an abundance in the landscape. Pest controls to minimise potential for pest species include:

- Camp wastes storage to be animal proof.
- All food scraps to be removed from site and disposed of at a licenced facility.
- Food scraps to be frozen and stored within freezer during wet season.
- Water sources are reduced around camps through centralised mess halls.

4.6 Conservation Areas

There are no national or world heritage places, Commonwealth land or heritage places or reserves or critical habitat areas listed under the EPBC Act are located within or adjacent to the exploration area.

The Bullwaddy Conservation Reserve occurs approximately 81-87 km north east of the Shenandoah S2 well site. The Reserve was declared in 2000 and is approximately 11,500 ha in area. It represents the only declared conservation area within the Sturt Plateau region to protect the Lancewood/Bullwaddy vegetation community. Less than 3% of this vegetation community is reserved nationally (PWCNT, 2005). The most significant values of the reserve are the flora and the associated fauna for which it provides habitat. This includes the Spectacled Hare-Wallaby, the Northern Nailtail Wallaby and the Giant Frog (*Cyclorana australis*). It is also a valuable area for research on the ecology of Bullwaddy, particularly the effects of fire (PWCNT, 2005).

Lake Woods is located approximately 91-129 km south-west of the Shenandoah S2 site on Newcastle Waters Station. This wetland is listed as a Site of Conservation Significance by the Department of Land Resource Management and is listed in the Directory of Important Wetlands in Australia. Although Lake Woods is located outside of the project area, it is fed principally by surface inflow of Newcastle Creek, itself originating more than 160 km north-east on Amungee Mungee Station. During the period of inundation, Lake Woods supports over 100,000 waterbirds including internationally significant numbers of Plumed Whistling-Duck (*Dendrocygna eytoni*). Numerous bird species nest and feed in the diverse wetland habitat, and the conservation group 'Birdlife International' nominated Lake Woods as an 'Important Bird Area' (IBA). The lake also includes the largest area of lignum swamp in the Northern Territory and in tropical Australia (Harrison *et al.*, 2009).

4.7 Groundwater Dependent Ecosystems

A search of the National Groundwater Dependent Ecosystems (GDE) Atlas (Bureau of Meteorology, 2023) was conducted in September 2023. The dataset expresses the potential for groundwater interaction/use for river/spring/wetland ecosystems across Australia. It shows the ecosystems that rely on groundwater that has been discharged to the surface, such as baseflow or spring flow.

The Atlas identifies two aquatic GDEs within the Shenandoah South E&A program area, consisting of Newcastle Creek and Yaroo Creek. The Shenandoah S2 program is not anticipated to impacts these GDEs.

The SREBA Beetaloo vegetation map spatial data (DEPWS, 2022a) identifies three broad vegetation groups predominantly occurring within the Beetaloo Basin that are classified as groundwater-dependent ecosystems:

- *Corymbia bella* woodland on alluvial plains
- *Melaleuca* forests (springs, river channels)
- Riparian woodland (ephemeral streams).

Of the three vegetation groups, Melaleuca forests associated with springs and river channels and other Riparian woodlands associated with the ephemeral streams strongly depend on ground water and are considered as riparian vegetation.

Within the Shenandoah E&A program Area, *Corymbia bella* woodland on alluvial plains and Riparian woodland (ephemeral streams) were recorded approximately 14 to 20 km west to the Shenandoah South E&A program area. No other terrestrial GDE's have been recorded within the area.

4.7.1 Stygofauna

Stygofauna comprise aquatic taxa occurring in groundwater aquifers and subterranean water bodies. Stygofauna inhabit and form a component of groundwater dependent ecosystems. Stygofauna are likely to be present in the karstic systems such as the Gum Ridge Formation aquifer where water level is less than 100 m below ground level (Rees *et al.*, 2020).

Stygofauna inhabit the interstitial spaces of the cavities of alluvial, sedimentary and karstic aquifers. The studies by Rees *et al.* (2020) identified and characterised stygofauna assemblages in the Cambrian

limestone aquifer units of the Beetaloo Sub-basin. Data is available that can provide an indication of the likelihood of stygofauna presence, with the following factors determining the distribution of stygofauna:

- Formation type: Stygofauna are predominantly found in aquifers with large (mm or greater) pore spaces, which are more common for alluvial, karstic and some fractured rock aquifers.
- Depth below ground level: The abundance and diversity of stygofauna typically decreases with depth below ground, with fauna being rarely found more than 100 m below ground level.
- Proximity of exchange and recharge: Stygofauna are more abundant in areas of surface water-groundwater exchange, compared to deeper areas or those further along the groundwater flow path remote from areas of exchange or recharge (Hose *et al.*, 2015).

The presence of significant assemblages of stygofauna in the Shenandoah South E&A is considered limited and impacts are unlikely. Stygofauna surveys have been undertaken in the Beetaloo Sub-basin in August and October of 2019 (Rees *et al*, 2020), and during May 2021 and October 2022 (Humphreys *et al.*, 2022). These surveys involved sampling across several bores in the region, including five bores within 50 km of the Shenandoah South E&A. The results of stygofauna surveys at these bores are summarised in Table 20.

Table 20 Stygofauna survey results (Rees *et al*, 2020; Humphreys *et al*., 2022)

Bore	Distance from Shenandoah S2	Summary of results
RN041444	28 km north-west	No stygofauna detected
Hayfield Shenandoah Homestead Bore	10 km north	25 stygofauna identified by DNA: • 6 to family level • 7 to order level • 8 to class level • 4 to phylum level
Sturt Plains Homestead Bore	22 km south-west	11 stygofauna identified by DNA: • 1 to family level • 4 to order level • 5 to class level • 1 to phylum level
RN038816	17 km south-west	18 *Enchytraeidae* sp. (pot worms) detected
RN00592	Greater than 50 km north	2 stygofauna specimens detected: • *Parisia unguis* • *Bathynellaceae Bresvisomabathynella* sp. 1 stygofauna eDNA

The study found two stygofauna specimens (*Parisia unguis* and *Bathynellaceae Bresvisomabathynella* sp.) and stygofauna eDNA from the Carpentaria Highway Roadside Bore (RN00592) located over 50 km north of the Shenandoah S2 area, while there were no reported findings of stygofauna in the Hayfield Homestead bore and the Sturt Plains Homestead bore. However, the study did identify eDNA which may indicate stygofauna presence. The results are consistent with Hose et al (2015), which indicates stygofauna are likely to be present at lower abundance at the observed groundwater depth within the Shenandoah South sites (~106 m below ground level).

4.7.2 Aquatic Ecosystems

Mapping of aquatic ecosystems undertaken by the NT Government indicates that while the majority of the project area can be classified as terrestrial aquatic ecosystems are scattered sparsely scattered throughout. Most of these are classified as floodplain systems, which are seasonally or intermittently flooded areas that have hydric soils and contain vegetation that has adapted to the intermittent presence of water. A smaller portion of the area is classified as a lacustrine system, which are characterised by deep standing or slow-moving water, and have less than 30% of their extent covered by vegetation such as trees, shrubs or persistent emergent vegetation (Humphreys *et al.*, 2022).

4.8 Matters of National Environmental Significance

4.8.1 Potential EPBC Act Controlling Provisions

Actions such as the proposed 2023 Tamboran exploration program may require approval by the Commonwealth Minister for the Environment, under the *EPBC Act*. Approval is only required if the action is likely to result in significant impacts on Matters of National Environmental Significance (MNES) or if the action will have or is likely to have a significant impact on the environment.

Potential triggers under the EPBC Act include a significant impact on:

- The world heritage values of a declared World Heritage Property
- The national heritage values of a listed National Heritage Place
- The ecological character of a declared Ramsar wetland
- A listed Threatened Ecological Community, or its habitat
- The members of a listed threatened species
- The members of a listed migratory species or their habitat
- A water resource, in relation to coal seam gas development and large coal mining development.

4.8.2 Matters of National Environmental Significance

An EPBC Protected Matters Search was generated on the 12 October 2023 (refer Appendix E) to identify whether MNES or other matters protected by the EPBC Act are likely to occur on or in the near vicinity of the project area. Results of the search are provided below in Table 30.

Table 21 Summary of EPBC Aspects for Shenandoah South E&A Program

Aspect	Located within the Shenandoah South E&A Program Area
Matters of National Environmental Significance	
World Heritage Properties	None
National Heritage Places	None
Wetlands of International Significance	None
Great Barrier Marine Park	None
Commonwealth Marine Area	None
Listed Threatened Ecological communities	None
Listed Threatened Species	18
Listed Migratory Species	13
Other Matters Protected by the EPBC Act	
Commonwealth Land	None
Commonwealth Heritage Places	None
Listed Marine Species	18
Whales and other Cetaceans	None
Critical Habitat	None
Commonwealth Reserves Terrestrial	None
Australian Marine Parks	None
Habitat Critical to the Survival of Marine Turtles	None

Aspect	Located within the Shenandoah South E&A Program Area
Extra Information (Information that may also be relevant to the Exploration sites)	
State and Territory Reserves	None
Regional Forest Agreement	None
Nationally Important Wetlands	None
EPBC Act Referrals	1 - Improving rabbit biocontrol: releasing another strain of RHDV, southern two thirds of Australia, Not Controlled Action - Completed
Key Ecological Features (Marine)	None
Biologically Important Areas	None
Bioregional Assessments	None
Geological and Bioregional Assessments	1 - Beetaloo GBA region

Section 4.5 provides details on threatened, migratory and marine fauna species that potentially occur within the Shenandoah S2 well site area. The threatened and migratory species that potentially occur within the area are unlikely to be significantly impacted by the exploration activities.

5.0 Land Condition Assessment

AECOM undertook land condition assessment of the proposed Shenandoah South E&A Program area. The aim of the assessment was to provide a baseline assessment of ecological conditions to support Tamboran's application to the NTG DEPWS to continue exploration activities. Information obtained during the LCA will assist in determining the effectiveness of site rehabilitation once exploration activities have ceased.

The vegetation communities that will be disturbed by the Shenandoah South E&A Program is summarised in Table 22. The vegetation communities planned to be disturbed for the Shenandoah S2 well site area include Community 2a, 2b and 4d. The total area of vegetation in hectares and percent for the buffered area of interest for the Shenandoah South E&A Program is presented, alongside the total vegetation community disturbance for Shenandoah S2.

Table 22 % of Vegetation Community Disturbance for Shenandoah South E&A Program and Shenandoah S2

Vegetation Community Descriptions		Shenandoah South Buffered Area (Ha)	Shenandoah North Buffered Areas (Ha)	Total Vegetation Community in Shenandoah E&A Area (Ha)	Total Vegetation Community Disturbance for Shenandoah S2 (Ha)
Lateritic Plains and Rises with sandy loam kandosol soils					
Comm 1a	*Acacia shirleyi* woodland over *Macropteranthes kekwickii, Terminalia volucris ± Acacia difficilis* shrubland, over open tussock grassland	194	326	520 (8.34%)	-
Comm 2a	*Corymbia dichromophloia ± Erythrophleum chlorostachys* open woodland, over *Acacia difficilis ± Terminalia canescens, Erythrophleum chlorostachys* open shrubland, over hummock grassland	3,385	66	3,451 (55.43%)	26.64 (4.01%)
Comm 2b	*Acacia shirleyi, Corymbia dichromophloia ± Eucalyptus leucophloia, Corymbia polycarpa* open woodland, over *Macropteranthes kekwickii, Petalostigma pubescens, Hakea arborescens* open shrubland, over tussock grassland	912	99	1,011 (16.24%)	7.68 (1.09%)
Comm 2c	*Eucalyptus leucophloia, Corymbia dichromophloia, Acacia shirleyi* woodland over *Dodonaea hispidula, Calytrix exstipulata* open shrubland over open hummock grassland	-	2	2 (0.03%)	-
Comm 3a	*Corymbia polycarpa, Eucalyptus chlorophylla, Acacia shirleyi* open woodland, over *Acacia difficilis, Macropteranthes kekwickii, Erythrophleum chlorostachys* open shrubland, over open tussock grassland	258	102	360 (5.79%)	-

Vegetation Community Descriptions		Shenandoah South Buffered Area (Ha)	Shenandoah North Buffered Areas (Ha)	Total Vegetation Community in Shenandoah E&A Area (Ha)	Total Vegetation Community Disturbance for Shenandoah S2 (Ha)
Drainage floors and relic drainages with clay and alluvial soils					
Comm 4a	*Acacia shirleyi* ± *Eucalyptus pruinosa, Eucalyptus chlorophylla* woodland, over *Melaleuca viridiflora, Eucalyptus pruinosa, Eucalyptus chlorophylla* open shrubland, over open tussock grassland	249	88	337 (5.40%)	-
Comm 4b	*Corymbia polycarpa, Eucalyptus microtheca* low open woodland, over *Melaleuca nervosa, Hakea arborescens, Melaleuca viridiflora* open shrubland, over tussock grassland	89	109	198 (3.18%)	-
Comm 4c	*Melaleuca viridiflora low open woodland +/- Acacia torulosa over Triodia bitextura hummock grassland*	312	-	312 (5.02%)	-
Riparian creek lines with sandy and alluvial soils					
Comm 4d	*Eucalyptus camaldulensis* low woodland over *Melaleuca viridiflora* sparse shrubland over open tussock grassland	26	6	32 (0.52%)	0.18 (0.02%)
Closed drainage, waterholes and swamps					
Comm 4e	*Eucalyptus camaldulensis* open woodland over *Eucalyptus microtheca* open shrubland	-	3	3 (0.05%)	-

During the survey the proposed exploration well site areas, seismic lines and associated access tracks was assessed to be in generally moderate to good condition with no current evidence of weeds, minor erosion, and some disturbance from cattle.

EPBC and TPWC Act Listed Threatened species that have a potential to be encountered within the Shenandoah S2 area:

- Gouldian Finch *Erythrura gouldiae* (Endangered EPBC Act, Vulnerable TPWC Act)
- Grey Falcon *Falco hypoleucos* (Vulnerable EPBC Act and TPWC Act)
- Northern Shrike-tit) *Falcunculus whitei* (Vulnerable EPBC Act)
- Painted Honeyeater *Grantiella picta* (Vulnerable EPBC Act and TPWC Act)
- Pale Field-rat *Rattus tunneyi* (Vulnerable TPWC Act)
- Common Brushtail Possum (northern) *Trichosurus vulpecula arnhemensis* (Vulnerable EPBC Act)
- Plains Death Adder *Acanthopsis hawkei* (Vulnerable EPBC ACT and TPWC Act)
- Yellow-spotted Monitor *Varanus panoptes* (Vulnerable TPWC Act).

Due to a scarcity of records and lack of critical habitat, it is unlikely that significant populations of these species occur within the Shenandoah S2 well site area. It is therefore unlikely threatened species will be significantly impacted from Tamboran's proposed exploration activities. No threated ecological communities are listed within the area.

Mitigation measures are presented in Tamboran's exploration program EMPs and will assist in minimising the impacts from Tamboran's activities on the natural environment and threatened species that may occur within the project area. Detailed land condition description and photographs of the Shenandoah S2 well site area is provided in Table 23.

Table 23 Shenandoah S2 well site land condition description

<table>
<tr><th colspan="6">Shenandoah South 2</th></tr>
<tr><td>Location</td><td>GDA94, Zone 53, 355291E, 8140676N</td><td>Vegetation community</td><td colspan="3">Comm 2a: Corymbia dichromophloia ± Erythrophleum chlorostachys open woodland over Acacia difficilis ± Terminalia canescens, Erythrophleum chlorostachys open shrubland over hummock grassland</td></tr>
<tr><td>Vegetation description</td><td colspan="5">Corymbia dichromophloia and Erythrophleum chlorostachys mid high open woodland, over Erythrophleum chlorostachys, Acacia difficilis and Terminalia canescens mid high open shrubland, over Triodia bitextura hummock grassland.</td></tr>
<tr><td>Basal area (5 sweeps)</td><td colspan="3">Corymbia dichromophloia (16), Erythrophleum chlorostachys (8), Corymbia ferruginea (6), Dead tree (9.5)</td><td>Stand basal area (average)</td><td>6 m²/ha</td></tr>
<tr><td>Landform</td><td>Flat</td><td rowspan="2">Habitat</td><td colspan="3" rowspan="2">Moderate - Common tree hollows and falling logs. Mistletoe and flowering plants absent. Shallow leaf litter.</td></tr>
<tr><td>Slope</td><td>0 %</td></tr>
<tr><td>Disturbance
Fire damage > 2 years ago. No erosion. Minor cattle impacts.
Termite mounds
Nil</td><td colspan="2">  </td><td colspan="3">  </td></tr>
<tr><td>Ground cover
55% vegetation, 2% leaf litter, 43% bare</td><td colspan="2">  </td><td colspan="3">  </td></tr>
<tr><td rowspan="3">Vegetation Structure</td><td colspan="2">Upper storey (8 - 15 m)</td><td colspan="3">Corymbia dichromophloia (13%), Erythrophleum chlorostachys (2%)</td></tr>
<tr><td colspan="2">Mid-storey (0.5 - 3 m)</td><td colspan="3">Erythrophleum chlorostachys (4%), Acacia difficilis (3%), Terminalia canescens (3%)</td></tr>
<tr><td colspan="2">Understorey (0 - 0 5 m)</td><td colspan="3">Triodia bitextura (55%)</td></tr>
<tr><td>Soil texture</td><td colspan="2">Clay Loam Sandy.</td><td colspan="3" rowspan="4">  </td></tr>
<tr><td>Soil drainage</td><td colspan="2">Well drained.</td></tr>
<tr><td>Soil colour</td><td colspan="2">5YR 3/4 dark reddish brown (upper) to 5YR 3/3 dark reddish brown</td></tr>
<tr><td>Soil pH</td><td colspan="2">5.8</td></tr>
</table>

6.0 References

AECOM Australia Pty Ltd. 2015. *Exploration Environmental Plan, Beetaloo Basin, NT*. Unpublished report for Origin Energy Resources Limited, Darwin, NT.

