ENVIRONMENT MANAGEMENT PLAN

PALM VALLEY GAS FIELD

Proposed PV-13 Well Site, Palm Valley NT

July 2018

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DOCUMENT CONTROL

FRONTISPIECE: Images 1-4: 1 – View of Mount Hermannsburg from Larapinta Drive; 2 – PV-7 blooie pit rehabilitation south west edge of proposed PV-13 well site; 3 – Traditional Owners and LES staff conducting a vegetation transect survey of the proposed PV-12 well site; 4 – Rock creek line adjacent to the proposed PV-13 well site and the PV-7 well site.

DISCLAIMER

This document has been prepared by Low Ecological Services (LES) for Central Petroleum Limited (Central) in accordance with an agreement with Central. LES has prepared this document using the skill and care expected from professional scientists to provide factual and technical information and reasonable solutions to identified risks. It does not constitute legal advice.

DOCUMENT DETAILS

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Authors:	Jess Cuneo, Bill Low and Jeremy Snowdon-James
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DOCUMENT REVISION

Approvals	Name	Signature	Date
Originator:	Low Ecological Services P/L		21/12/17
Reviewer:	Central Petroleum Limited		04/07/18
Administrator:	Central Petroleum Limited		04/07/18
Approver:	Department of Primary Industry and Resources	×	
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REVISION DETAILS

Date	Revision	Details	Name	Company
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21/12/17	Draft 1	Review	James van Rooyen	Central Petroleum Limited
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PREFACE

All information on proposed operations contained within this document has been supplied by Central Petroleum Limited.

GLOSSARY	
AAPA	Aboriginal Areas Protection Authority
ALARP	As Low As Reasonably Practicable
APPEA	Australian Petroleum Production and Exploration Association
API	American Petroleum Institute
ASC	Australian Soils Classification
ASX	Australian Securities Exchanges
bbls	Barrels
bgl	Below ground level
BOP	Blowout protector
CBL	Cement bond log
CLC	Central Land Council
Central (CTP)	Central Petroleum Limited
Cr	Critically endangered
DD	Data deficient
DPIR	Department of Primary Industry and Resources
EPBC	Environmental Protection and Biodiversity Conservation
EMP	Environmental Management Plan
EcSD	Ecologically Sustainable Development
En	Endangered
EW	Extinct in the Wild
EX	Extinct
FIT	Formation integrity test
HS&E	Health, Safety and the Environment
km	Kilometres
KW	Kilowatts
L	Litres
lbs	Pounds
LES	Low Ecological Services
m	Metres
Mi	Migration (EPBC listed)
Ma	Marine (EPBC listed)
mm	millimetres
NT	Northern Territory
Nt	Near threatened
OL	Operating Licence
P&A	Plugged and Abandoned
PMSR	Protected Matters Search Report
PMST	Protected Matters Search Tool
psi	Pounds per square inch
PV-13	Palm Valley 13 (appraisal well)

GLOSSARY	
PVGF	Palm Valley Gas Field
RPM	Rotations Per Minute
SoBS	Sites of Botanical Significance
SoCS	Sites of Conservation Significance
TPWC	Territory Parks and Wildlife Conservation
TO	Traditional Owner
Vu	Vulnerable

1 EXECUTIVE SUMMARY

This Environmental Management Plan (EMP) has been developed by Low Ecological Services (LES) on behalf of Central Petroleum Limited (Central) for the proposed, Palm Valley 13 (PV-13) hydrocarbon appraisal well. Hydraulic fracturing of potential gas bearing strata will *not* be used in this drilling operation. The drilling program will rely on natural fractures and porosity of the targeted Lower Stairway and Pacoota Sandstones.

The well will be located within the Palm Valley Gas Field (PVGF) in Operating License 3 (OL3) which is in the Amadeus Basin, approximately 130km west of Alice Springs in the Northern Territory (NT). The OL falls within Aboriginal Freehold Land owned by the Ntaria Aboriginal Corporation on behalf of the Western Arrente Traditional Owners (TO). The nearest population is the community at Hermannsburg (also known as Ntaria) to the north east of the PVGF. The PVGF lies within Aboriginal freehold land administered by the Central Land Council (CLC)

This EMP details mitigation and preventative measures to reduce identified risks to the environment because of well drilling operations. Any activities, their mitigation and preventative environmental measures, which are classified as routine operations, are covered in the appendices. This EMP is based on LES's over 50 years of experience including most recently from work relating to drilling PV11 under very similar controlled conditions.

The activities covered by this EMP include:

- Clearing of vegetation for drill pad development;
- Drilling of one appraisal well (PV-13);
- Construction and operation of temporary camps; and
- Rehabilitation of the drill and camp site on termination of the drilling program.

The existing environment has been extensively surveyed and described by LES in this EMP and previous surveys throughout the development and management of the PVGF since the mid-1980s and more recently for the advanced preparation of the future drilling of PV-12, 400m from the proposed PV-13 site. The area in which the proposed PV-13 site is located is dominated by the Hermannsburg sandstone outcrop with Witchetty bush and other shrubs over soft spinifex. The area is classified as shallow, skeletal soil with limited water holding capacity. Drainage channels occur widely in the area surrounding the proposed PV-13 site and minimising run-off from the site will be of primary concern. The Acacia shrubland vegetation is widespread and characteristic of the surrounding area and land-systems. No flora or fauna species of conservation significance were identified as likely to be significantly impacted by the proposed disturbance of the appraisal well activities. This was determined through comprehensive desktop record searches, on ground surveys and extensive knowledge of the area by LES.

The appraisal well will be drilled using industry best practice and safety standards. The well will be drilled vertically to a depth of approximately 1.1km and then horizontally to reach the target formation. The well will then be tested for flow of hydrocarbons. If successful, the well will be developed into a producing well. If the results are inconclusive the well will be suspended pending further evaluation. If the well is unsuccessful, it will be plugged, abandoned and the area rehabilitated as soon as practicable using industry best practise principles, based on the *Northern Territory Schedule of Onshore Petroleum Exploration and Production Requirements 2017* and the Australian Petroleum Production and Exploration Association (APPEA) onshore oil and gas environmental code of practice, to ensure no contamination occurs.

Industry best practise standards for well drilling and monitoring will be followed during the entire life of the appraisal well program to ensure contamination of the potable groundwater aquifer from potential cross-flow between hydrocarbon bearing formations and aquifers does not occur.

The environmental management approach includes the use of Ecologically Sustainable Design (EcSD) and reducing risks to As Low As Reasonably Possible (ALARP). Central's adherence to the EcSD principles through the commitments made in this EMP will ensure all works are conducted in a manner that does not impact the future amenity of the environment for either Central or surrounding stakeholders. Reducing risks to ALARP requires implementing current industry best practise principles and guidelines to mitigate the identified environmental risks. A detailed risk assessment has been undertaken for drilling-related activities in section 8-6. Further, additional risk mitigation measures which apply to the PVGF more broadly have also been included in Appendix 13. These combine to demonstrate that environmental risks have been reduced to ALARP.

Initial rehabilitation activities will depend on the outcome of the drilling program. There are several options as follows:

1. If the well is successful, the drill pad will remain cleared at 120m x 120m for approximately three years allowing for future works; that is completion or standard production and remedial well work that may be required. After this time the well pad size will be assessed and where possible reduced. If the well remains on production the drill pad will be reduced to approximately 50m x 50m to allow for standard production operations for the life of the well.
2. If the well is not successful, Central will plug and abandon (P&A) the well in accordance with the NT regulations and will commence full rehabilitation of these sites as per Appendix 9.

If the well is suspended:

- All waste will be removed from site in accordance with Appendix 10;
- The well pad will remain at 120m x 120m for three years;
- The mud sump will be backfilled on site, following drying and results of soil testing (if required);
- After three years, the well will be reassessed;
- If the well goes to production:
    - The cleared area will be reduced to 50m x 50m,
    - The remainder of the pad will be shallow ripped along the contour
    - Any remaining stockpiled vegetation and top soil will be re-spread over rehabilitated cleared areas
- Any weed infestations will be removed on an ongoing basis.

For P&A, the following activities will be undertaken:

- All waste will be removed and disposed of in accordance with Appendix 10;
- The mud sump will be backfilled on site, following drying and results of soil testing (if required);
- The final landform will be reinstated to match surrounding environment;
- Any gravel used for hardstands will be removed and deep ripped on the contour;
- Stockpiled top soil and vegetation will be re-spread over the 120m x 120m cleared well pad;
- Any weed infestations will be removed;
- Signs of vegetation re-growth will be monitored following first significant rainfall season; and
- All access tracks will be removed.

The affected stakeholders for this operation are those outlined in Appendix 11 and include the Ntaria Aboriginal Land Trust, the Central Land Council and the Department of Primary Industry and Resources.

Central will follow the current and ongoing consultation process as outlined in Appendix 6.

Key contact details for the project are:

Company Name	Central Petroleum Limited
ACN/ABN	ABN: 95 081 592 734
Street Address	Level 7/369 Ann Street
Postal Address	PO Box 292 Brisbane, Qld 4000
Telephone	+61 (0)7 3181 3800
Facsimile	+61 (0)7 3181 3855
Key Contact	James van Rooyen – Acting as General Operations Manager
Email	jamesvanrooyen@centralpetroleum.com.au
Website	www.centralpetroleum.com.au

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3 INTRODUCTION

3.1 Project Outline

Central Petroleum Limited (Central), as owner and operator of Operating License 3 (OL3), proposes to undertake the drilling of Palm Valley 13 (PV-13) appraisal well. The well is proposed for appraisal only and does not involve hydraulic stimulation under this Environmental Management Plan (EMP).

The proposed appraisal well site is situated within the central section of the Palm Valley Gas Field (PVGF), approximately 8km east of the existing Central Treatment Plant (CTP). The proposed well will target the Lower Stairway and Pacoota Sandstone Formations for the main conventional reservoirs, drilling to approximately 3.6km deep before drilling horizontally to reach the target hydrocarbon reserves.

This EMP provides an analysis of all potential environmental impacts and associated mitigation measures, monitoring requirements and environmental objectives for the proposed drilling program.

3.2 Location

PV-13 is to be drilled within OL3 which is in the Amadeus Basin, approximately 130km west of Alice Springs in the Northern Territory (NT). The OL falls within Aboriginal Freehold Land owned by the Ntaria Aboriginal Corporation on behalf of the Western Arrente Traditional Owners (TO).

Access to the field from Alice Springs is via a network of sealed and unsealed public and private roads, heading west from Alice Springs along Larapinta Drive / Red Centre Way to Hermannsburg. The turn off to PVGF is on the left, 6.5km past the Finke River crossing near Hermannsburg.

The nearest population is the community at Hermannsburg (also known as Ntaria) to the north east of the PVGF. The PVGF lies within Aboriginal freehold land administered by the Central Land Council (CLC).

Key topographic features of the area include:

- Mount Hermannsburg 1.2km north east of the PVGF
- Finke Gorge National Park to the south of the PVGF and has overlapping boundaries with OL3; and
- Finke River to the east of the PVGF.

Figure 3-1 shows the location of the proposed PV-13 well site at PVGF in relation to Alice Springs and other nearby communities. Land tenure in the OL3 area and surrounds is mapped in Figure 3-2.