Aldrick JM and Wilson PL. 1990. *Land systems of the Southern Gulf Region, Northern Territory*, Technical Report No. 42, Conservation Commission of the Northern Territory, Palmerston, NT.

Aumann, T. and Baker-Gabb D. 1991. RAOU Report 75. *A Management Plan for the Red Goshawk*. RAOU. Royal Australasian Ornithologists Union, Melbourne.

Baker, B., Price, O., Woinarski, J, Gold, S., Connors., G, Fisher, A. and Hempel, C. 2005. *Northern Territory Bioregions: assessment of key biodiversity values and threats*. Department of Natural Resources, Environment and the Arts, Northern Territory Government.

Baxter, C. and Henderson, R. 2000. *A literature summary of the Princess Parrot Polytelis alexandrae and a suspected recent breeding event in South Australia*, South Australian Ornithologist, vol. 33, pp. 93-108.

BirdLife International. 2024. Species factsheet: *Falco hypoleucos*. https://datazone.birdlife.org/species/factsheet/grey-falcon-falco-hypoleucos.

Bureau of Meteorology. 2022. Northern Territory Weather Observations. Available from http://www.bom.gov.au/nt/observations/index.shtml. Site accessed 29 May 2022.

Bureau of Meteorology. *National Groundwater Dependent Ecosystems (GDE) Atlas*. Available from GDE Atlas Map: Water Information: Bureau of Meteorology (bom.gov.au). Site accessed September 2023.

CloudGMS, 2015. *Beetaloo Basin Hydrogeological Assessment.* Prepared by S. Fulton and A. Knapton, February 2015.

Cogger, H. 2000. Reptiles and Amphibians of Australia (6th edition). Ralph Curtis Publishing.

Cole, J. and Woinarski, J. 2002. *Field Guide to the Rodents and Dasyurids of the Northern Territory*. Surrey Beatty and Sons, Chipping Norton, NSW.

Curtis, Lee K., A. J. Dennis, K. R. McDonald, P. M. Kyne, and Debus S.J.S., Eds. (2012). *Queensland's Threatened Animals*. CSIRO Publishing, Collingswood.

Davis, J, Gillespie, G, Cuff, N, Garcia, E, Andersen, A, Young, L, Leiper, I, Ribot, R, Kennard, M, Pintor, A, Bonney, S, and Wedd, D. 2021. *Beetaloo GBA Region Baseline Survey Program*. Research Institute for Environment & Livelihoods, Charles Darwin University, Darwin, Australia.

Department of Climate Change, Energy, the Environment and Water (DCCEEW). 2015. *Sawfish and River Sharks Multispecies Recovery Plan*. Australian Government, Canberra, ACT.

DCCEEW. 2023a. *Conservation Advice for Tiliqua scincoides intermedia (northern blue-tongue skink)*. Australian Government, Canberra.

DCCEEW. 2023b. *Conservation Advice for Varanus mertensi (Mertens' Water Monitor)*. Australian Government, Canberra.

DCCEEW. 2023c. *Conservation Advice for Varanus mitchelli (Mitchell's Water Monitor)*. Australian Government, Canberra.

DDCCEEW. 2023d. *Directory of Important Wetlands in Australia (DIWA) – Information Sheet – Lake Woods NT013*, Australian Wetlands Database - Directory Wetland Information Sheet (environment.gov.au) [accessed 7 July 2023].

DCCEEW. 2024. *Protected Matters Search Tool*. Australian Government. Canberra. Protected Matters Search Tool: Interactive Map (awe.gov.au). [accessed numerous times between 6 July 2023 to 22 April 2024].

Department of Environment and Natural Resource (DENR). 2018. *Northern Territory Stream Order, Strahler stream orders over the Northern Territory, topographic scale data 250k*, Spatial Data and Mapping Branch, Water Resources Division, Northern Territory Government, Darwin, NT.

Department of Environment, Parks and Water Security (DEPWS). 2021. *Land Clearing Guidelines*. Northern Territory Planning Scheme, Northern Territory Government. Darwin. NT.

DEPWS. 2021a. *Threatened species of the Northern Territory – Tassel sedge Carex fascicularis*. Northern Territory Government. https://nt.gov.au/__data/assets/pdf_file/0020/208424/carex-fascicularis.pdf. [Site accessed 7 March 2024].

DEPWS. 2021b. *Tennant Creek Regional Weeds Strategy*. depws.nt.gov.au/__data/assets/pdf_file/0006/258099/tennant-creek-regional-weeds-strategy.pdf. [Site accessed 6th July 2023].

DEPWS. 2021c. *Katherine Regional Weeds Strategy*. Katherine Regional Weeds Strategy 2021-2026 (nt.gov.au). [Ste accessed 6th July 2023]

DEPWS. 2021d. *Threatened species of the Northern Territory – Grey Falcon Falco hypoleucos*. Northern Territory Government. https://nt.gov.au/__data/assets/pdf_file/0020/206354/grey-falcon.pdf. [Ste accessed 6th July 2023]

DEPWS. 2021e. *Threatened species of the Northern Territory – Crested Shrike-tit (northern) Falcunculus frontatus whitei*. Northern Territory Government. https://nt.gov.au/__data/assets/pdf_file/0004/376168/crested-shrike-tit.pdf. [Ste accessed 6 July 2023]

DEPWS. 2021f. *Threatened species of the Northern Territory – Night Parrot Pezoporus occidentalis*. Northern Territory Government. Threatened species of the Northern Territory - Night parrot (Pezoporus occidentalis) [Ste accessed 14 March 2024]

DEPWS. 2021g. *Threatened species of the Northern Territory – Princess Parrot Polytelis alexandrae*. Northern Territory Government. Threatened species of the Northern Territory - Night parrot (Pezoporus occidentalis) [Ste accessed 14 March 2024]

DEPWS. 2021h. *Threatened species of the Northern Territory – Australian Painted Snipe Rostratula australis*. Northern Territory Government. https://nt.gov.au/__data/assets/pdf_file/0018/206361/australian-painted-snipe.pdf.

DEPWS. 2021i. *Threatened species of the Northern Territory – Ghost Bat Macroderma gigas*. Northern Territory Government. https://nt.gov.au/__data/assets/pdf_file/0010/376138/ghost-bat.pdf

DEPWS. 2021j. *Threatened species of the Northern Territory - Bare-rumped sheath-tailed bat Saccolaimus saccolaimus nudicluniatus*. Northern Territory Government. Available from: https://nt.gov.au/__data/assets/pdf_file/0007/376117/bare-rumped-sheath-tailed-bat.pdf

DEPWS. 2021k. *Threatened species of the Northern Territory - Gulf snapping turtle Elseya lavarackorum*. Northern Territory Government. https://nt.gov.au/__data/assets/pdf_file/0008/376181/gulf-snapping-turtle.pdf

DEPWS. 2021l. *Threatened species of the Northern Territory – Mertens' Water Monitor Varanus mertensi*. Northern Territory Government. https://nt.gov.au/__data/assets/pdf_file/0018/206460/mertens-water-monitor.pdf.

DEPWS. 2021m. *Threatened species of the Northern Territory – Masked Owl (northern mainland) Tyto novaehollandiae kimberli*, Northern Territory Government. Threatened species of the Northern Territory - Masked own (northern mainland) (Tyto novaehollandiae kimberli) [Accessed 10 April 2024].

DEPWS. 2022a, *SREBA Data Catalogue*, https://srebadata.nt.gov.au/ [accessed 6 July 2023].

DEPWS. 2022b, *Regional Report*, Strategic Regional Environmental and Baseline Assessment (SREBA) for the Beetaloo Sub-basin, Northern Territory Government, Darwin NT. https://depws.nt.gov.au/__data/assets/pdf_file/0005/1247018/sreba-beetaloo-regional-report.pdf. [accessed 7 July 2023].

DEPWS. Water Resources Division, 2022c. *Water resources of the Georgina Basin water management area*. Available at: https://hdl.handle.net/10070/900056

DEPWS, 2022d. *Water resources of the Wiso Basin water management area*. Available at: Available at: https://hdl.handle.net/10070/900058

DEPWS. 2023, *Natural Resource Maps*, Geospatial Data. Northern Territory Government. Darwin. NR MAPS (nt.gov.au) [accessed numerous times between 6 July 2023 to 22 April 2024)].

Department of Land Resource Management (DLRM). 2013. *Land Systems of the Southern part of the Northern Territory*. Northern Territory Government.

Dickman, C. R. 1996. *Impact of exotic generalist predators on the native fauna of Australia*. Wildlife Biology 2(3):185-195.

Dickman C.R. 2009. *House cats as predators in the Australian environment: impacts and management*. Human-Wildlife Conflicts 3:41-48.

Dostine, P.L., and Franklin, D.C. 2002. *A comparison of the diet of three finch species in the Yinberrie Hills area, Northern Territory*. *Emu* 102:159-164.

Garnett, S and Baker, G.B. 2021. *The Action Plan for Australian Birds 2020*. CSIRO Publishing.

Garnett, S., J. Szabo & G. Dutson. 2011. *The Action Plan for Australian Birds 2010*. CSIRO Publishing. Collingwood, Victoria.

Harrison, L., McGuire, L., Ward, Simon, Fisher, A., Pavey, C., Fegan, M., Lynch, B., Natural Heritage Trust (Australia) and Northern Territory. Department of Natural Resources, Environment, The Arts And Sport. Biodiversity Conservation Unit. Division of Environment, Heritage and the Arts. (2009, February 19) *Lake Woods*. Northern Territory Government, Palmerston. Retrieved March 2024, from https://hdl.handle.net/10070/532083.

Higgins, P.J. and Davies, S.J.J.F. 1996. *Handbook of Australian. New Zealand and Antarctic Birds, Volume 3, Snipe to Pigeons*. Oxford University Press, Melbourne.

Higgins, P.J. (Ed.). 1999. *Handbook of Australian. New Zealand and Antarctic Birds, Volume 4, Parrots to Dollarbird.* Oxford University Press, Melbourne.

Hose, G.C., Sreekanth, J., Barron, O. and Pollino, C. 2015. *Stygofauna in Australian Groundwater Systems: Extent of Knowledge*. CSIRO, Australia.

HLA-Envirosciences, 2005, *Environmental Management Plan, Onshore Petroleum Exploration, Beetaloo Basin, NT*, Prepared for Sweetpea Petroleum Pty Ltd, NT.

HLA-Envirosciences, 2006, *An Analysis of Available Water Quality Data and Gap Analysis for Beetaloo Basin, Northern Territory*, Prepared for Sweetpea Petroleum Pty Ltd, NT.

Humphreys G, Hamilton Z, Finston T, Hitchen Y. 2022. *Aquatic Ecosystems Baseline Report: Stygofauna. Strategic Regional Environmental and Baseline Assessment for the Beetaloo Sub-Basin*. DEPWS Technical Report 29/2022. Report to Northern Territory Department of Environment, Parks and Water Security. Biota Environmental Sciences and HelixMolecular Solutions.

International Erosion Control Association (IECA). 2008. *Best Practice Erosion and Sediment Control – for building and construction sites*. International Erosion Control Association (Australiasia). Picton. NSW.

Legge, S., Murphy, S. and Heathcote, J. 2008. The Short-term Effects of an Extensive and High-intensity Fire on Vertebrates in the Tropical Savannas of the Central Kimberley, Northern Australia. *Wildlife Research*, Volume. 35, pp. 33-43.

Menkhorst, P. and Knight F. 2011. *A Field Guide to the Mammals of Australia*. Oxford University Press, Sydney.

Northern Territory Government (NTG 2021a), A-Z list of weeds in the NT, List of declared weeds in the NT. https://nt.gov.au/__data/assets/pdf_file/0016/252133/declared-weeds-in-the-nt.pdf. Accessed on July 2023.

Northern Territory Government (NTG 2021 b), Important biodiversity conservation sites, Sites of conservation significance list, https://nt.gov.au/environment/environment-data-maps/important-biodiversity-conservation-sites/conservation-significance-list. [accessed 7 July 2023].

Palmer, C., Woinarski J., and Ward S. 2012. *Threatened Species of the Northern Territory: Gouldian Finch Erythrura gouldiae*. Department of Land Resource Management, Northern Territory Government.

Parks and Wildlife Commission of the NT (PWCNT). 2005. *Bullwaddy Conservation Reserve Plan of Management*, Parks and Wildlife Commission of the NT, Darwin.

Pavey, C. 2006. *National Recovery Plan for the Greater Bilby Macrotis lagotis*. Northern Territory Department of Natural Resources, Environment and the Arts.

Pizzey, G., and Knight, F. 2012. *The Field Guide to Australian Birds*. HarperCollins Publishers, Sydney.

Rees G.N, Oberprieler, S., Nielsen, D., Watson, G., Shackleton, M. and Davis, J.A. 2020. *Characterisation of the stygofauna and microbial assemblages of the Beetaloo Sub-basin, Northern Territory*. CSIRO, Australia.

Richards, C. and Bond, M. (2023) *Environmental Health Baseline Report: Soils. Strategic Regional Environmental and Baseline Assessment for the Beetaloo Sub-basin*. Report prepared for the Northern Territory Department of Environment, Parks and Water Security by Tetra Tech Coffey

Smith, J.G., and Phillips, B.L. 2006.*Toxic tucker: the potential impact of cane toads on Australian reptiles*. Pacific Conservation Biology 12:40-49.

Southgate, R. I. & Paltridge, R. 1998. *Recovery of the Greater Bilby Macrotis lagotis*. Final Report for Project Number 185, Nature Australia, Biodiversity Group, Endangered Species Program and Feral Pests Program.

Thorburn, D.C., Morgan, D.L., Rowland, A.J., Gill, H. S. and Paling, E. 2007. *Life history notes of the critically endangered dwarf sawfish, Pristis clavata*, Garman 1906 from the Kimberley region of Western Australia. Environmental Biology of Fishes.

Threatened Species Scientific Committee (TSSC). 2020. *Falco hypoleucos Grey Falcon Conservation Advice.* Commonwealth Government: https://www.environment.gov.au/biodiversity/threatened/species/pubs/929-conservation-advice-09072020.pdf

Threatened Species Scientific Committee (TSSC). 2021. *Conservation Advice Trichosurus vulpecula arnhemensis Northern Brushtail Possum*. Commonwealth Government.: http://www.environment.gov.au/biodiversity/threatened/species/pubs/83091-conservation-advice-11052021.pdf .

Tickell, S., 2003. Water Resource Mapping of the Barkly Tablelands. Department of Infrastructure, Planning and Environment, Northern Territory Government.

Ward, S.J., 2008. Habitat-use, foraging and breeding ecology of the northern shrike-tit *Falcunculus frontatus whitei*. Report to NHT (Department of Natural Resources, Environment, the Arts and Sport, Darwin).

Ward, S.J., Berghout, M. and Baker, B. 2009. Notes on the form and habitat of nests of the northern shrike-tit. *Northern Territory Naturalist.* Volume 21, pp. 54-60.

Ward, S., Woinarski, J., Griffiths, T. and McKay, L., 2012. *Threatened Species of the Northern Territory: Yellow-spotted Monitor, Northern Sand Goanna, Floodplain Monitor Varanus panoptes*. Department of Land Resource Management, Northern Territory Government.