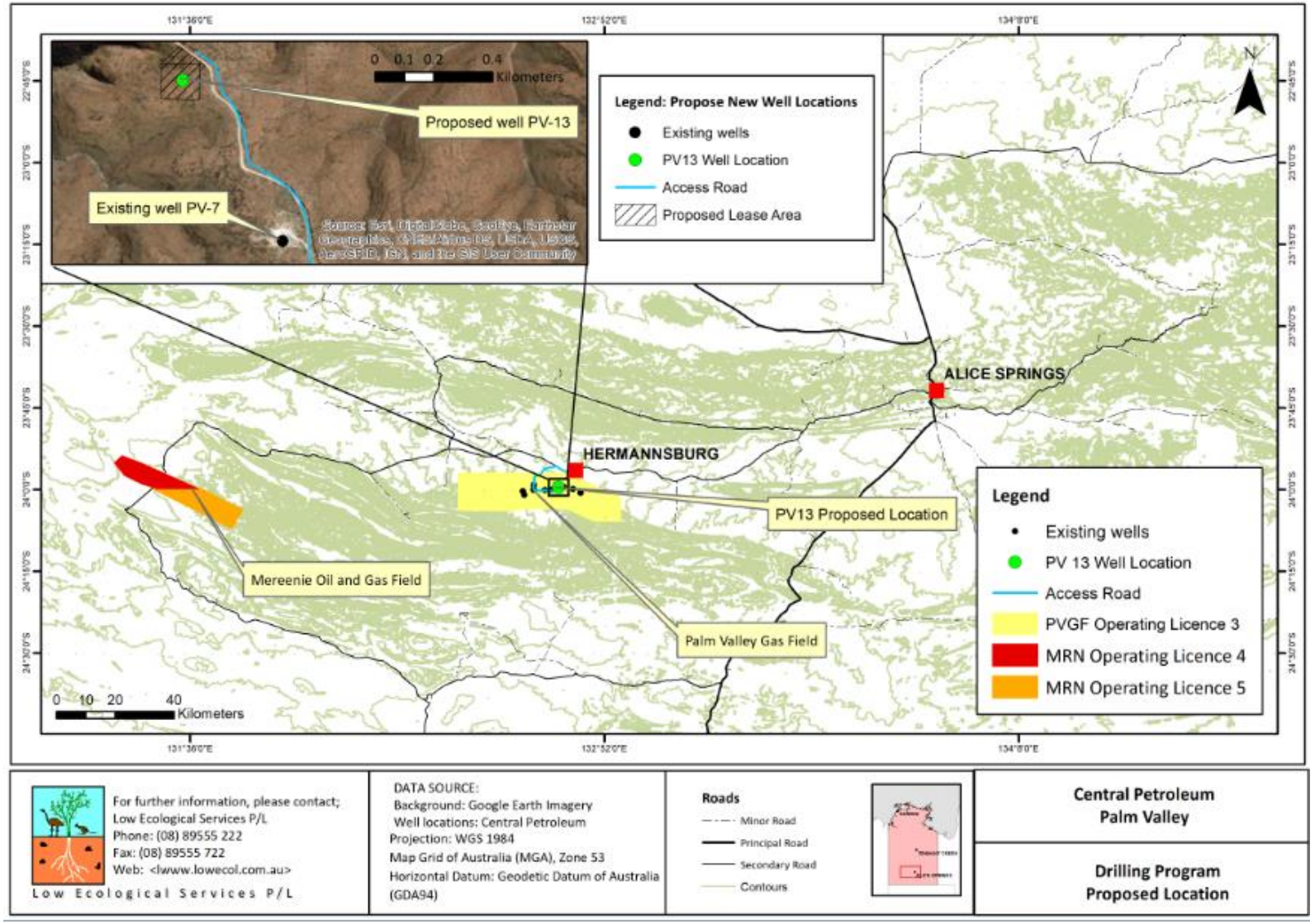

Figure 3-1. Location of the proposed well site PV-13 in the existing PVGF area

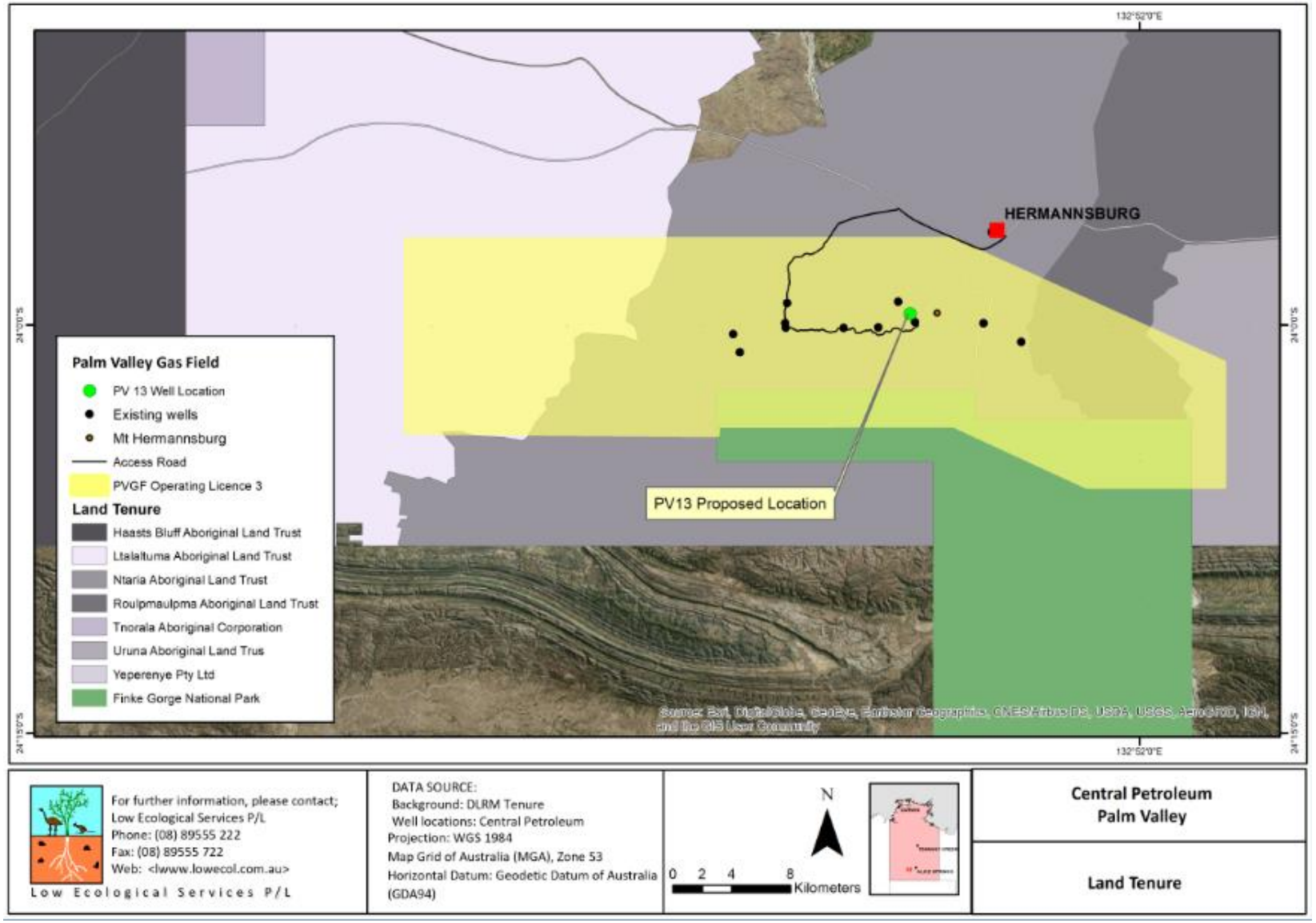

Figure 3-2. Land tenure in the OL3 area and surrounds.

3.3 Proponent

Central is an Australian Securities Exchange (ASX) listed exploration and production company, registered on the 7th March 2006 under the Corporations Act 2001. Central operates the largest holding of prospective onshore acreage in Australia totalling over 229,000km^2, predominantly in the Northern Territory and Queensland.

Table 3-1. Central Petroleum company details

Company Name	Central Petroleum Limited
ACN/ABN	ABN: 95 081 592 734
Street Address	Level 7/369 Ann Street
Postal Address	PO Box 292 Brisbane, Qld 4000
Telephone	+61 (0)7 3181 3800
Facsimile	+61 (0)7 3181 3855
Key Contact	James van Rooyen – Acting as General Operations Manager
Email	jamesvanrooyen@centralpetroleum.com.au
Website	www.centralpetroleum.com.au

3.4 Purpose

The purpose of this EMP is to:

- Provide information to the NT Department of Primary Industry and Resources (DPIR) - Energy Directorate as required under Section 45 (1) (f) of the *Petroleum Act*;
- Provide additional information as outlined in the NT Petroleum (Environment) Regulations 2016;
- Provide information to the Northern Territory Environment Protection Authority (NT EPA) to make an assessment under the *Environmental Assessment Act*, if required;
- Communicate environmental aspects, risks, management measures and responsibilities to Central personnel and contractors; and
- Provide a basis for environmental audits of the proposed appraisal well site within PVGF.

3.5 Scope

This EMP covers the environmental hazards and management measures relevant to activities relating to the proposed PV-13 appraisal well conducted by PVGF personnel and contractors hired by Central to work on site. This EMP has been designed to cover environmental impacts posed by the drilling operations. Where any activities or risks relate to the overarching environmental management of the PVGF are relevant, details of these risks and mitigation measures have been included as an appendix. Activities covered by this EMP (main document) include:

- Clearing of land for well pad;
- Temporary on-site camp and staff accommodation and associated infrastructure for up to 68 persons at any one time;
- Drilling hydrocarbon appraisal well; and
- Rehabilitation of the wellsite and camp areas.

3.6 Objectives

Central set out below the overall environmental objectives for PV-13 well site.

Table 3-2 Environmental Objectives for the Proposed PV-13 Appraisal Well Site Program

Environmental Aspect	Objectives
Biodiversity	Central will preserve the overall biodiversity of the PV-13 well site by ensuring that there is no impact to: • significant fauna • significant fauna habitat • significant flora • matters of national environmental significance.
Water	Central will preserve water quality by ensuring that there is no: • degradation to surface water quality or drainage • detrimental impact to groundwater dependant ecosystems • degradation to groundwater quality • loss of groundwater amenity to surrounding users.
Air Quality and Noise	Central will preserve air quality and control noise by ensuring there is no: • impact to surrounding stakeholders from noise • deterioration to air quality due to drilling or operational activities.
Soil and Landform	Central will preserve soil and landform by ensuring: • there is no significant erosion and sedimentation from the proposed drilling operations • the soil profile remains intact post drilling and rehabilitation operations.
Cultural and Heritage	Central will ensure there is no unauthorised disturbance to identifie cultural and heritage significant sites and/or objects.

4 CORPORATE ENVIRONMENT POLICY

4.1 Central's Commitment to the Environment

Central maintains high standards of environmental responsibility which are implemented through operational quality and integrity measures that go above and beyond industry standards. The Environmental Policy recently endorsed by the Board is shown in Figure 4-1 and the corporate Health, Safety and Environment (HS&E) policy is provided in Figure 4-2.

Central Petroleum

Central Petroleum Limited

CENTRAL PETROLEUM LTD
ENVIRONMENTAL PROTECTION POLICY

Central Petroleum Limited considers protection of the natural and social environment to be of the highest priority in all its activities, both domestic and international, and conducting its operations in an environmentally responsible manner.

It is Central Petroleum's policy to:

- Comply, at a minimum, with applicable laws, regulations, standards, codes and guidelines for the protection of the environment and cultural heritage, and in their absence, adopt the best practicable means to prevent or minimise adverse environmental and cultural heritage impacts;
- Cooperate with governments and industry in the formulation of rational and practical environmental and cultural heritage guidelines and legislation;
- Continuously develop the company's environmental management system and cultural heritage management plans to identify, control and monitor risks and compliance with government regulations and industry guidelines, utilising the most appropriate technology available;
- Commit all levels of management to accept responsibility for environmental and cultural heritage management in all Central Petroleum activities;
- Promote environmental and cultural heritage awareness in all Central Petroleum employees and contractors through induction and training programs;
- Maintain cooperative and positive relationships with indigenous people with custodial responsibility for the land where Central Petroleum operates to minimise the impact of those operations on the cultural heritage of the indigenous people, and cooperate with other legitimate land users so that, where appropriate, multiple land use is possible;
- Conduct all Company operations in such a way as to minimise disturbance to the environment, protect native flora and fauna, avoid the pollution of land, water and air, and avoid disturbance of known sites of archaeological, cultural heritage, historical, natural or scientific significance; and
- Maintain an active rehabilitation program that will restore operational areas to a condition which is compatible with the prior land use.