Ward, S., Woinarski, J., Griffiths, T. and McKay, L. 2012. *Threatened Species of the Northern Territory: Yellow-spotted Monitor, Northern Sand Goanna, Floodplain Monitor Varanus panoptes*. Department of Land Resource Management, Northern Territory Government.

Ward, S. and Phillips, B. 2012. *Threatened Species of the Northern Territory: Plains Death Adder Acanthopsis hawkei*. Northern Territory Department of Environment and Natural Resources, Darwin, NT.

Whitty, J.M., Phillips, N.M., Morgan, D.L., Chaplin, J.A., Thorburn, D.C. and Peverell, S.C., 2008. *Habitat associations of Freshwater Sawfish (Pristis microdon) and Northern River Sharks (Glyphis sp. C): including genetic analysis of P. microdon across northern Australia*. Report to Department of the Environment, Water, Heritage and the Arts. Centre for Fish and Fisheries Research, Murdoch University.

Wilson, S. and Swan, G. 2010. *A Complete Guide to the Reptiles of Australia*. 2010. New Holland, Sydney.

Woinarski, J.C.Z. and Tidemann, S.C., 1991. *The bird fauna of a deciduous woodland in the wet-dry tropics of northern Australia*. *Wildlife Research* 18: 479-500.

Woinarski, J.C.Z. 2004a. *National Multi-species Recovery Plan for the Partridge Pigeon Geophaps smithii smithii, Crested Shrike-tit, Falcunculus frontatus whitei, Masked Owl Tyto novaehollandiae kimberli and Masked Owl Tiwi Islands Tyto novaehollandiae melvillensis 2004-2009*. Northern Territory Department of Infrastructure Planning and Environment. Available http://www.environment.gov.au/biodiversity/threatened/publications/recovery/smithii-whitei-kimberli-melvillensis/index.html.

Woinarski, J.C.Z. 2004b. National Multi-species Recovery Plan for the *Carpentarian Antechinus Pseudantechinus mimulus*, Butler's Dunnart *Sminthopsis butleri* and Northern Hopping-mouse *Notomys aquilo*, 2004 - 2009. Northern Territory Department of Infrastructure Planning and Environment.

Woinarski, J.C.Z, 2006. *Threatened Species of the Northern Territory: Gulf Snapping Turtle*. Department of Environment and Natural Resources, Northern Territory Government.

Woinarski, J.C.Z., Pavey C., Kerrigan R., Cowie I. & Ward S. 2007. *Lost from our Landscape: Threatened Species of the Northern Territory*. Palmerston: Department of Natural Resources, Environment and the Arts.

Woinarski, J. and Hill, B. 2012. *Threatened Species of the Northern Territory: Northern Quoll Dasyurus hallucatus*. Northern Territory Department of Environment and Natural Resources, Northern Territory Government, Darwin, NT.

Woinarski, J.C.Z and Ward, S. 2012. Threatened Species of the Northern Territory: Crested Shrike-tit *Falcunculus (frontatus) whitei*. Department of Land Resource Management, Northern Territory Government.

Young, L, Patykowski, J, Leiper, I, Nano, C, Fisher, A, Gillespie, G, Barnett, G, Buckley, K, Hanrahan, N, McDonald, P, Miller, A, Ribot, R, Ruykys, L, Stewart, A, and Zimny, A., 2022, *Terrestrial Ecosystems Baseline Report. Strategic Regional Environmental and Baseline Assessment for the Beetaloo Sub-basin*, Technical Report 36/2022. Northern Territory Government. Darwin. https://hdl.handle.net/10070/898910 [accessed 6 July 2023].

Appendix A

Soil Material Laboratory Results

Appendix A Soil Material Laboratory Results

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2245889**	Page	: 1 of 5
Client	: **AECOM AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MS ALANA COURT	Contact	: Sepan Mahamad
Address	: GPO BOX 3175 DARWIN NT, AUSTRALIA 0801	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 08 8942 6200	Telephone	: +61 2 8784 8555
Project	: 60667354	Date Samples Received	: 20-Dec-2022 08:30
Order number	: 60667354	Date Analysis Commenced	: 20-Dec-2022
C-O-C number	: ----	Issue Date	: 04-Jan-2023 15:56
Sampler	: WILLIAM RIDDELL		
Site	: ----		
Quote number	: EN/004/21		
No. of samples received	: 13		
No. of samples analysed	: 13		

ilac-MRA NATA
Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Layla Hafner	Acid Sulphate Soils - Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Wisam Marassa	Inorganics Coordinator	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- ALS is not NATA accredited for the analysis of Exchangeable Cations on Alkaline Soils when performed under ALS Method ED006.
- EA058 Emerson: V. = Very, D. = Dark, L. = Light, VD. = Very Dark
- ED007 and ED008: When Exchangeable Al is reported from these methods, it should be noted that Rayment & Lyons (2011) suggests Exchange Acidity by 1M KCl - Method 15G1 (ED005) is a more suitable method for the determination of exchange acidity (H+ + Al3+).

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	Shen South 1, A	Shen South 1, B	Shen South 2, A	Shen South 2, B	Shen South 3, A
			Sampling date / time	15-Dec-2022 00:00	15-Dec-2022 00:00	15-Dec-2022 00:00	15-Dec-2022 00:00	14-Dec-2022 00:00
Compound	CAS Number	LOR	Unit	ES2245889-001	ES2245889-002	ES2245889-003	ES2245889-004	ES2245889-005
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	7.1	7.6	5.8	6.3	6.4
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	16	13	24	13	9
EA058: Emerson Aggregate Test								
Color (Munsell)	----	-	-	Dark Yellowish Brown (10YR 3/4)	Pale Brown (10YR 6/3)	Dark Reddish Brown (5YR 3/4)	Dark Reddish Brown (5YR 3/3)	Dark Reddish Brown (5YR 3/4)
Texture	----	-	-	Sandy Clay Loam	Clay Loam Sandy	Clay Loam Sandy	Clay Loam Sandy	Sandy Clay Loam
Emerson Class Number	EC/TC	-	-	3	6	3	6	3
ED006: Exchangeable Cations on Alkaline Soils								
Exchangeable Calcium	----	0.2	meq/100g	----	2.8	----	----	----
Exchangeable Magnesium	----	0.2	meq/100g	----	1.2	----	----	----
Exchangeable Potassium	----	0.2	meq/100g	----	0.5	----	----	----
Exchangeable Sodium	----	0.2	meq/100g	----	0.5	----	----	----
Cation Exchange Capacity	----	0.2	meq/100g	----	5.1	----	----	----
Exchangeable Sodium Percent	----	0.2	%	----	9.2	----	----	----
ED007: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	1.0	----	1.0	0.7	0.7
Exchangeable Magnesium	----	0.1	meq/100g	0.3	----	0.2	0.3	0.2
Exchangeable Potassium	----	0.1	meq/100g	0.1	----	<0.1	<0.1	<0.1
Exchangeable Sodium	----	0.1	meq/100g	<0.1	----	<0.1	<0.1	<0.1
Cation Exchange Capacity	----	0.1	meq/100g	1.4	----	1.4	1.1	1.0
Exchangeable Sodium Percent	----	0.1	%	1.3	----	1.8	2.0	1.4

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	Shen South 3, B	Shen Pad 4, A	Shen Pad 4, B	Shen Pad 5, A	Shen Pad 5, B
			Sampling date / time	14-Dec-2022 00:00	14-Dec-2022 00:00	14-Dec-2022 00:00	15-Dec-2022 00:00	15-Dec-2022 00:00
Compound	CAS Number	LOR	Unit	ES2245889-006	ES2245889-007	ES2245889-008	ES2245889-009	ES2245889-010
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	6.3	5.3	5.4	5.6	5.9
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	9	15	8	9	7
EA058: Emerson Aggregate Test								
Color (Munsell)	----	-	-	Reddish Brown (5YR 4/4)	Gray (7.5YR 5/1)	Light Gray (10YR 7/1)	Gray (10YR 5/1)	Gray (10YR 6/1)
Texture	----	-	-	Sandy Clay Loam	Sandy Clay Loam	Clay Loam Sandy	Sandy Clay Loam	Sandy Clay Loam
Emerson Class Number	EC/TC	-	-	6	3	6	3	6
ED007: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	0.6	0.5	0.4	0.5	0.5
Exchangeable Magnesium	----	0.1	meq/100g	0.3	0.2	0.2	0.2	0.3
Exchangeable Potassium	----	0.1	meq/100g	<0.1	<0.1	<0.1	<0.1	<0.1
Exchangeable Sodium	----	0.1	meq/100g	<0.1	<0.1	<0.1	<0.1	<0.1
Cation Exchange Capacity	----	0.1	meq/100g	0.9	0.8	0.7	0.8	0.8
Exchangeable Sodium Percent	----	0.1	%	1.7	3.6	2.1	2.0	1.6

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	Kyalia 98 S2, A3	Kyalia 98 S2, B	Kyalia 117 N1, B1	----	----
			Sampling date / time	15-Dec-2022 00:00	15-Dec-2022 00:00	15-Dec-2022 00:00	----	----
Compound	CAS Number	LOR	Unit	ES2245889-011	ES2245889-012	ES2245889-013	--------	--------
				Result	Result	Result	----	----
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	**7.2**	**7.0**	**7.5**	**----**	**----**
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	**17**	**19**	**18**	**----**	**----**
EA058: Emerson Aggregate Test								
Color (Munsell)	----	-	-	**Dark Brown (7.5YR 3/2)**	**Brown (7.5YR 4/2)**	**Brown (7.5YR 4/2)**	**----**	**----**
Texture	----	-	-	**Sandy Loam**	**Sandy Loam**	**Sandy Clay Loam**	**----**	**----**
Emerson Class Number	EC/TC	-	-	**3**	**3**	**3**	**----**	**----**
ED006: Exchangeable Cations on Alkaline Soils								
Exchangeable Calcium	----	0.2	meq/100g	**----**	**----**	**0.5**	**----**	**----**
Exchangeable Magnesium	----	0.2	meq/100g	**----**	**----**	<0.2	**----**	**----**
Exchangeable Potassium	----	0.2	meq/100g	**----**	**----**	<0.2	**----**	**----**
Exchangeable Sodium	----	0.2	meq/100g	**----**	**----**	<0.2	**----**	**----**
Cation Exchange Capacity	----	0.2	meq/100g	**----**	**----**	**0.5**	**----**	**----**
Exchangeable Sodium Percent	----	0.2	%	**----**	**----**	<0.2	**----**	**----**
ED007: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	**1.2**	**0.7**	**----**	**----**	**----**
Exchangeable Magnesium	----	0.1	meq/100g	**0.3**	**0.2**	**----**	**----**	**----**
Exchangeable Potassium	----	0.1	meq/100g	<0.1	<0.1	**----**	**----**	**----**
Exchangeable Sodium	----	0.1	meq/100g	<0.1	<0.1	**----**	**----**	**----**
Cation Exchange Capacity	----	0.1	meq/100g	**1.6**	**1.0**	**----**	**----**	**----**
Exchangeable Sodium Percent	----	0.1	%	**1.1**	**2.3**	**----**	**----**	**----**

Inter-Laboratory Testing

Analysis conducted by ALS Brisbane, NATA accreditation no. 825, site no. 818 (Chemistry) 18958 (Biology).

(SOIL) EA058: Emerson Aggregate Test

CERTIFICATE OF ANALYSIS

Work Order	: **ES2311781**	Page	: 1 of 6
Client	: **AECOM AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MS ALANA COURT	Contact	: Sepan Mahamad
Address	: GPO BOX 3175 DARWIN NT, AUSTRALIA 0801	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 08 8942 6200	Telephone	: +61 2 8784 8555
Project	: 60667354	Date Samples Received	: 12-Apr-2023 08:30
Order number	: 60667354	Date Analysis Commenced	: 15-Apr-2023
C-O-C number	: ----	Issue Date	: 24-Apr-2023 15:20
Sampler	: Tiane Mcquire		
Site	: ----		
Quote number	: EN/004/21		
No. of samples received	: 20		
No. of samples analysed	: 20		

Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Dian Dao	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EA058 Emerson: V. = Very, D. = Dark, L. = Light, VD. = Very Dark
- ED007 and ED008: When Exchangeable Al is reported from these methods, it should be noted that Rayment & Lyons (2011) suggests Exchange Acidity by 1M KCl - Method 15G1 (ED005) is a more suitable method for the determination of exchange acidity (H+ + Al3+).

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	Shen SA - B Horizon	Shen SA - C Horizon	Shenandoah SC - Horizon A	Shenandoah SC - B Horizon	Shenandoah SC - C Horizon
				Sampling date / time	31-Mar-2023 00:00	31-Mar-2023 00:00	31-Mar-2023 00:00	31-Mar-2023 00:00	31-Mar-2023 00:00
Compound	CAS Number	LOR	Unit		ES2311781-001	ES2311781-002	ES2311781-003	ES2311781-004	ES2311781-005
					Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)									
pH Value	----	0.1	pH Unit		7.3	7.1	6.7	7.0	6.8
EA010: Conductivity (1:5)									
Electrical Conductivity @ 25°C	----	1	µS/cm		6	7	8	10	12
EA058: Emerson Aggregate Test									
Color (Munsell)	----	-	-		Dark Brown (7.5YR 3/4)	Dark Reddish Brown (5YR 3/3)	Dark Gray (10YR 4/1)	Brown (10YR 5/3)	Grayish Brown (10YR 5/2)
Texture	----	-	-		Sandy Loam	Sandy Loam	Silty Clay Loam	Clay Loam Sandy	Clay Loam Sandy
Emerson Class Number	EC/TC	-	-		2	2	2	2	2
ED007: Exchangeable Cations									
Exchangeable Calcium	----	0.1	meq/100g		1.8	1.5	3.6	4.4	4.8
Exchangeable Magnesium	----	0.1	meq/100g		0.4	0.5	0.7	1.1	1.6
Exchangeable Potassium	----	0.1	meq/100g		0.2	0.2	0.1	0.1	0.1
Exchangeable Sodium	----	0.1	meq/100g		<0.1	<0.1	<0.1	<0.1	<0.1
Cation Exchange Capacity	----	0.1	meq/100g		2.4	2.2	4.4	5.6	6.5
Exchangeable Sodium Percent	----	0.1	%		<0.1	<0.1	<0.1	0.2	0.4

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	Shenandoah SB - Horizon A	Shenandoah SB - Horizon C	Shen NA - Option 1 - A Horiz	Shen NA - Option 1 - Horiz B	Amungee NW3 - Horiz A
			Sampling date / time	01-Apr-2023 00:00	01-Apr-2023 00:00	01-Apr-2023 00:00	01-Apr-2023 00:00	02-Apr-2023 00:00
Compound	CAS Number	LOR	Unit	ES2311781-006	ES2311781-007	ES2311781-008	ES2311781-009	ES2311781-010
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	**7.0**	**7.4**	**6.5**	**6.3**	**6.5**
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	**17**	**13**	**12**	**8**	**8**
EA058: Emerson Aggregate Test								
Color (Munsell)	----	-	-	**Dark Gray (10YR 4/1)**	**Gray (10YR 6/1)**	**Dark Gray (5YR 4/1)**	**Dark Yellowish Brown (10YR 4/4)**	**Dark Reddish Gray (5YR 4/2)**
Texture	----	-	-	**Clay Loam Sandy**	**Light Medium Clay**	**Clay Loam Sandy**	**Sandy Clay Loam**	**Clay Loam**
Emerson Class Number	EC/TC	-	-	**2**	**2**	**2**	**2**	**2**
ED007: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	**2.2**	**3.4**	**3.4**	**3.8**	**2.3**
Exchangeable Magnesium	----	0.1	meq/100g	**0.4**	**1.2**	**1.5**	**2.3**	**0.5**
Exchangeable Potassium	----	0.1	meq/100g	**0.2**	**0.3**	**0.2**	**0.2**	**0.2**
Exchangeable Sodium	----	0.1	meq/100g	<0.1	<0.1	<0.1	<0.1	<0.1
Cation Exchange Capacity	----	0.1	meq/100g	**2.8**	**4.9**	**5.1**	**6.3**	**3.0**
Exchangeable Sodium Percent	----	0.1	%	<0.1	<0.1	<0.1	**0.3**	<0.1