Richard Cottee
Managing Director
1st March 2017

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Figure 4-1. Central's corporate environmental policy

Central Petroleum Limited

CENTRAL PETROLEUM LTD
HSSE POLICY

Central Petroleum Limited believes that effective management of Health, Safety, Security and Environmental (HSSE) issues is essential for success in its business, by:

- Providing leadership and commitment to HSE issues and communicating our expectations to employees, contractors and other stakeholders;
- Providing clear direction and monitoring of a zero drug and alcohol tolerance to all contractors and employees whilst involved in drilling, seismic or production activities (Operations) on site or when binding decisions relevant to Operations are required to be made;
- Zero tolerance to smoking in any workplace, except designated areas;
- Complying with national, state and local legislation;
- Providing a safe working environment for all employees, contractors and third party personnel;
- Minimising the impact of our activities on the environment;
- Selecting and managing contractors to ensure their HSE performance meets our and statutory requirements;
- Carrying out risk assessments and taking effective measures to reduce risks to as low as reasonably practicable on all our operations;
- Providing sufficient training, resources, equipment and personnel to achieve our HSE objectives;
- Maintaining appropriate HSE documentation;
- Monitoring HSE performance-investigating and reporting all incidents and accidents regularly to the Board of Directors as well as relevant authorities;
- Striving for continuous improvement;
- Ensuring effective emergency response procedures are in place;
- Supporting wherever possible the advancement of local communities in areas where we operate; and
- Conducting audits and reviews to assess compliance with this policy.
- Implementing and using management systems for integrity management of plant, pipelines and equipment.

It is the responsibility of all employees and contractors to comply with this policy and to assist Central Petroleum Limited in its implementation.

Richard Cottee
Managing Director
1st March 2017

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Figure 4-2. Central's corporate HSSE policy

5 ENVIRONMENTAL LEGISLATION AND OTHER REQUIREMENTS

5.1 Legislation and Approvals

The legislation and associated approvals relevant to environmental management of operations at the proposed appraisal well site is listed in Table 5-1.

Table 5-1. Legislation, Consents and Approvals.

Policy Jurisdiction	Legislation
Internal	Central Petroleum Environmental Protection Policy 2018
Commonwealth	Aboriginal Land Rights (Northern Territory) Act 1967
	Native Title Act 1993
	Aboriginal and Torres Strait Islander Heritage Protection Act 1984
	National Environmental Protection Council Act
	National Greenhouse and Energy Reporting Act
	Australian Heritage Council Act 2003
	Environmental Protection and biodiversity Conservation Act 1999
Northern Territory	Aboriginal Land Act 2013
	Work Health and Safety (National Uniform Legislation) Act 2016
	Public Health (General Sanitation, Mosquito Prevention, Rat Exclusion and Prevention) Regulations 1988
	Plant Health Act 2015
	Petroleum (Prospecting and Mining) Regulations Act 2001
	Biological Control Act 2011
	Northern Territory Aboriginal Sacred Sites Act 2013
	Bushfires Management Act 2016
	Control of Roads Act 2015
	Dangerous Goods (Road and Rail Transport Act) 2012
	Energy Pipelines Act 2015
	Environmental Assessment Act 2013
	Environmental Offences and Penalties Act 2011
	Fire and Emergency Act 2016
	Heritage Act 2016
	Petroleum (Environment) Regulations 2016
	Petroleum Act 2016
	Public and Environmental Health Act 2016
	Public and Environmental Health Regulations 2014
	Schedule of Onshore Petroleum Exploration and Production Requirements 2017 (under the Petroleum Act 2016)
	Soil Conservation and Land Utilisation Act 2016
	Territory Parks and Wildlife Act 2014
	Waste Management and Pollution Control Act 2016

Policy Jurisdiction	Legislation
	Water Act 2016
	Weeds Management Act 2013
Operating Consents	OL3

No referral or notice of intent is required under the EA ACT or EPBC Act due to the minor nature of the work program. The Department of Environment and Natural Resources was consulted in this decision.

5.2 Standards and Policies

The standards and policy relevant to environmental management of operations at the proposed appraisal well sites are listed in Table 5-2. These Standards will be applied in accordance with Central's HS&E MS and have assisted in determination of "as low as reasonably practical" in Section 8.

Table 5-2 Central Petroleum Standards and Policy

Activity	Standard and/or Policy
Drilling	American Petroleum Industry (API)
Transport of wastes across State or Territory borders	National Environment Protection (Movement of Controlled waste Between States and Territories) Measure (Controlled Waste NEPM 2013)
Contaminated sites	National Environment Protection (Assessment of Site Contamination) Measure (NEPM 2013)
Waste removal from site	NT EPA approved contractor
Erosion and sediment control	IECA and DLRM guideline and best practise principles
Land access agreements	AAPA approval and certificate
Risk management	AS/NZS ISO 31000:2009 and HB 203:2006
General Operations	APPEA Code of Environmental Practice
Central	*MSTD09-01 v1 – Hazard Identification, Risk Management and Control*.
	Central Health, Safety and Environmental Management System (HS&E MS).

6 DESCRIPTION OF ACTIVITY

6.1 Background

Design and planning of the PV-13 drilling location follows strict procedures on well construction and operational aspects to eliminate contamination both during drilling operations and for the life of the well. The well will be drilled and constructed using American Petroleum Industry (API) Standard equipment operated by certified personnel. The proposed appraisal well design and equipment used to drill the well are designed to prevent groundwater aquifer contamination, uncontrollable discharge of water or gas at surface, chemical/fuel spills, and to minimise surface disturbance by operating to industry best practise standards.

6.2 Plan

PV-13 will be drilled as a sub horizontal borehole through the Lower Stairway Sandstone Reservoir using a combination of mud drilling and compressed air and mist drilling, depending on the hardness of the rock and having regard to preserving the production capability of the target reservoir. If gas flow rates to the surface are satisfactory, it will be completed as a production well. A summary of the proposed appraisal well activities is provided in Table 6-1 below.

If the well is successful or the well is cased and suspended, the drill pad will remain cleared at 120m x 120m for approximately three years allowing for future works, including completions or standard production and remedial well work that may be required.

After this time the well pad size will be assessed and, where possible, reduced. If the well remains on production the drill pad will be reduced to approximately 50m x 50m to allow for standard production operations for the life of the well.

If the well is not successful, the full rehabilitation of these sites will be commenced as per Appendix 9.

Table 6-1. PV-13 Appraisal Well Data Summary

Well Name and Number:	Palm Valley-13	
Designation:	Petroleum Appraisal Well	
Permit:	OL 3 (Northern Territory)	
Basin:	Amadeus Basin	
Proposed Location: (MGA94, Zone 53)	Latitude	23° 59' 36.351" S (GDA94)
	Longitude	132° 43' 33.602" E (GDA94)
	Easting	268656.4023 m E (MGA94, Zone 53)
	Northing	7344633.313 m N (MGA94, Zone 53)
Drill Pad area:	Approximately 120m x 120m	
Anticipated Spud Date:	June 2018	
Anticipated Total Well Days:	45 Days	
Drilling Contractor:	Ensign Australia Pty Limited	
Rig Name and Type:	Ensign 932, Dreco Conventional Drilling Rig	
Primary Objective:	Hydrocarbons (Gas) within the Pacoota P1 Sandstone	
Estimated Total Depth:	3715.0m MD (2110m TVD)	

6.2.1 Proposed Drill Site Location

The PV-13 drill site will be situated within the Palm Valley gas field (OL3), approximately 8km east of the existing CTP and 150m from the existing PV-7 well site (Figure 6-1 and 6-2).

6.2.2 Access and Well Pad Data

The proposed drill site will be accessed utilising existing roads in the PVGF area (see Figures 6-1 and 6-2).

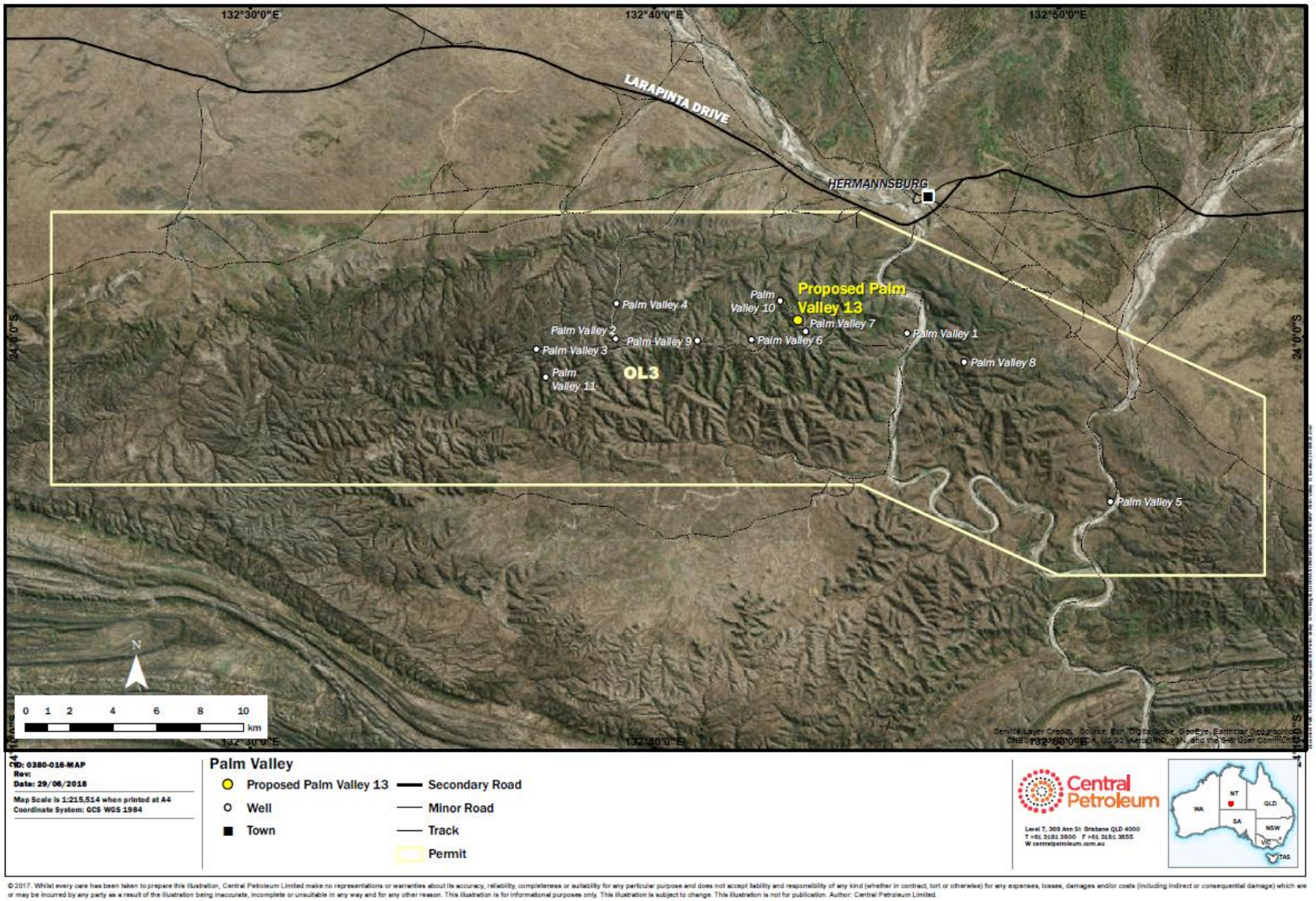

Figure 6-1. Proposed location of PV-13 appraisal well in relation to existing wells and the PVGF area