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	Amungee NW3 - Horiz C	Shenandoah NA - OP 2 - Horiz A	Shenandoah NA - Option 2 - Horiz B	Shenandoah NA - Option 2 - Horiz C	Shenandoah NB - Horiz A
			Sampling date / time	02-Apr-2023 00:00	02-Apr-2023 00:00	02-Apr-2023 00:00	02-Apr-2023 00:00	03-Apr-2023 00:00
Compound	CAS Number	LOR	Unit	ES2311781-011	ES2311781-012	ES2311781-013	ES2311781-014	ES2311781-015
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	**6.9**	**5.8**	**5.6**	**6.2**	**6.2**
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	**14**	**10**	**10**	**9**	**5**
EA058: Emerson Aggregate Test								
Color (Munsell)	----	-	-	**Dark Reddish Brown (5YR 3/4)**	**Gray (7.5YR 5/1)**	**Brown (10YR 5/3)**	**Strong Brown (7.5YR 4/6)**	**Dark Reddish Brown (5YR 3/3)**
Texture	----	-	-	**Silty Loam**	**Clay Loam Sandy**	**Light Medium Clay**	**Medium Clay**	**Clayey Sand**
Emerson Class Number	EC/TC	-	-	**3**	**2**	**2**	**2**	**2**
ED007: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	**3.2**	**1.5**	**1.9**	**2.9**	**1.7**
Exchangeable Magnesium	----	0.1	meq/100g	**0.8**	**0.7**	**1.1**	**1.8**	**0.3**
Exchangeable Potassium	----	0.1	meq/100g	**0.2**	**0.2**	**0.1**	<0.1	**0.2**
Exchangeable Sodium	----	0.1	meq/100g	<0.1	<0.1	<0.1	<0.1	<0.1
Cation Exchange Capacity	----	0.1	meq/100g	**4.2**	**2.4**	**3.1**	**4.7**	**2.2**
Exchangeable Sodium Percent	----	0.1	%	<0.1	<0.1	<0.1	<0.1	<0.1

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	Shenandoah NB - Horiz B	Shenandoah NB - Horiz C	Amungee NW4 - Horizon A	Amungee NW4 - Horizon B	Amungee NW4 - Horizon C
			Sampling date / time	03-Apr-2023 00:00	03-Apr-2023 00:00	03-Apr-2023 00:00	03-Apr-2023 00:00	03-Apr-2023 00:00
Compound	CAS Number	LOR	Unit	ES2311781-016	ES2311781-017	ES2311781-018	ES2311781-019	ES2311781-020
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	**6.2**	**6.1**	**6.8**	**6.9**	**6.9**
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	**6**	**6**	**15**	**12**	**10**
EA058: Emerson Aggregate Test								
Color (Munsell)	----	-	-	**Dark Reddish Brown (5YR 3/4)**	**Reddish Brown (2.5YR 4/4)**	**Dark Reddish Brown (5YR 3/4)**	**Dark Reddish Brown (5YR 3/4)**	**Dark Reddish Brown (5YR 3/4)**
Texture	----	-	-	**Silty Loam**	**Silty Clay Loam**	**Silty Loam**	**Silty Loam**	**Sandy Loam**
Emerson Class Number	EC/TC	-	-	**2**	**3**	**3**	**2**	**2**
ED007: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	**1.1**	**0.8**	**3.1**	**1.8**	**1.4**
Exchangeable Magnesium	----	0.1	meq/100g	**0.3**	**0.5**	**0.6**	**0.5**	**0.5**
Exchangeable Potassium	----	0.1	meq/100g	**0.2**	**0.1**	**0.2**	**0.2**	**0.2**
Exchangeable Sodium	----	0.1	meq/100g	<0.1	<0.1	<0.1	<0.1	<0.1
Cation Exchange Capacity	----	0.1	meq/100g	**1.6**	**1.4**	**3.9**	**2.4**	**2.2**
Exchangeable Sodium Percent	----	0.1	%	<0.1	<0.1	<0.1	<0.1	<0.1

Inter-Laboratory Testing

Analysis conducted by ALS Brisbane, NATA accreditation no. 825, site no. 818 (Chemistry) 18958 (Biology).

(SOIL) EA058: Emerson Aggregate Test

Appendix B

Vegetation Community Description

Appendix B Vegetation Community Description

Shenandoah S2 Well Site Area

Community 2a - *Corymbia dichromophloia ± Erythrophleum chlorostachys* mid high open woodland, over *Acacia difficilis ± Terminalia canescens, Erythrophleum chlorostachys* mid high open shrubland, over *Triodia bitextura, Aristida hygrometrica, Chrysopogon fallax* mid high hummock grassland

Upper 1: Mid high open woodland dominated by *Corymbia dichromophloia ± Erythrophleum chlorostachys*

Mid 1: Mid high open shrubland dominated by *Acacia difficilis ± Terminalia canescens, Erythrophleum*

Ground 1: Mid high hummock grassland dominated by *Triodia bitextura, Aristida hygrometrica, Chrysopogon fallax*

No. of sites: (46) Shen S A, Ground 8, Ground 16, Ground 17, ground 24, Ground 40, Ground 41, Ground 43, Ground 60, Ground 61, Ground 66, Ground 68, Air 1, Air 2, Air 4, Air 5, Air 6, Air 7, Air 11, Air 12, Air 19, Air 20, Air 21, Air 22, Air 23, Air 25, Air 28, Air 34, Air 35, Air 36, Air 37, Air 38, Air 39, Air 42, Air 46, Air 47, Air 49, Air 58, Air 62, Air 63, Air 64, Air 65, Shen S2, 3, 4, 5

Other common species

Upper stratum (U1): *Acacia shirleyi, Eucalyptus chlorophylla*

Mid stratum (M1): *Grevillea parallela, Dodonaea hispidula, Ehretia saligna, Acacia drepanocarpa subsp. latifolia, Acacia thomsonii, Acacia gonoclada, Brachychiton diversifolius, Brachychiton paradoxus, Grewia savannicola, Macropteranthes kekwickii, Persoonia falcata, Petalostigma pubescens, Wrightia saligna*

Ground stratum (G1): *Aristida inaequiglumis, Setaria surgens, Corchorus sidoides, Eriachne ciliata, Mnesithea formosa*

Landform: Lateritic Plains and Rises -associated with deeply weathered profiles (laterite) including sand sheets and other depositional products, sandy and earth soils

Soil: Brown sandy loam kandosol soils.

Total area of the survey area: 3,385.2 ha (62.40%)

Community structural summary

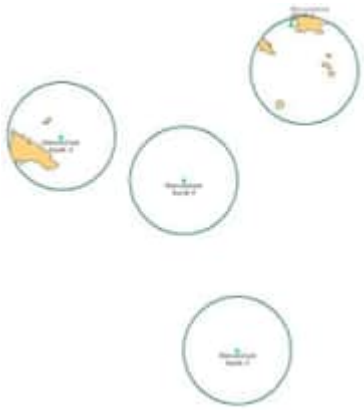
Strata	Modal growth form	Mean cover %	Mean height (m)
Upper U1	Tree	14 (8 – 16)	12.2 (12 – 14)
Mid M1	Shrub	21 (10 – 30)	6.2 (6 – 7)
Ground G1	Tussock grass	37 (15 – 70)	0.5

Community 2b - *Acacia shirleyi, Corymbia dichromophloia ± Eucalyptus leucophloia, Corymbia polycarpa* mid high open woodland, over *Macropteranthes kekwickii, Petalostigma pubescens, Hakea arborescens* mid high open shrubland, over *Chrysopogon fallax, Mnesithea formosa, Eriachne ciliata* mid high tussock grassland

Upper 1: Mid high open woodland dominated by *Acacia shirleyi, Corymbia dichromophloia ± Eucalyptus leucophloia, Corymbia polycarpa*

Mid 1: Mid high open shrubland dominated by *Macropteranthes kekwickii, Petalostigma pubescens, Hakea arborescens*

Ground 1: Mid high tussock grassland dominated by *Chrysopogon fallax, Mnesithea formosa, Eriachne ciliata*



No. of sites: (15) Shen S C Well, Air 3, Air 15, Air 18, Air 26, Air 30, Air 32, Air 33, Air 45, Air 48, Air 51, Air 56, Air 67, Air 171 (incorporated veg description from Shenandoah North), Shen S 4

Other common species

Upper stratum (U1): *Ventilago viminalis*

Mid stratum (M1): *Calytrix exstipulata, Eucalyptus chlorophylla, Terminalia volucris*

Ground stratum (G1): *Sorghum intrans, Eulalia aurea*

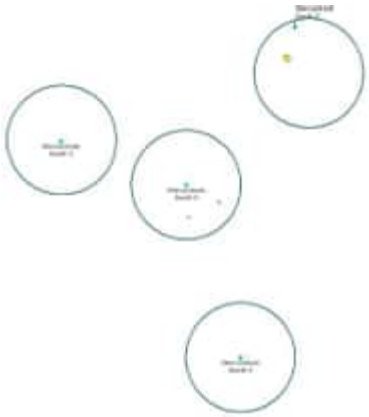
Landform: Lateritic Plains and Rises -associated with deeply weathered profiles (laterite) including sand sheets and other depositional products, sandy and earth soils

Soil: Brown sandy loam kandosol soils.

Total area of the survey area: 912.17 ha (16.81%)

Community structural summary

Strata	Modal growth form	Mean cover %	Mean height (m)
Upper U1	Tree	17 (10 – 35)	12
Mid M1	Shrub	17.8 (7 – 20)	6.3 (5 – 8)
Ground G1	Tussock grass	65 (60 – 70)	0.5

Community 3a - *Corymbia polycarpa, Eucalyptus chlorophylla, Acacia shirleyi* mid high open woodland, over *Acacia difficilis, Macropteranthes kekwickii, Erythrophleum chlorostachys* mid high open shrubland, over *Aristida sp1, Aristida sp3* mid high open tussock grassland	
Upper 1: Mid high open woodland dominated by *Corymbia polycarpa, Eucalyptus chlorophylla, Acacia shirleyi*	
Mid 1: Mid high open shrubland dominated by *Acacia difficilis, Macropteranthes kekwickii, Erythrophleum chlorostachys*	
Ground 1: Mid high open tussock grassland dominated by *Aristida hygrometrica, Aristida contorta*	
	
No. of sites: (4) Shen S B Well, Ground 27, Air 52, Air 53	
Other common species	
Upper stratum (U1): -	
Mid stratum (M1): *Atalaya hemiglauca*	
Ground stratum (G1): *Pterocaulon serrulatum, Grewia savannicola*	
Landform: Lateritic Plains and Rises -associated with deeply weathered profiles (laterite) including sand sheets and other depositional products, sandy and earth soils	
Soil: Brown sandy loam kandosol soils.	
Total area of the survey area: 258.05 ha (4.76%)	
Community structural summary	

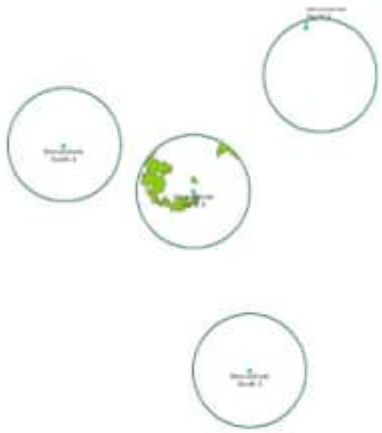
Strata	Modal growth form	Mean cover %	Mean height (m)
Upper U1	Tree	16	12
Mid M1	Shrub	20 (15 – 25)	5
Ground G1	Tussock grass	15	0.5

Community 4b - *Corymbia polycarpa, Eucalyptus microtheca* low open woodland, over *Melaleuca nervosa, Hakea arborescens, Melaleuca viridiflora* mid high open shrubland, over *Aristida contorta, Waltheria indica, Eriachne armitii* mid high tussock grassland

Upper 1: Low open woodland dominated by *Corymbia polycarpa, Eucalyptus microtheca*

Mid 1: Mid high open shrubland dominated by *Melaleuca nervosa, Hakea arborescens, Melaleuca viridiflora*

Ground 1: Mid high tussock grassland dominated by *Aristida contorta, Waltheria indica, Eriachne armitii*



No. of sites: (3) Ground 29, Ground 54, Ground 59

Other common species

Upper stratum (U1): -

Mid stratum (M1): *Acacia difficilis, Acacia holosericea, Macropteranthes kekwickii*

Ground stratum (G1): *Aristida hygrometrica, Eulalia aurea, Setaria surgens*

Landform: Drainage floors and relic drainages associated with clay and alluvial soils

Soil: Brown clay soils

Total area of the survey area: 88.79 ha (1.64%)

Community structural summary

Strata	Modal growth form	Mean cover %	Mean height (m)
Upper U1	Tree	8	9.6 (7 – 12)
Mid M1	Shrub	26.6 (20 – 40)	5.3 (5 – 6)
Ground G1	Tussock grass	31.6 (15 – 60)	0.5

Appendix C

Flora Atlas Species Records

Appendix C Flora Atlas Species Records

Table 24 Native flora recorded within 5 km of the project area

Family	Genus	Species
ACANTHACEAE	*Dicliptera*	*armata*
	Hygrophila	*angustifolia*
AMARANTHACEAE	*Achyranthes*	*aspera*
	Alternanthera	*denticulata*
	Alternanthera	*nana*
	Alternanthera	*nodiflora*
	Ptilotus	*fusiformis*
	Ptilotus	*polystachyus*
	Ptilotus	*spicatus*
APOCYNACEAE	*Carissa*	*lanceolata*
	Cynanchum	*viminale*
	Marsdenia	*australis*
	Marsdenia	*geminata*
	Marsdenia	*viridiflora*
	Secamone	*elliptica*
ASTERACEAE	*Bidens*	*bipinnata*
	Pterocaulon	*serrulatum*
	Pterocaulon	*sphacelatum*
BIGNONIACEAE	*Dolichandrone*	*heterophylla*
BORAGINACEAE	*Ehretia*	*saligna*
	Heliotropium	*ramulipatens*
CAPPARACEAE	*Capparis*	*lasiantha*
	Capparis	*umbonata*
CARYOPHYLLACEAE	*Polycarpaea*	*breviflora*
CELASTRACEAE	*Denhamia*	*cunninghamii*
	Denhamia	*obscura*
CLEOMACEAE	*Cleome*	*viscosa*
COMBRETACEAE	*Macropteranthes*	*kekwickii*
	Terminalia	*canescens*
	Terminalia	*volucris*
COMMELINACEAE	*Commelina*	*ciliata*
	Cyanotis	*axillaris*
CONVOLVULACEAE	*Bonamia*	*pannosa*
	Evolvulus	*alsinoides*

CONVOLVULACEAE	*Ipomoea*	*argillicola*
	Ipomoea	*diamantinensis*
	Ipomoea	*eriocarpa*
	Ipomoea	*gracilis*
	Ipomoea	*polymorpha*
	Polymeria	*longifolia*
	Xenostegia	*tridentata*
CUCURBITACEAE	*Cucumis*	*melo*
CYPERACEAE	*Bulbostylis*	*barbata*
	Cyperus	*carinatus*
	Cyperus	*tenuispica*
	Eleocharis	*atropurpurea*
	Eleocharis	*brassii*
	Fimbristylis	*depauperata*
	Fimbristylis	*laxiglumis*
	Fimbristylis	*microcarya*
	Fimbristylis	*phaeoleuca*
	Schoenoplectiella	*dissachantha*
	Schoenoplectiella	*laevis*
ELATINACEAE	*Bergia*	*pedicellaris*
ERIOCAULACEAE	*Eriocaulon*	*cinereum*
EUPHORBIACEAE	*Euphorbia*	*australis*
	Euphorbia	*bifida*
	Excoecaria	*parvifolia*
FABACEAE	*Abrus*	*precatorius*
	Acacia	*ancistrocarpa*
	Acacia	*hammondii*
	Acacia	*lysiphloia*
	Acacia	*monticola*
	Acacia	*shirleyi*
	Acacia	*stenophylla*
	Aeschynomene	*indica*
	Bauhinia	*cunninghamii*
	Chamaecrista	*absus*
	Crotalaria	*medicaginea*
	Crotalaria	*montana*
	Desmodium	*muelleri*
	Dichrostachys	*spicata*

FABACEAE	*Erythrophleum*	*chlorostachys*
	Flemingia	*parviflora*
	Galactia	*tenuiflora*
	Neptunia	*gracilis*
	Neptunia	*monosperma*
	Petalostylis	*cassioides*
	Rhynchosia	*minima*
	Sesbania	*cannabina*
	Sesbania	*muelleri*
	Tephrosia	*brachyodon*
	Vigna	*lanceolata*
	Vigna	*sp. McDonald Downs Station*
	Zornia	*muriculata*
GOODENIACEAE	*Goodenia*	*byrnesii*
	Goodenia	*minutiflora*
	Goodenia	*strangfordii*
	Goodenia	*viscidula*
	Scaevola	*browniana*
	Scaevola	*ovalifolia*
HYDROLEACEAE	*Hydrolea*	*zeylanica*
LAMIACEAE	*Clerodendrum*	*floribundum*
LORANTHACEAE	*Amyema*	*sanguinea*
LYTHRACEAE	*Ammannia*	*multiflora*
	Rotala	*diandra*
MALVACEAE	*Abutilon*	*fraseri*
	Abutilon	*hannii*
	Brachychiton	*paradoxus*
	Corchorus	*aestuans*
	Corchorus	*sidoides*
	Grewia	*retusifolia*
	Herissantia	*crispa*
	Hibiscus	*meraukensis*
	Hibiscus	*sturtii*
	Melhania	*oblongifolia*
	Sida	*brachypoda*
	Sida	*rohlenae*
	Sida	*spinosa*
	Triumfetta	*micracantha*