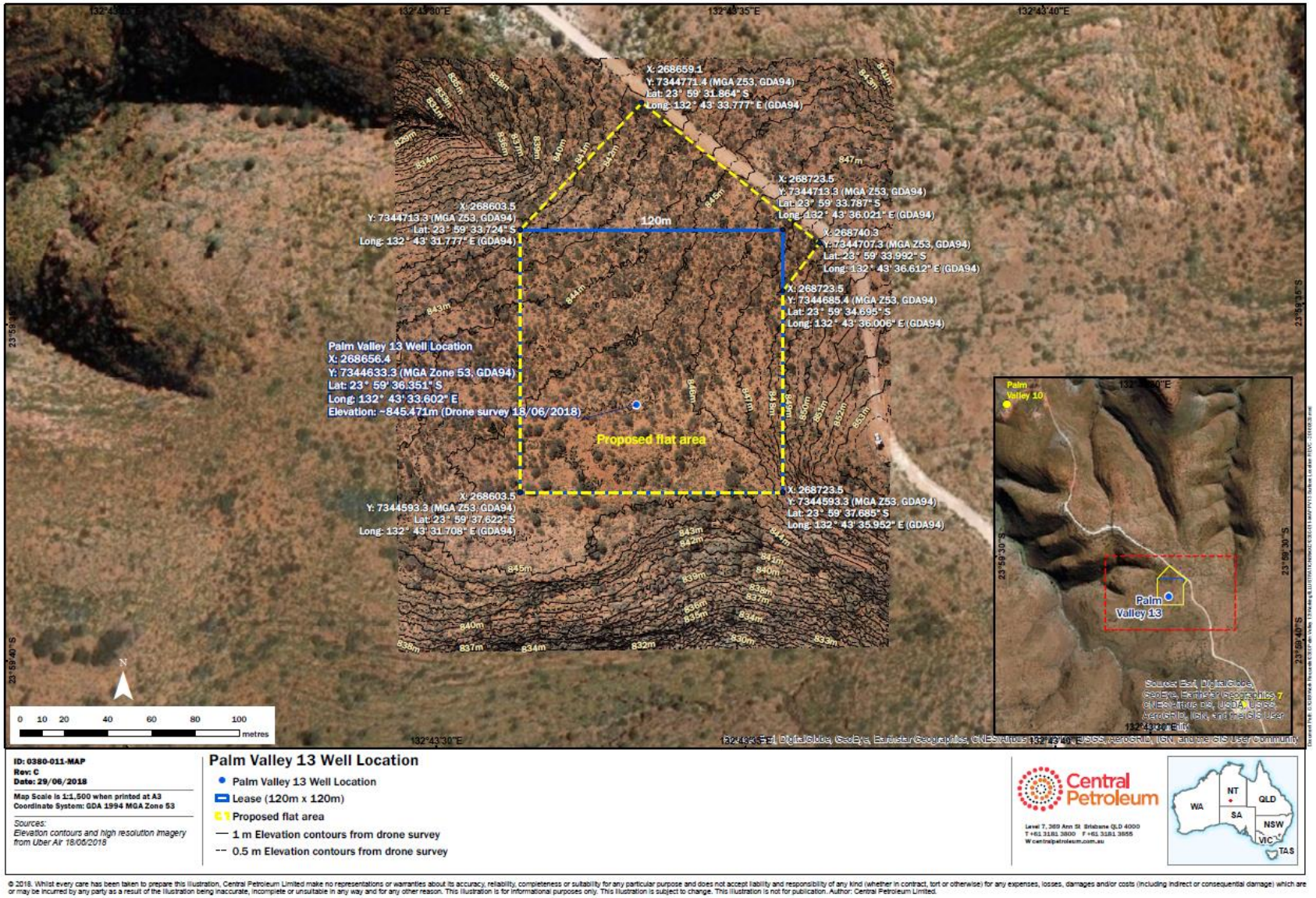

Figure 6-2. Location of proposed PV-13 well site and existing roads.