MALVACEAE	*Waltheria*	*indica*
MARSILEACEAE	*Marsilea*	*angustifolia*
MENISPERMACEAE	*Tinospora*	*smilacina*
MENYANTHACEAE	*Nymphoides*	*crenata*
	Nymphoides	*indica*
MYRTACEAE	*Corymbia*	*dichromophloia*
	Corymbia	*ferruginea*
	Corymbia	*flavescens*
	Corymbia	*polycarpa*
	Corymbia	*setosa*
	Eucalyptus	*chlorophylla*
	Eucalyptus	*cyanoclada*
	Eucalyptus	*microtheca*
	Eucalyptus	*tectifica*
	Lophostemon	*grandiflorus*
NYCTAGINACEAE	*Boerhavia*	*coccinea*
	Boerhavia	*dominii*
ONAGRACEAE	*Ludwigia*	*perennis*
PHRYMACEAE	*Mimulus*	*gracilis*
	Uvedalia	*linearis*
PHYLLANTHACEAE	*Breynia*	*cernua*
	Flueggea	*virosa*
	Margaritaria	*dubium-traceyi*
	Phyllanthus	*exilis*
	Phyllanthus	*hebecarpus*
	Phyllanthus	*maderaspatensis*
	Synostemon	*rhytidospermus*
	Synostemon	*trachyspermus*
PICRODENDRACEAE	*Petalostigma*	*pubescens*
PLANTAGINACEAE	*Bacopa*	*floribunda*
POACEAE	*Acrachne*	*racemosa*
	Aristida	*calycina*
	Aristida	*holathera*
	Aristida	*inaequiglumis*
	Aristida	*latifolia*
	Aristida	*pruinosa*
	Aristida	*queenslandica*
	Brachyachne	*convergens*

POACEAE	*Chrysopogon*	*fallax*
	Cymbopogon	*bombycinus*
	Dactyloctenium	*radulans*
	Dichanthium	*fecundum*
	Dichanthium	*sericeum*
	Digitaria	*brownii*
	Digitaria	*gibbosa*
	Ectrosia	*scabrida*
	Elytrophorus	*spicatus*
	Enneapogon	*decipiens*
	Enneapogon	*lindleyanus*
	Enneapogon	*oblongus*
	Enneapogon	*pallidus*
	Enneapogon	*polyphyllus*
	Enneapogon	*purpurascens*
	Eragrostis	*cumingii*
	Eragrostis	*tenellula*
	Eriachne	*armittii*
	Eriachne	*obtusa*
	Eulalia	*aurea*
	Heteropogon	*contortus*
	Imperata	*cylindrica*
	Iseilema	*macratherum*
	Iseilema	*membranaceum*
	Iseilema	*vaginiflorum*
	Mnesithea	*formosa*
	Oryza	*australiensis*
	Oryza	*rufipogon*
	Panicum	*decompositum*
	Panicum	*effusum*
	Panicum	*latzii*
	Panicum	*mindanaense*
	Paspalidium	*gracile*
	Paspalidium	*rarum*
	Schizachyrium	*fragile*
	Sehima	*nervosum*
	Sorghum	*plumosum*
	Sorghum	*timorense*

POACEAE	*Sporobolus*	*australasicus*
	Themeda	*avenacea*
	Triodia	*bitextura*
	Urochloa	*holosericea*
	Whiteochloa	*capillipes*
POLYGALACEAE	*Polygala*	*barbata*
	Polygala	*longifolia*
	Polygala	*pterocarpa*
PONTEDERIACEAE	*Monochoria*	*cyanea*
PORTULACACEAE	*Portulaca*	*bicolor*
	Portulaca	*filifolia*
PROTEACEAE	*Grevillea*	*parallela*
	Hakea	*arborescens*
PTERIDACEAE	*Cheilanthes*	*nudiuscula*
	Cheilanthes	*tenuifolia*
RHAMNACEAE	*Alphitonia*	*excelsa*
RUBIACEAE	*Spermacoce*	*argillacea*
	Spermacoce	*breviflora*
	Spermacoce	*dolichosperma*
	Spermacoce	*stenophylla*
SANTALACEAE	*Santalum*	*lanceolatum*
SAPINDACEAE	*Atalaya*	*hemiglauca*
	Cardiospermum	*halicacabum*
	Dodonaea	*hispidula*
	Dodonaea	*lanceolata*
	Dodonaea	*physocarpa*
	Dodonaea	*stenophylla*
SOLANACEAE	*Solanum*	*tumulicola*
STYLIDIACEAE	*Stylidium*	*adenophorum*
VITACEAE	*Cayratia*	*trifolia*
ZYGOPHYLLACEAE	*Tribulopis*	*pentandra*
	Tribulus	*terrestris*

Appendix D

Fauna Atlas Species Records

Appendix D Fauna Atlas Species Records

Table 25 Native fauna recorded within 5 km of project area

Scientific Name	Common Name
Birds	
Accipiter fasciatus	Brown Goshawk
Aegotheles cristatus	Australian Owlet-nightjar
Aprosmictus erythropterus	Red-winged Parrot
Apus pacificus	Fork-tailed Swift
Aquila audax	Wedge-tailed Eagle
Ardeotis australis	Australian Bustard
Artamus cinereus	Black-faced Woodswallow
Artamus minor	Little Woodswallow
Burhinus grallarius	Bush Stone-curlew
Calyptorhynchus banksii macrorhynchus	Red-tailed Black-cockatoo (north-western)
Chalcites osculans	Black-eared Cuckoo
Chlamydera nuchalis	Great Bowerbird
Cincloramphus mathewsi	Rufous Songlark
Circus assimilis	Spotted Harrier
Cissomela pectoralis	Banded Honeyeater
Climacteris melanurus	Black-tailed Treecreeper
Colluricincla harmonica	Grey Shrike-thrush
Conopophila rufogularis	Rufous-throated Honeyeater
Coracina maxima	Ground Cuckoo-shrike
Coracina novaehollandiae	Black-faced Cuckoo-shrike
Coracina papuensis	White-bellied Cuckoo-shrike
Corvus bennetti	Little Crow
Corvus orru	Torresian Crow
Coturnix ypsilophora	Brown Quail
Cracticus nigrogularis	Pied Butcherbird
Dacelo leachii	Blue-winged Kookaburra
Daphoenositta chrysoptera	Varied Sittella
Dicaeum hirundinaceum	Mistletoebird
Entomyzon cyanotis	Blue-faced Honeyeater
Eolophus roseicapilla	Galah
Eurystomus orientalis	Dollarbird
Falco berigora	Brown Falcon
Falco cenchroides	Nankeen Kestrel

Scientific Name	Common Name
Gavicalis virescens	Singing Honeyeater
Geopelia cuneata	Diamond Dove
Geopelia humeralis	Bar-shouldered Dove
Geopelia placida	Peaceful Dove
Gerygone olivacea	White-throated Gerygone
Grallina cyanoleuca	Magpie-lark
Gymnorhina tibicen	Australian Magpie
Hamirostra melanosternon	Black-breasted Buzzard
Lalage tricolor	White-winged Triller
Lichmera indistincta	Brown Honeyeater
Malurus lamberti	Variegated Fairy-wren
Malurus melanocephalus	Red-backed Fairy-wren
Manorina flavigula	Yellow-throated Miner
Melanodryas cucullata	Hooded Robin
Melithreptus albogularis	White-throated Honeyeater
Melithreptus gularis	Black-chinned Honeyeater
Merops ornatus	Rainbow Bee-eater
Microeca fascinans	Jacky Winter
Milvus migrans	Black Kite
Myiagra nana	Paperbark Flycatcher
Myiagra rubecula	Leaden Flycatcher
Nymphicus hollandicus	Cockatiel
Ocyphaps lophotes	Crested Pigeon
Oreoica gutturalis	Crested Bellbird
Pachycephala rufiventris	Rufous Whistler
Pardalotus rubricatus	Red-browed Pardalote
Pardalotus striatus	Striated Pardalote
Philemon citreogularis	Little Friarbird
Podargus strigoides	Tawny Frogmouth
Poephila acuticauda	Long-tailed Finch
Poliocephalus poliocephalus	Hoary-headed Grebe
Pomatostomus temporalis	Grey-crowned Babbler
Ptilotula flavescens	Yellow-tinted Honeyeater
Ptilotula keartlandi	Grey-headed Honeyeater
Ptilotula plumula	Grey-fronted Honeyeater
Rhipidura leucophrys	Willie Wagtail
Scythrops novaehollandiae	Channel-billed Cuckoo

Scientific Name	Common Name
Smicrornis brevirostris	Weebill
Struthidea cinerea	Apostlebird
Taeniopygia bichenovii	Double-barred Finch
Todiramphus pyrrhopygius	Red-backed Kingfisher
Turnix pyrrhothorax	Red-chested Button-quail
Turnix velox	Little Button-quail
Mammals	
Lagorchestes conspicillatus	Spectacled Hare-wallaby
Leggadina lakedownensis	Northern Short-tailed Mouse
Onychogalea unguifera	Northern Nailtail Wallaby
Planigale maculata	Common Planigale
Reptiles	
Amalosia rhombifer	Zig-zag Gecko
Ctenotus spaldingi	Straight-browed Ctenotus
Heteronotia binoei	Bynoe's Gecko
Lucasium stenodactylum	Sand-plain Gecko
Rhynchoedura ornata	Western Beaked Gecko
Strophurus ciliaris	Northern Spiny-tailed Gecko
Suta punctata	Little Spotted Snake
Varanus tristis	Black-headed Monitor

Appendix E

Protected Matters Search Report 10 km and 50 km

Appendix E Protected Matters Search Report 10 km

Australian Government

Department of Climate Change, Energy, the Environment and Water

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 08-Mar-2024

Summary

Matters of National Environment Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	17
Listed Migratory Species:	13

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	17
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

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

State and Territory Reserves:	None
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	1
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Listed Threatened Species			[Resource Information]
Status of Conservation Dependent and Extinct are not MNES under the EPBC Act. Number is the current name ID.			
Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Erythrotriorchis radiatus Red Goshawk [942]	Endangered	Species or species habitat may occur within area	In feature area
Erythrura gouldiae Gouldian Finch [413]	Endangered	Species or species habitat likely to occur within area	In feature area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area	In feature area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat known to occur within area	In feature area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area	In feature area
Tyto novaehollandiae kimberli Masked Owl (northern) [26048]	Vulnerable	Species or species habitat may occur within area	In feature area
MAMMAL			

Scientific Name	Threatened Category	Presence Text	Buffer Status
Macroderma gigas			
Ghost Bat [174]	Vulnerable	Species or species habitat may occur within area	In feature area
Macrotis lagotis			
Greater Bilby [282]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Saccolaimus saccolaimus nudicluniatus			
Bare-rumped Sheath-tailed Bat, Bare-rumped Sheathtail Bat [66889]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Trichosurus vulpecula arnhemensis			
Northern Brushtail Possum [83091]	Vulnerable	Species or species habitat likely to occur within area	In feature area
REPTILE			
Acanthophis hawkei			
Plains Death Adder [83821]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Tiliqua scincoides intermedia			
Northern Blue-tongued Skink [89838]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Varanus mertensi			
Mertens' Water Monitor, Mertens's Water Monitor [1568]	Endangered	Species or species habitat may occur within area	In feature area
Varanus mitchelli			
Mitchell's Water Monitor [1569]	Critically Endangered	Species or species habitat may occur within area	In feature area
SHARK			
Pristis pristis			
Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat may occur within area	In feature area

Listed Migratory Species			[Resource Information]
Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
Apus pacificus			
Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Migratory Marine Species			

Scientific Name	Threatened Category	Presence Text	Buffer Status
Pristis pristis			
Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat may occur within area	In feature area
Migratory Terrestrial Species			
Cecropis daurica			
Red-rumped Swallow [80610]		Species or species habitat may occur within area	In feature area
Cuculus optatus			
Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area	In feature area
Hirundo rustica			
Barn Swallow [662]		Species or species habitat may occur within area	In feature area
Motacilla cinerea			
Grey Wagtail [642]		Species or species habitat may occur within area	In feature area
Motacilla flava			
Yellow Wagtail [644]		Species or species habitat may occur within area	In feature area
Migratory Wetlands Species			
Actitis hypoleucos			
Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area
Calidris acuminata			
Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area	In feature area
Calidris ferruginea			
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Calidris melanotos			
Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
Charadrius veredus			
Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Glareola maldivarum](#) Oriental Pratincole [840]		Species or species habitat may occur within area	In feature area

Other Matters Protected by the EPBC Act

Listed Marine Species			[Resource Information]
Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
[Actitis hypoleucos](#) Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area
[Anseranas semipalmata](#) Magpie Goose [978]		Species or species habitat may occur within area overfly marine area	In feature area
[Apus pacificus](#) Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
[Bubulcus ibis as Ardea ibis](#) Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
[Calidris acuminata](#) Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area	In feature area
[Calidris ferruginea](#) Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Calidris melanotos](#) Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
[Cecropis daurica as Hirundo daurica](#) Red-rumped Swallow [80610]		Species or species habitat may occur within area overfly marine area	In feature area
[Chalcites osculans as Chrysococcyx osculans](#) Black-eared Cuckoo [83425]		Species or species habitat may occur within area overfly marine area	In feature area
[Charadrius veredus](#) Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area overfly marine area	In feature area
[Glareola maldivarum](#) Oriental Pratincole [840]		Species or species habitat may occur within area overfly marine area	In feature area
[Haliaeetus leucogaster](#) White-bellied Sea-Eagle [943]		Species or species habitat may occur within area	In feature area
[Hirundo rustica](#) Barn Swallow [662]		Species or species habitat may occur within area overfly marine area	In feature area
[Merops ornatus](#) Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
[Motacilla cinerea](#) Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area	In feature area
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area overfly marine area	In feature area

Extra Information

EPBC Act Referrals				[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action				
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In buffer area only

Caveat

1 PURPOSE

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

The report contains the mapped locations of:

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

2 DISCLAIMER

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

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

3 DATA SOURCES

Threatened ecological communities

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

Threatened, migratory and marine species

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

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

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

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

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

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

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

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

Acknowledgements

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

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

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

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

Department of Climate Change, Energy, the Environment and Water
GPO Box 3090
Canberra ACT 2601 Australia
+61 2 6274 1111

Appendix E Protected Matters Search Report 50 km

Australian Government

Department of Climate Change, Energy, the Environment and Water

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 08-Mar-2024

Summary

Matters of National Environment Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	22
Listed Migratory Species:	13

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	18
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

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

State and Territory Reserves:	None
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	1
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Listed Threatened Species			[Resource Information]
Status of Conservation Dependent and Extinct are not MNES under the EPBC Act. Number is the current name ID.			
Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Erythrotriorchis radiatus Red Goshawk [942]	Endangered	Species or species habitat may occur within area	In feature area
Erythrura gouldiae Gouldian Finch [413]	Endangered	Species or species habitat likely to occur within area	In feature area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat known to occur within area	In feature area
Falcunculus frontatus whitei Crested Shrike-tit (northern), Northern Shrike-tit [26013]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat known to occur within area	In feature area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Polytelis alexandrae](#) Princess Parrot, Alexandra's Parrot [758]	Vulnerable	Species or species habitat may occur within area	In buffer area only
[Rostratula australis](#) Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area	In feature area
[Tyto novaehollandiae kimberli](#) Masked Owl (northern) [26048]	Vulnerable	Species or species habitat may occur within area	In feature area
MAMMAL			
[Dasyurus hallucatus](#) Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat may occur within area	In buffer area only
[Macroderma gigas](#) Ghost Bat [174]	Vulnerable	Species or species habitat may occur within area	In feature area
[Macrotis lagotis](#) Greater Bilby [282]	Vulnerable	Species or species habitat known to occur within area	In feature area
[Saccolaimus saccolaimus nudicluniatus](#) Bare-rumped Sheath-tailed Bat, Bare-rumped Sheathtail Bat [66889]	Vulnerable	Species or species habitat may occur within area	In buffer area only
[Trichosurus vulpecula arnhemensis](#) Northern Brushtail Possum [83091]	Vulnerable	Species or species habitat likely to occur within area	In feature area
REPTILE			
[Acanthophis hawkei](#) Plains Death Adder [83821]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
[Elseya lavarackorum](#) Gulf Snapping Turtle [67197]	Endangered	Species or species habitat may occur within area	In buffer area only
[Tiliqua scincoides intermedia](#) Northern Blue-tongued Skink [89838]	Critically Endangered	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Varanus mertensi			
Mertens' Water Monitor, Mertens's Water Monitor [1568]	Endangered	Species or species habitat may occur within area	In feature area
Varanus mitchelli			
Mitchell's Water Monitor [1569]	Critically Endangered	Species or species habitat may occur within area	In feature area
SHARK			
Pristis pristis			
Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat may occur within area	In feature area

Listed Migratory Species		[Resource Information]	
Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
Apus pacificus			
Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Migratory Marine Species			
Pristis pristis			
Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat may occur within area	In feature area
Migratory Terrestrial Species			
Cecropis daurica			
Red-rumped Swallow [80610]		Species or species habitat may occur within area	In feature area
Cuculus optatus			
Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area	In feature area
Hirundo rustica			
Barn Swallow [662]		Species or species habitat may occur within area	In feature area
Motacilla cinerea			
Grey Wagtail [642]		Species or species habitat may occur within area	In feature area
Motacilla flava			
Yellow Wagtail [644]		Species or species habitat may occur within area	In feature area
Migratory Wetlands Species			

Scientific Name	Threatened Category	Presence Text	Buffer Status
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area	In feature area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area	In feature area

Other Matters Protected by the EPBC Act

Listed Marine Species			[Resource Information]
Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area overfly marine area	In feature area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
Cecropis daurica as Hirundo daurica Red-rumped Swallow [80610]		Species or species habitat may occur within area overfly marine area	In feature area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat known to occur within area overfly marine area	In feature area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area overfly marine area	In feature area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area overfly marine area	In feature area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area	In feature area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Merops ornatus](#) Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
[Motacilla cinerea](#) Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area	In feature area
[Motacilla flava](#) Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area	In feature area
[Rostratula australis as Rostratula benghalensis (sensu lato)](#) Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area overfly marine area	In feature area
Reptile			
[Crocodylus johnstoni](#) Freshwater Crocodile, Johnston's Crocodile, Johnstone's Crocodile [1773]		Species or species habitat may occur within area	In buffer area only

Extra Information

EPBC Act Referrals [Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action				
[Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia](#)	2015/7522	Not Controlled Action	Completed	In buffer area only

Caveat

1 PURPOSE

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

The report contains the mapped locations of:

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

2 DISCLAIMER

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

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

3 DATA SOURCES

Threatened ecological communities

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

Threatened, migratory and marine species

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

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

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

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

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

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

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

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

Acknowledgements

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

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

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

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

Department of Climate Change, Energy, the Environment and Water
GPO Box 3090
Canberra ACT 2601 Australia
+61 2 6274 1111

Appendix I Cultural Heritage Assessment

AECOM Australia Pty Ltd
Larrakia Country
Level 3, 9 Cavenagh Street
Darwin NT 0800
GPO Box 3175
Darwin NT 0801
Australia
www.aecom.com

+61 1800 868 654 tel
+61 8 8942 6299 fax
ABN 20 093 846 925

24 September 2024

Commercial-in-Confidence

Tamboran B2 Pty Ltd

Cultural Heritage Assessment - Shenandoah South 2

1.0 Introduction

AECOM Australia Pty Ltd (AECOM) has been commissioned by Tamboran B2 Pty Ltd (Tamboran) to conduct heritage assessments of potential development areas in the Northern Territory to expand their gas exploration program in the Beetaloo Sub-basin. To date, AECOM have undertaken extensive site investigations in four potential development area: Amungee North-West, Shenandoah North, Shenandoah South, and Kyalla (the study areas). The proposed works fall within exploration permit (EP) areas EP98 and EP117, south-east of Daly Waters in the Beetaloo Sub-basin, Northern Territory.

A report was initially prepared for Tamboran for the clearing and placement of well site infrastructure, including but not limited to well pads, pipeline and gathering lines, access track, camp pad, helipad, laydown areas, groundwater bores, site turn-ins, firebreaks / fence lines, and associated infrastructure in accordance with the Regulation 5 of the Petroleum (Environment) Regulations 2016. This abridged report version focusses on the heritage assessment of the Shenandoah S2 site as it specifically relates to the placement of the Sturt Plateau compression facility (SPCF) on the repurposed 5.0 ha laydown area, adjacent to the Shenandoah S2 well pad (Figure 1).

A heritage assessment for this location was completed in accordance with relevant legislation (see Appendix A). The assessments involved desktop reviews of existing heritage data from the Australian Heritage database, the NT Heritage Branch and archaeological survey reports, as well as targeted field inspections of potential works areas by representatives of AECOM and Bamarrnganja Traditional Owners. The findings of these assessments have previously been reported in a larger heritage assessment (AECOM Australia Pty Ltd, 2023a, 2023b, 2023c, 2024).

2.0 Project Location and Overview

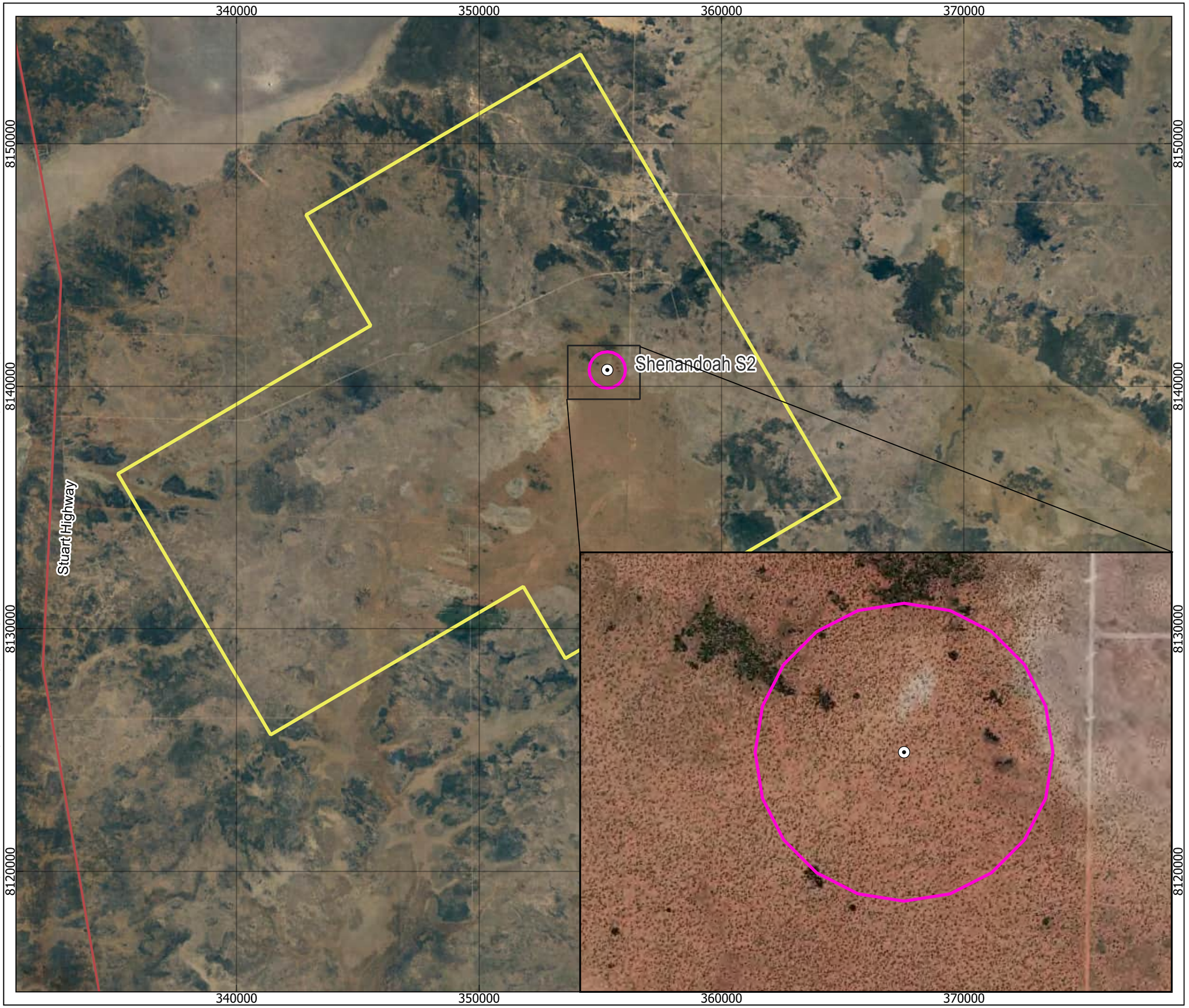
Tamboran is proposing to expand their gas exploration program in the Beetaloo Sub-basin. As part of these development efforts, a heritage site assessment was requested for one well pad (the Project) (Table 1, Figure 1).

Table 1 Project Coordinates

Name	Potential Works	Centroid Datum: GDA94 Zone 53	
		Easting	Northing
Shenandoah S2	Well Pad	355291	8140676

The proposed activity at each location may include any or all of the regulated activities specified under Regulation 5 of the *Petroleum (Environment) Regulations 2016*.

For the purposes of this assessment, a 750 m buffer has been established around the potential well pad, and is henceforth referred to as the Well Site. This Well Site has been established to entirely encompass the likely impacts associated with Project works (Figure 1).



AECOM
www.aecom.com

0 1 2 3 4 5 km

1:147,522
(when printed at A3)

LEGEND

Main Roads

Study Areas

Kyalla

Tamboran Potential Works Locations

Well Pads

Shenandoah South 2

Well Site

Shenandoah South 2

Data Sources:
AECOM
Google Satellite

CRS:
GDA94 Zone 53

Tamboran B2 Pty Ltd
2022 - 2023 Heritage Scouting

Shenandoah S2

PROJECT ID	60667354
CREATED BY	KC
LAST MODIFIED	15-5-2024
VERSION	2

Figure 1

3.0 Existing Data Sources

Information on the location of heritage sites across the region was obtained from a review of:

- Native Title claims and Indigenous Land Use Agreements over the Study Areas
- Commonwealth heritage registers (Australian Heritage Database)
- Registered archaeological sites on the Northern Territory Heritage Register
- Known sacred sites managed by the Aboriginal Areas Protection Authority (AAPA)
- Past archaeological survey reports and assessments undertaken within the local area.

3.1 Native Title

One Native Title determination extends across the Well Site (see Table 2).

Table 2 Native title current for Study Areas

Name	Tribunal No	Fed Court Number	Outcome	Native Title Holders
Shenandoah Pastoral Lease	DCD2012/007	NTD21/2010	Native Title exists in parts of the determination area	Kinbininggu; Bamarrnganja;

3.2 Australian Heritage Database

A search of the Australia Heritage Database on 7 June 2023 identified that there are no statutory or non-statutory heritage places within of adjacent to the Well Site.

3.3 Northern Territory Heritage Register

A search of the public aspects of the Northern Territory Heritage Register (NTHR) on 7 June 2023 did not identify any heritage places or artefacts within or adjacent to the Well Site.

As part of the wider heritage assessments in the Beetaloo Basin (AECOM 2024), two requests were lodged with the Northern Territory Heritage Branch for a search of confidential aspects of the NTHR, one on 23 February 2023, and one on 27 April 2023. Responses on 6 March 2023 and 11 May 2023 identified that there are no nominated, provisionally declared, or declared Aboriginal archaeological or Macassan heritage places or objects within the wider study areas (Appendix B).

3.4 Aboriginal Areas Protection Authority

Aboriginal Areas Protection Authority (AAPA) Authority Certificate C2023/049 applies to Tamboran exploration activities in the Kyalla study area. These AAPA certificates will identify the extent of recognised sacred sites and established Restricted Works Areas, none of which overlap with the Well Site.

3.4 Previous Archaeological Investigations

The majority of archaeological investigations near the Well Site have been associated with either linear infrastructure parallel to the Stuart Highway, or to natural gas exploration activities associated with the Beetaloo Basin. Of the assessments relevant to the Project, the majority of heritage sites identified are artefact scatters composed of commonly found local raw material (quartz, silcrete and quartzite). One stone arrangement has also been recorded. AECOM has been involved in numerous other heritage assessments in the Beetaloo Basin, including assessments on the Shenandoah-Hayfield leases and adjacent properties with similar physiographic contexts.

Table 3 provides a summary of previous archaeological investigations undertaken in the local area.

Table 3 Previous archaeological assessments relevant to the Study Areas

Researchers	Assessment Type	Locality	Key Findings
Smith (1986)	Excavation	Lake Woods	*In situ* artefacts dated to 6,000 years.

Researchers	Assessment Type	Locality	Key Findings
Hermes (1986)	Survey	Amadeus Basin to Katherine	Large scale survey for a proposed natural gas pipeline targeting areas of major cultural sensitivity from Daly Waters to Katherine. 32 sites were identified with the majority being artefact scatters associated with watercourses.
Quaternary Archaeological Surveys (1998)	Survey	Stuart Highway to Mataranka Homestead	Large scale survey for a fibre optic cable corridor. Three isolated artefacts and one historic heritage site identified.
Heritage Surveys (1999)	Survey	Daly Waters to McArthur River	Nine archaeological sites identified including rockshelters and artefact scatters.
HLA Envirosciences (HLA) (2006a, 2006b, 2006c, 2006d, 2007)	Survey	Beetaloo Basin	Several archaeological sites identified across the exploration permits including artefact scatters, isolated artefacts and stone cairns. Assessments developed a preliminary predictive model based on site modelling and landform.
AECOM (2011, 2012a, 2012b)	Survey	Beetaloo Basin	Several archaeological sites identified during clearance of seismic lines and exploratory drill locations including large artefact scatters (>1km), quarry sites and isolated artefacts. Predictive model refined and used in the field to identify 'hot spots' of Indigenous archaeological significance.
AECOM (2014)	Survey	Beetaloo Basin	Heritage assessment for Origin exploration wells including areas within EP98. One isolated artefact identified.
AECOM (2015)	Survey	Beetaloo Basin	Large scale survey for four drill hole locations. One large artefact scatter and three smaller artefact scatters identified.
AECOM (2019)	Survey	Beetaloo Basin	Heritage assessment for proposed exploration lease areas, including those on the Shenandoah pastoral lease. No surface archaeology was identified within the Shenandoah lease area.
AECOM (2020)	Survey	Beetaloo Basin	Heritage assessment for seismic survey areas for nearby EP136. Survey assessment identified 25 Aboriginal archaeological sites including large artefact scatters associated with Newcastle Creek. Based on the findings of the assessment, AECOM identified the following landforms as being sensitive for Aboriginal cultural heritage: • Non-flood prone areas adjacent to established watercourses • Areas with distinctive vegetation patterning, such as those areas associated with *Macropteranthes kekwickii* (bullwaddy) • Adjacent to flood plains where a noticeable change in vegetation is identified • On the periphery of lagoons and 'chain of ponds' features.

Researchers	Assessment Type	Locality	Key Findings
AECOM (2021)	Survey	Beetaloo Basin	Heritage assessment for seismic survey areas for Amungee NW-1 and Velkerri 76 S2, occurring nearby the Amungee NW Study Area. A targeted survey assessment identified nine Aboriginal archaeological sites. These sites occurred in areas surrounding soaks and depressions, and in non-flood prone areas adjacent to drainage channels.

4.0 Survey Methodology

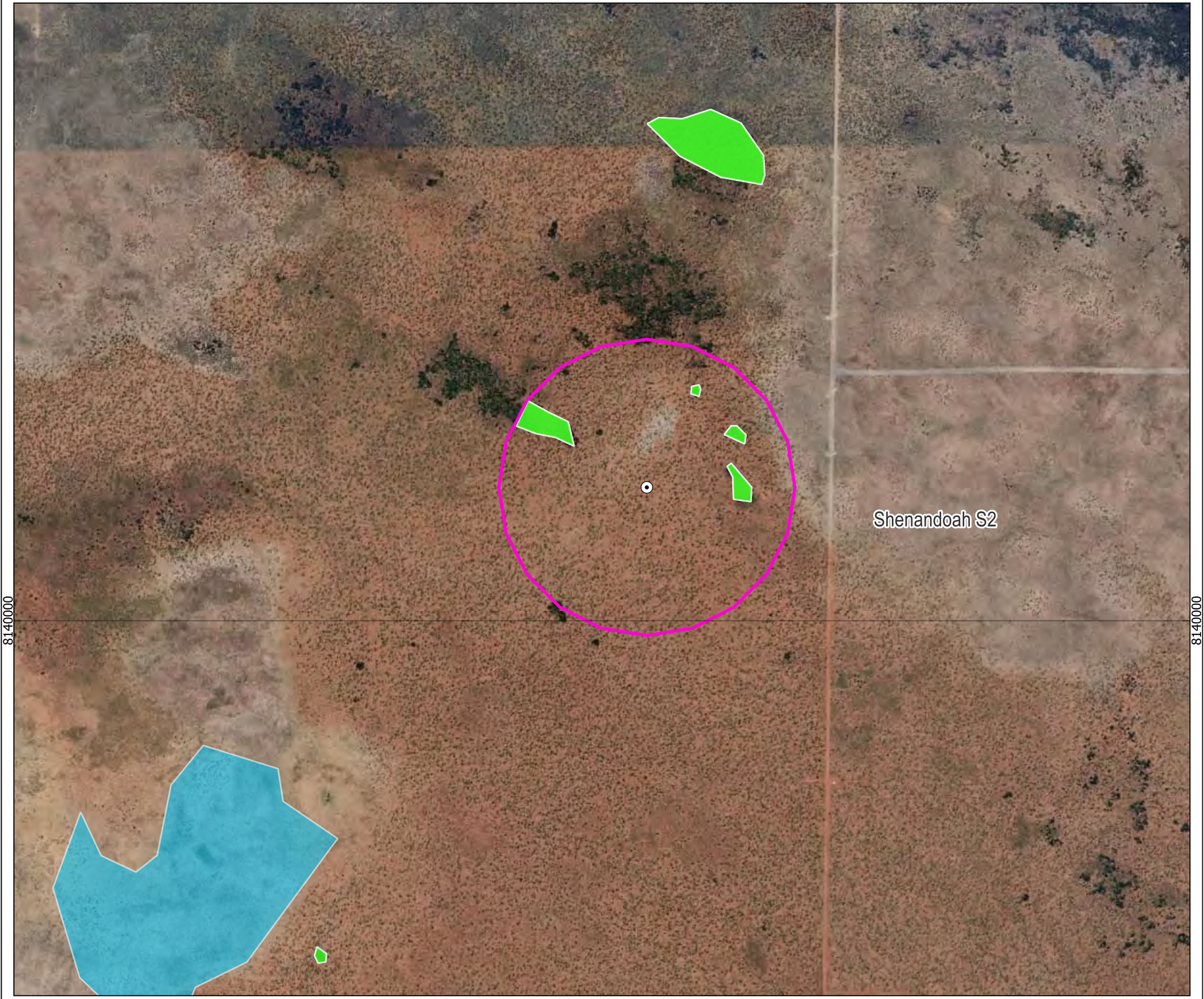
Following previous work in the area, AECOM undertook a desktop assessment using satellite imagery to identify the presence of landforms with heightened sensitivity for Aboriginal cultural heritage (Figure 2). Sensitive landforms include areas surrounding soaks and depressions, permanent water sources, non-flooding areas adjacent to established channels, and thick patches of shade providing Lancewood-Bullwaddy Woodland (a distinctive community that combines *Macropteranthes kekwickii* (bullwaddy) and *Acacia shirleyi* (lancewood)) (AECOM Australia Pty Ltd (AECOM), 2012 s4.4 and 7.3; HLA-Envirosciences Pty Ltd, 2006a s5.3). Only one potentially sensitive landform is relevant to the Well Site - potential stands of Lancewood-Bullwaddy.

Across Australia, numerous archaeological studies in different environmental zones and contexts have demonstrated a correlation between the permanence of a water source and the permanence and/or complexity of Aboriginal occupation (e.g. Rowland & Connolly, 2002). Within the Northern Territory and the Beetaloo Basin, previous surveys had also identified heritage sites associated with stands of Bullwaddy and Lancewood-Bullwaddy – primarily these were sacred sites, although artefact scatters were also found (AECOM Australia Pty Ltd, 2020; HLA-Envirosciences Pty Ltd, 2007, 2006a)).

High Priority areas were identified as areas adjacent to a permanent water source associated with a waterhole, soakage or channelised creek, none of which are located within or adjacent to the Well Site.

The heritage surveys were seeking to validate desktop findings and identify any Aboriginal heritage sites or areas of potential. In all cases, survey combined aerial and pedestrian methodologies, with helicopter flyovers used to gain an appreciation of landscape, and pedestrian transects used to inspect areas of high sensitivity. While this approach was designed to maximise the probability of identifying Aboriginal sites or areas of sensitivity within the Well Site, it does not achieve total survey coverage of the Well Site, and there remains the potential for future additional finds.

During the pedestrian surveys of the Well Site, notes and photographs were taken on landform, ground surface visibility (GSV), and ground surface integrity (GSI) (Appendix C).



AECOM
www.aecom.com

0 200 400 600 800 m

1:18,440.3
(when printed at A3)

LEGEND

Study Areas

Kyalla

Tamboran Potential Works Locations

Well Pads

Shenandoah South 2

Well Site

Shenandoah South 2

Areas of heritage sensitivity

Vegetation

Water Source

Data Sources:
AECOM
Google Satellite

CRS:
GDA94 Zone 53

Tamboran B2 Pty Ltd
2022 - 2023 Heritage Scouting

Shenandoah S2
Well Site

PROJECT ID	60667354
CREATED BY	KC
LAST MODIFIED	15-5-2024
VERSION	2

Figure 2

5.0 Results

5.1 Survey Results

A cultural heritage survey was conducted for the entire Well Site, with a focus on potential sensitive landforms. All sensitive landforms was subject to pedestrian survey, with the remaining location assessed from the air. No archaeological sites were identified and no areas identified by Traditional Owners as having potential cultural significance, were identified.

GSV varied across the surveyed areas, ranging from 25-50%, with visibility impeded in places by substantial plant growth following the wet season. GSI was generally high, with a lack of previous significant ground disturbance over the majority of the proposed well site. The main types of ground disturbance observed caused by cattle accessing water sources and walking across inundated ground. Given the size of the surveyed areas, GSV and GSI values varied markedly, and rankings presented are average results (see Table 4 for summary).

Plate 1 and Plate 2 provide photographs illustrating the landscape contexts and GSV conditions encountered at the Well Site.

Table 4 Survey results for Well Site

Well Site	Potential Works Location	GSV%	GSI	Heritage
Shenandoah S2	Well Pad	25-50	High	No

Plate 1 Shenandoah S2 Well Pad general context GSV

Plate 2 Shenandoah S2 Well Pad general context looking south

6.0 Impact Assessment

No cultural heritage sites or areas of heritage values were identified within or adjacent to the Well Site, therefore no impacts are anticipated.

7.0 Key Findings

The key findings of this heritage assessment are:

- Aerial and targeted pedestrian surveys was completed in consultation with the Traditional Owners for the entire Well Site
- A review of existing heritage data and reports indicates that there are no previously recorded Aboriginal archaeological sites within or adjacent to the Well Site
- This survey did not achieve full coverage of the individual Well Site, and there remains the potential for future additional finds.

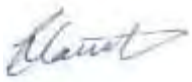
- Base on the previous assessments within the Beetaloo Basin and the results of the heritage assessment for the Well Site. The potential for unidentified cultural heritage sites is considered low.

8.0 Recommendations

On the basis of the above findings, the following recommendations are made for Project works:

- Consultation with the Northern Land Council and Traditional Owners is recommended to ensure that an appropriate clearance protocol is put in place for the duration of the proposed works, noting the limitations regarding the survey coverage achieved during the scouting survey and the potential for additional finds in the survey areas.
- An unexpected heritage finds stop works procedure is to be implemented for the duration of proposed works (see Appendix D).
- Induction of staff on site should include reference to the unexpected finds procedure.

Yours faithfully



Perri Braithwaite
Senior Heritage Specialist
perri.braithwaite@aecom.com
Mobile: [redacted]

Alana Court
Technical Director - Environment
alana.court@aecom.com
Mobile: [redacted]

References

AECOM Australia Pty Ltd. (2011). *Archaeological Assessment - Drill Sites and Access Roads: Beetaloo Basin, Barkly Region NT*. Unpublished report to Falcon Oil and Gas Australia Limited.

AECOM Australia Pty Ltd. (2012a). *EP99 Archaeological Survey, Beetaloo Basin*. Unpublished report for Falcon Oil and Gas Australia.

AECOM Australia Pty Ltd. (2012b). *Interim Report Archaeological Surveys 2011*. Unpublished report for Hess Australia (Beetaloo) Pty Limited.

AECOM Australia Pty Ltd. (2014). *Aboriginal & Historic Heritage Assessment*. Unpublished report for Origin Energy Resources Limited.

AECOM Australia Pty Ltd. (2015). *Paltar Petroleum Limited: Aboriginal & Historic Heritage Assessment*. Unpublished report to Paltar Petroleum Limited.

AECOM Australia Pty Ltd. (2019). *Aboriginal and Historic Heritage Assessment: 2018 Exploration Lease Areas*. Unpublished report for Origin Energy Resources Limited.

AECOM Australia Pty Ltd. (2020). *Cultural Heritage Assessment: EP136 - Beetaloo Sub-Basin, NT*. Unpublished report for Sweetpea Petroleum Pty Ltd.

AECOM Australia Pty Ltd. (2021). *Cultural Heritage Assessment: Amungee NW 1 and Velkerri 76 S2*. Unpublished report for Origin Energy Resources Ltd.

AECOM Australia Pty Ltd. (2023a). *Cultural Heritage Assessment: Amungee NW 3*. Unpublished report for Tamboran B2 Pty Ltd.

AECOM Australia Pty Ltd. (2023b). *Cultural Heritage Assessment: Kyalla Study Area*. Unpublished Report for Tamboran Resources Ltd.

AECOM Australia Pty Ltd. (2023c). *Cultural Heritage Assessment Report: Shenandoah and Amungee Heritage Scouting*. Unpublished report for Tamboran B2 Pty Ltd.

AECOM Australia Pty Ltd (AECOM). (2012). *Final Report Archaeological Surveys 2011/2012: Onshore Seismic Exploration Program, Beetaloo Basin, NT*.

Bickford, A., & Sullivan, S. (1984). Assessing the research significance of historic sites. In S. Sullivan & S. Bowdler (Eds.), *Site survey and significance assessment in Australian Archaeology* (1st ed., pp. 19–26). Australian Institute of Aboriginal Affairs.

Bowdler, S. (1981). Unconsidered Trifles? Cultural Resource Management, Environmental Impact Statements and Archaeological Research in New South Wales. *Australian Archaeology*, *12*.

Burke, H., & Smith, C. (2004). *The Archaeologist's Field Handbook*. Allen & Unwin.

Coutts, P. J. F., & Witter, D. C. (1977). Summer Field Programme of the Victoria Archaeological Survey. *Australian Archaeology*, *6*.

Godwin, L. (2011). The Application of Assessment of Cumulative Impacts in Cultural Heritage Management: A Critique. *Australian Archaeology*, *73*(73), 88–91.

Heritage Surveys. (1999). *Additional archaeological assessments, Daly Waters to McArthur River Gas Pipeline, Northern Territory*. Unpublished report to Northern Territory Power and Water Authority.

Hermes, M. (1986). *Amadeus Basin to Darwin Natural Gas Pipeline - Spread 2: Internal report on archaeological findings*. Unpublished report to the NT Museums and Art Galleries.

HLA-Envirosciences Pty Ltd. (2006a). *Archaeological Assessment 2006 for the Sweetpea Petroleum Seismic Program, Beetaloo Basin, Northern Territory, 2006*. Unpublished report for Sweetpea Petroleum Pty Ltd.

HLA-Envirosciences Pty Ltd. (2006b). *Beetaloo Basin: Cooee Hill and 80 Metre Tower Archaeological Assessment*. Unpublished report for Sweetpea Petroleum Pty Ltd.

HLA-Envirosciences Pty Ltd. (2006c). *Beetaloo Basin: Newcastle Creek Archaeological Assessment*.

Unpublished report for Sweetpea Petroleum Pty Ltd.

HLA-Envirosciences Pty Ltd. (2006d). *Beetaloo Basin: Yaroo, South Martyr's Tree and Dunmarra Archaeological Assessment*. Unpublished report for Sweetpea Petroleum Pty Ltd.

HLA-Envirosciences Pty Ltd. (2007). *Beetaloo Basin: Newcastle Creek (Seismic Line 13A) Archaeological Assessment*. Unpublished report for Sweetpea Petroleum Pty Ltd.

Kuskie, P. J. (2000). An Aboriginal Assessment of the Proposed Mount Arthur North Coal Mine, Near Muswellbrook, Hunter Valley, New South Wales. In HLA-Envirosciences Pty. Ltd. (Ed.), *Environmental Impact Statement and Statement of Environmental Effects, Proposed Jerrys Plains Coal Terminal, Rail Spur and Associated Infrastructure.* Report prepared by South Eastern Archaeology to Umwelt (Australia) Pty. Ltd.

Long, A. (2003). *Scarred Trees: An Identification and Recording Manual*. Aboriginal Affairs Victoria.

Pearson, M., & Sullivan, S. (1995). *Looking After Heritage Places: The Basics of Heritage Planning for Managers, Landowners and Administrators*. Melbourne University Press.

Quaternary Archaeological Surveys. (1998). *Archaeological survey of the Stuart Highway to Mataranka Homestead Optic Fibre Cable Corridor, Northern Territory*. Unpublished report for Telstra.

Rowland, M., & Connolly, M. (2002). Towards GIS Mapping and Spatial Modelling of Archaeological Sites in the Southeast Queensland Bioregion. *Queensland Archaeological Research*, *13*(August 2000), 39. https://doi.org/10.25120/qar.13.2002.67

Smith, M. A. (1986). An Investigation of Possible Pleistocene Occupation at Lake Woods, Northern Territory. *Australian Archaeology*, *22*, 60–74.

Appendix A - Legislation

Commonwealth Legislation

Environment Protection and Biodiversity Conservation Act

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) took effect on the 16 July 2000. Under section 26 of the EPBC Act it is stated that:

> *A person must not take on Commonwealth land an action that has, will have or is likely to have a significant impact on the environment.*

Under section 28 of the EPBC Act it is stated that:

> *The Commonwealth or a Commonwealth agency must not take inside or outside the Australian jurisdiction an action that has, will have or is likely to have a significant impact on the environment inside or outside the Australian jurisdiction.*

An action is defined as a project, development, undertaking, activity, series of activities, or alteration. An action will also require approval if:

- It is undertaken on Commonwealth land and will have or is likely to have a significant impact;
- It is undertaken outside Commonwealth land and will have or is likely to have a significant impact on the environment on Commonwealth land; and
- It is undertaken by the Commonwealth and will have or is likely to have a significant impact.

The EPBC Act defines ‘environment’ as both natural and cultural environments and therefore includes Aboriginal and historic heritage items. Under the Act, protected heritage items are listed on the National Heritage List (items of significance to the nation) or the Commonwealth Heritage List (items belonging to the Commonwealth or its agencies). These two lists replaced the Register of the National Estate (RNE) which is no longer a statutory list.

Aboriginal and Torres Strait Islander Heritage Protection Act 1984

The *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* (the ATSIHP Act) provides for the preservation and protection of places, areas and objects of particular significance to Indigenous Australians. The stated purpose of the ATSIHP Act is the 'preservation and protection from injury or desecration of areas and objects in Australia and in Australian waters, being areas and objects that are of particular significance to Aboriginals in accordance with Aboriginal tradition' (section 4).

Under the Act, ‘Aboriginal tradition’ is defined as “the body of traditions, observances, customs and beliefs of Aboriginals generally or of a particular community or group of Aboriginals, and includes any such traditions, observances, customs or beliefs relating to particular persons, areas, objects or relationships” (Section 3). A ‘significant Aboriginal area’ is an area of land or water in Australia that is of ‘particular significance to Aboriginals in accordance with Aboriginal tradition’ (Section 3). A ‘significant Aboriginal object’, on the other hand, refers to an object (including Aboriginal remains) of like significance.

For the purposes of the Act, an area or object is considered to be injured or desecrated if:

- In the case of an area:
  - it is used or treated in a manner inconsistent with Aboriginal tradition;
  - the use or significance of the area in accordance with Aboriginal tradition is adversely affected;
  - passage through, or over, or entry upon, the area by any person occurs in a manner inconsistent with Aboriginal tradition;
- in the case of an object:
  - it is used or treated in a manner inconsistent with Aboriginal tradition.

Appendix B - Heritage Register Searches

McNeil, Jess

From: David Steinberg <David.Steinberg@nt.gov.au> on behalf of Heritage Branch <Heritage.Branch@nt.gov.au>
Sent: Monday, 6 March 2023 12:45 PM
To: McNeil, Jess
Cc: Brigden, Isobel
Subject: RE: Request regarding information about Aboriginal and Macassan places - Tamboran Energy, Betaloo Basin

Hi Jess,

Thank you for your enquiry regarding known archaeological places in the footprint of your project. To confirm your email said 8 possible well pad location and seismic lines and tracks. I counted 9 possible well sites in the GIS layer you provided. I have conducted the search of the 9 locations and tracks and lines as detailed in the GIS layer.

To confirm this response to your enquiry constitutes a basic request for information about known sites. It **cannot** be used for advice relating to work as defined in the *Heritage Act 2011*.

In preparing this advice, the Heritage Branch has referred to the Northern Territory Heritage Register and the Heritage Branch archaeological database which includes known information about Aboriginal and Macassan archaeological places and objects in the Northern Territory. The fact that there are no known archaeological places recorded may be because no archaeological surveys have been conducted in that particular area, and is not necessarily an indication they do not exist.

The search has found that there are no nominated, provisionally declared or declared heritage places or objects within the subject area.

The search has found that there are no known archaeological places within the subject site.

regards

David

Dr David Steinberg
Senior Heritage Officer/Maritime Archaeologist
Heritage Branch
Community Participation and Inclusion
Territory Families, Housing and Communities

Floor 1, JHV2 – Jape Homemaker Village,
356 Bagot Road Millner
PO Box 37037 Winnellie 0821

p (08) 8999 5083
e david.steinberg@nt.gov.au
w www.nt.gov.au

McNeil, Jess

From: Fiona Earl <Fiona.Earl@nt.gov.au> on behalf of Heritage Branch <Heritage.Branch@nt.gov.au>
Sent: Thursday, 11 May 2023 10:39 AM
To: McNeil, Jess
Subject: RE: Request regarding information about Aboriginal and Macassan places - Tamboran Energy

Hi Jess,
This initial advice is provided following a request for information from the Heritage Branch.
For requests related to sacred sites, contact the Aboriginal Areas Protection Authority https://www.aapant.org.au.

Work details

Name of proponent (company or department)	AECOM
Contact person (name and title)	Jess McNeil – Graduate Heritage Specialist
Date enquiry received	27 April 2023
Location of work	Daly Waters (Beetaloo Basin)
Brief description of work as provided	Exploration activities (oil and gas wells)
Date of Heritage Branch response	11 May 2023
Our reference	HCD2023/00236

The context of Heritage Branch advice

The Northern Territory Government's Heritage Branch administers the *Heritage Act 2011* and provides authoritative advice about obligations under the *Heritage Act 2011,* including steps to take to manage the impact of proposed work on Aboriginal and Macassan archaeological places and objects
It is important that advice given by the Heritage Branch is followed. A failure to follow advice received from the Heritage Branch may be considered as evidence in an investigation if damage occurs to an Aboriginal or Macassan archaeological place or object.

Relevant parts of the Northern Territory's *Heritage Act* 2011

Under the Northern Territory's *Heritage Act 2011* (the Act):

1. All Aboriginal or Macassan archaeological places and objects are automatically protected - this includes places and objects not previously recorded;
2. Places and objects include an artefact or thing given shape by a person - examples include stone tools, stone arrangements, fish traps, rock art, modified trees, and shell middens;
3. Ancestral remains are also protected;
4. Underwater Cultural Heritage is protected, up to three nautical miles from the coast;
5. There is an obligation to notify of the discovery of Aboriginal or Macassan archaeological places or objects

Conditions of advice

1. This advice is based on the description of the work provided to the Heritage Branch. If the work expands or changes significantly seek further advice.

2. In preparing this advice, the Heritage Branch has referred to an archaeological database which includes information about Aboriginal and Macassan archaeological places and objects in the Northern Territory. However the database only includes information about known archaeological places. The fact that there are no known archaeological places recorded may be because no archaeological surveys have been conducted in that particular area, and is not necessarily an indication they do not exist.

Actions

The following actions have been taken in relation to the enquiry.

- A search of the Northern Territory Heritage Register;
- A search for known archaeological places located within the subject site on the Heritage Branch archaeological database;
- A search for known archaeological places located within the proximity of the subject site on the Heritage Branch archaeological database;
- The extent of pre-existing ground disturbance;
- The scale and nature of the work proposed (major, moderate or minor);
- Areas identified as being excluded from the work footprint e.g. riparian buffers; and
- An assessment of the likelihood of unrecorded archaeological places existing within the subject site, based on landscape features, known archaeological places in the vicinity, and other predictive tools.

Advice

The search has found that there are no known Aboriginal or Macassan archaeological places within the subject site. However the likelihood of possible unrecorded Aboriginal or Macassan archaeological places has been assessed as *possible or likely*. The extent of pre-existing disturbance and the nature of the work itself has also been considered. The Heritage Branch recommends that an archaeological survey and cultural heritage management plan are required to identify and mitigate the impact to Aboriginal or Macassan archaeological places.

1. The Heritage Branch can provide a list of qualified archaeologists on request.
2. The Heritage Branch can provide advice in regard to the scope of the survey and plan on request.
3. The Heritage Branch must receive a copy of the final report for our records.

Declared Heritage Advice

The search has found that there are no nominated, provisionally declared or declared heritage places or objects within the subject area.

Further comments

Further information can also be found on our website:
https://nt.gov.au/property/building/heritage-properties/heritage-properties-building-works-and-development
Aboriginal heritage information | NT.GOV.AU

Thanks,

Fi

Dr Fiona Earl
Heritage Officer
Heritage Branch
Community Participation and Inclusion
Territory Families, Housing and Communities

Level 1 Building JHV2,
Jape Homemaker Village, 356 Bagot Road Millner
PO Box 37037, Winellie, NT 0821

t. 08 8999 5051

McNeil, Jess

From: David Steinberg <David.Steinberg@nt.gov.au> on behalf of Heritage Branch <Heritage.Branch@nt.gov.au>
Sent: Monday, 6 March 2023 12:45 PM
To: McNeil, Jess
Cc: Brigden, Isobel
Subject: RE: Request regarding information about Aboriginal and Macassan places - Tamboran Energy, Betaloo Basin

Hi Jess,

Thank you for your enquiry regarding known archaeological places in the footprint of your project. To confirm your email said 8 possible well pad location and seismic lines and tracks. I counted 9 possible well sites in the GIS layer you provided. I have conducted the search of the 9 locations and tracks and lines as detailed in the GIS layer.

To confirm this response to your enquiry constitutes a basic request for information about known sites. It **cannot** be used for advice relating to work as defined in the *Heritage Act 2011*.

In preparing this advice, the Heritage Branch has referred to the Northern Territory Heritage Register and the Heritage Branch archaeological database which includes known information about Aboriginal and Macassan archaeological places and objects in the Northern Territory. The fact that there are no known archaeological places recorded may be because no archaeological surveys have been conducted in that particular area, and is not necessarily an indication they do not exist.

The search has found that there are no nominated, provisionally declared or declared heritage places or objects within the subject area.

The search has found that there are no known archaeological places within the subject site.

regards

David

Dr David Steinberg
Senior Heritage Officer/Maritime Archaeologist
Heritage Branch
Community Participation and Inclusion
Territory Families, Housing and Communities

Floor 1, JHV2 – Jape Homemaker Village,
356 Bagot Road Millner
PO Box 37037 Winnellie 0821

p (08) 8999 5083
e david.steinberg@nt.gov.au
w www.nt.gov.au

Appendix C - Assessment Criteria

Ground surface visibility and integrity

Table 12 Ground Surface Visibility (GSV) Scheme

GSV rating	Percentage GSV
Nil to poor	0-25%
Poor to good	26-50%
Good to very good	51-75%
Very good to excellent	76-100%

Table 13 Ground Surface Integrity (GSI) Scheme

GSI rating	Definition
Low	Ground surface has been subjected to significant disturbance (e.g. earthworks, excavation). Little to no integrity remains.
Moderate	Ground surface has been subject to moderate disturbance (e.g. native vegetation clearance) but retains a reasonable degree of integrity.
High	An unmodified or minimally modified ground surface.

Significance Assessment

Scientific Value

Scientific value refers to the importance of a place in terms of its rarity, representativeness and the extent to which it may contribute further information (i.e., its research potential).

Research Potential

Research potential can be defined as the potential of an archaeological site to address what Bowdler (1981) has referred to as “timely and specific research questions”. These questions may relate to any number of issues concerning past human lifeways and environments and, as suggested by Bowdler’s quote, will inevitably reflect current trends or problems in academic research (Burke & Smith, 2004). For their part, Bickford and Sullivan (1984) suggest that the research potential of an archaeological site can be determined by answering the following series of questions:

1. Can the site contribute knowledge which no other resource can?
2. Can the site contribute knowledge which no other such site can?
3. Is this knowledge relevant to general questions about human history or other substantiative subjects?

Several criteria can be used to assess the research potential of an archaeological site. Particularly important in the context of Aboriginal archaeology are the intactness or integrity of the site in question, its complexity (place contents) and its representativeness.

Complexity (Place Contents)

The *complexity* of a site refers primarily to the nature or character of the artefactual materials or features that constitute it but also includes site structure (e.g., the physical size of the site, spatial patterning in observed cultural materials). In the case of open artefact sites, for example, the principal criteria used to assess complexity are the site’s size (i.e., number of artefacts and/or spatial extent), the presence, range and frequency of artefact and raw material types, and the presence of features such as hearths. Table 14 provides the assessment criteria for the complexity of the site.

Table 14 Place complexity criteria

Criteria	Value
Place contains 0-10 artefacts	Low - 0

Criteria	Value
Place contains large number of artefacts but limited range of cultural heritage materials	Medium - 1
Place contains large number of artefacts and diverse range of cultural heritage material	High - 2

Rarity and Representativeness

Rarity and r*epresentativeness* are related concepts. Rarity refers to the relative uniqueness of a site within its local and regional context. The scientific significance of a site is assessed as higher if it is unique or rare within either context. Conversely, it is considered to be of lower significance if it is common in one or both. The concept of representativeness, meanwhile, refers to the question of whether or not a site is "a good example of its type, illustrating clearly the attributes of its significance" ((Burke & Smith, 2004). Representativeness is an important criterion as one of the primary goals of cultural heritage management is to preserve for future generations a representative sample of all archaeological site types in their full range of environmental contexts.

In common with rarity, assessments of representativeness within a region are dependent on the state of current knowledge concerning the number and type of archaeological sites present within that region. This is a critical point, for as suggested by Kuskie (2000) and others (Bowdler, 1981; Godwin, 2011; Pearson & Sullivan, 1995), the absence across most of Australia of regional-scale quantitative data for Aboriginal sites and places represents a major constraint in assessments of representativeness and rarity. As stressed by Bowdler 1981 some 40 years ago, detailed regional-scale assessments of the Aboriginal archaeological record of Australia are required to address this issue. Table 15 provides the assessment criteria for the place's rarity.

Table 15 Rarity criteria

Criteria	Value
Common occurrence within the geographical region	Low - 0
Irregular occurrence within the geographical region	Medium - 1
Rare occurrence within the geographical region	High - 2

Integrity/Place Condition

Integrity refers to the extent to which a site has been disturbed by natural and/or anthropogenic phenomena and includes both the state of preservation of particular remains (e.g., animal bones, plant remains) and, where applicable, stratigraphic integrity. Assessments of archaeological integrity are predicated on the notion that undisturbed or minimally disturbed sites are likely to yield higher quality archaeological and/or environmental data than those whose integrity has been significantly compromised by natural and/or anthropogenic phenomena. Establishing levels of preservation or integrity in the context of a surface survey is difficult. Nonetheless, useful rating schemes are available for 'open' sites (Coutts & Witter, 1977) and modified trees (Long, 2003). Table 16 provide the assessment criteria for the place's integrity.

Table 16 Integrity criteria for place's integrity

Criteria	Values
Place demonstrates high degree of disturbance with some cultural materials remaining	Low – 0
Place in good condition with little disturbance	Medium - 1
Place in excellent condition with minimum or no disturbance	High - 2

Impact Assessment

The degree of impact an activity will have on a cultural heritage place is assessed in terms of the magnitude of change to the acknowledged heritage values of a place as summarised in Table 17.

These impacts may be direct, such as the demolition of heritage buildings, or indirect, such as changes to the views or setting of a cultural heritage place. In some cases, indirect impacts might also cause physical damage to a cultural heritage place, such as excessive vibration causing structural damage, or excessive pollution causing damage to surfaces.

Table 17 Determining magnitude of change

Magnitude	Example criteria
Major	Change to all or most significant aspects of the place, such that its heritage values are substantially reduced or destroyed.
Medium	Change to some significant aspects of the place, such that some of its heritage values are partially reduced.
Low	Minor change to significant aspects of the place, such that some of its heritage values are slightly reduced.
Negligible	Changes to insignificant aspects of the places, such that its heritage values are not reduced.
No Change	No change.

The final assessment of the significance of impact on a cultural heritage place is a factor of the cultural heritage sensitivity of the place, combined with the predicted magnitude of change, as outlined in Table 18. A prediction of impact significance can be made both before and after the implementation of identified mitigation measures, allowing the efficacy of the measures to be assessed and revealing residual impacts that need to be taken into account.

Table 18 Estimating impact significance

Significance of impact		Magnitude of change				
		Major	**Medium**	**Low**	**Negligible**	**No change**
Cultural heritage sensitivity	**Extreme**	Very large	Large/very large	Moderate/large	Slight	Neutral
	Very high	Very large	Large/very large	Moderate/large	Slight	Neutral
	High	Large/very large	Moderate/large	Slight/moderate	Slight	Neutral
	Moderate	Moderate/large	Moderate	Slight	Neutral/slight	Neutral
	Low	Slight/moderate	Slight	Neutral/slight	Neutral/slight	Neutral
	Negligible	Slight	Neutral/slight	Neutral/slight	Neutral	Neutral

Appendix D - Unexpected Heritage Finds Procedure

Aboriginal Cultural Heritage

Aboriginal finds can include the following:

- Stone artefacts - sharp edged rocks that have identifiable features demonstrating evidence of human modification
- Scarred Trees - trees with symmetrical scars that might demonstrate evidence of removal of bark for use in coolamons, shields and huts
- Grindstones - large sandstone items (either fixed in bedrock or mobile) that have manmade grooves in them demonstrating use.
- Stone Axes - heavy hatchet head like stone items, typically with the leading edge sharpened
- Bone & Shell - potential historical food waste dumps (also known as Middens).

Historical Cultural Heritage

Historical finds include the following:

- Glass - coloured glass, bottles (complete or fragmentary etc.)
- Metal - identifiable metallic objects such as cutlery, buckles, framing equipment, woodworking metal equipment etc.
- Ceramic - plates, cups, ink wells, pipes etc.
- Wood - identifiable human manufactured wooden items
- Stone - identifiable human manufactured stone items
- Bone & Shell - potential historical food waste dumps

Unexpected Finds Procedure

The following procedure is to be followed:

1. If an unexpected heritage find is identified during proposed works within the Project Area, work will stop immediately in the immediate area and the Site Project Manager will be notified of the find.
2. A minimum 10 m area radius is to be cordoned off by temporary fencing around the suspected archaeological site.
3. The Site Project Manager should immediately contact the Senior Heritage Officer, NT Heritage Branch on 08 8999 5039. **Note that contacting the NT Heritage Branch is compulsory under the NT *Heritage Act* for any finds.**
4. Do not resume work in the exclusion zone until a clearance is given by the Senior Heritage Officer attending.
    a. If, at any stage in the project, archaeological places or objects cannot be avoided, an Application to Carry Out Works on a heritage place needs to be lodged with the Heritage Council.
    b. A stop work remains in place until after the Heritage Council has made a decision regarding the Application to Carry Out Works.

Discovery of Human Remains

In all cases when human remains are located it is important to remember:

- The discovery of any human remains must as soon as possible be reported to the NT Police.
- It is an offence to interfere with human remains, whether buried or not.

The following process should be adhered to:

1. Work is to immediately cease, and a 50 m temporary cordon be established.
2. The Site Project Manager must be immediately notified of the find.
3. If human remains are suspected, the Site Project Manager must contact the NT Police assistance line on 131 444 to advise them of the presence of human remains.
4. Police will then take control of the site and establish the area as a potential crime scene.
5. Police will undertake appropriate scientific or other procedures to assist the Coroner in making an appropriate determination about the remains.
6. Police will contact the Senior Heritage Officer, NT Heritage Branch and the CEO of the Aboriginal Areas Protection Authority if necessary.
7. Resume work only after completion of Police and NT Heritage Branch investigations and appropriate removal of remains according to the NT *Coroners Act.*