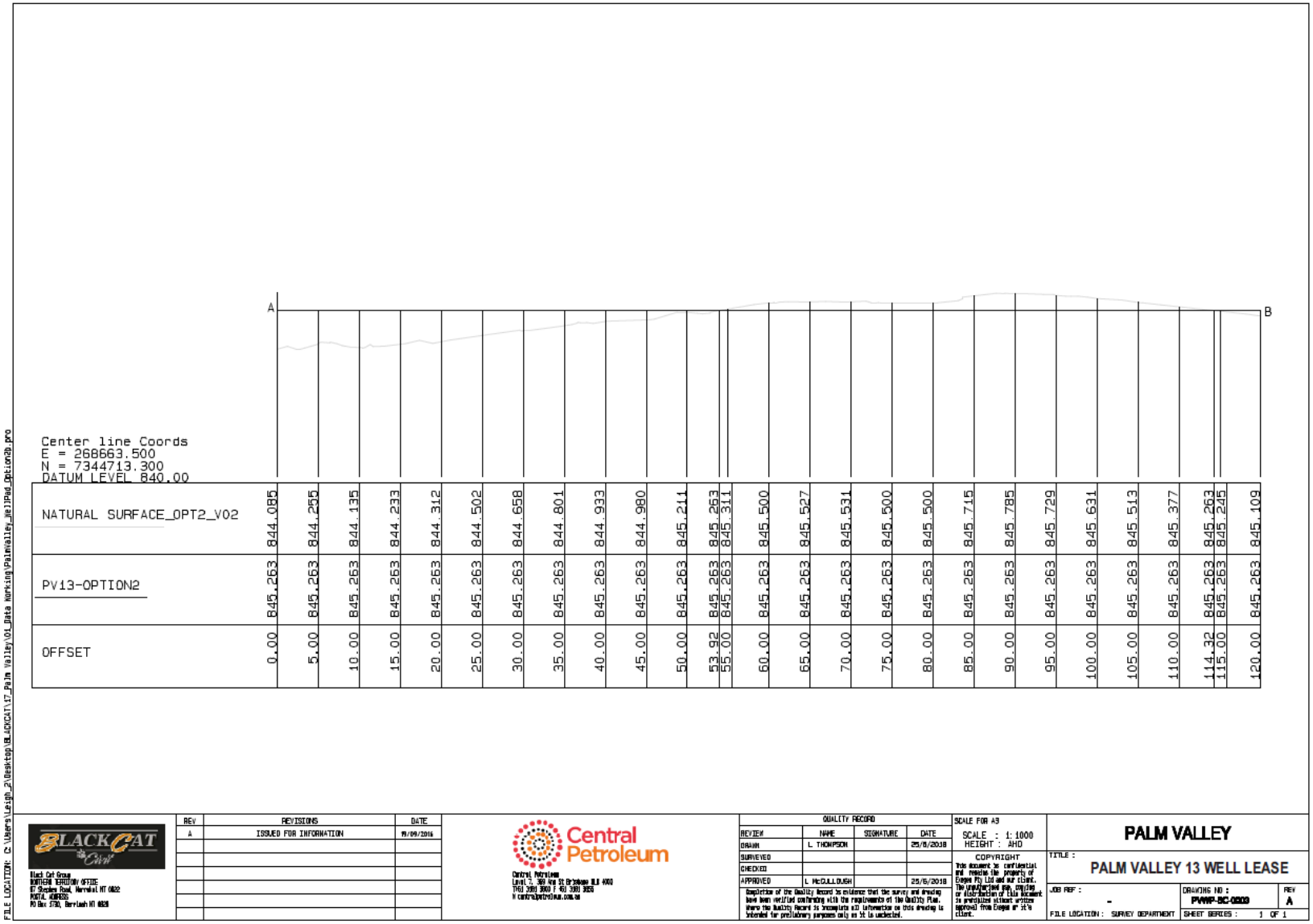

Figure 6-3. Lease construction cross section A-B

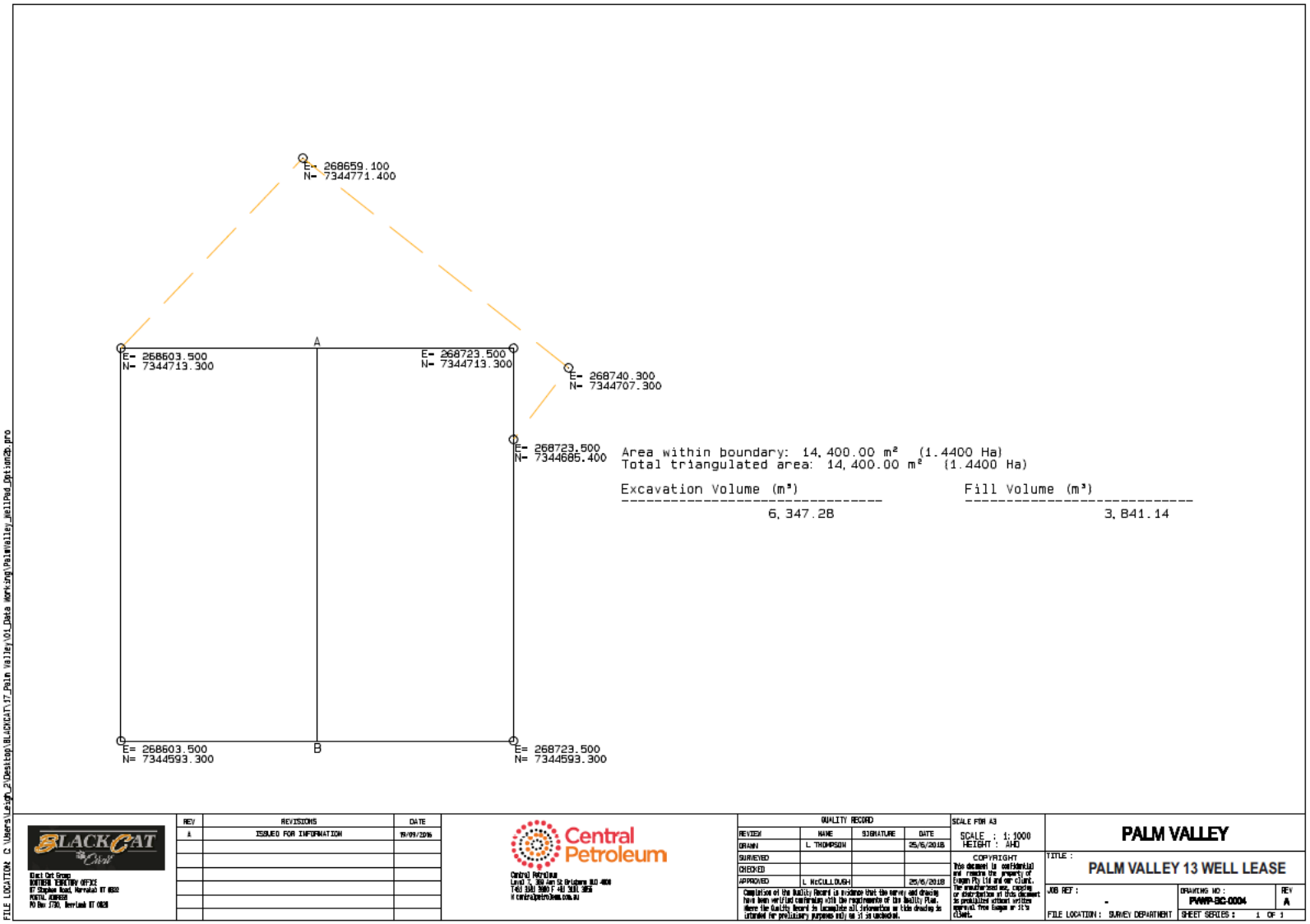

Figure 6-4. Well pad elevations including excavation volumes

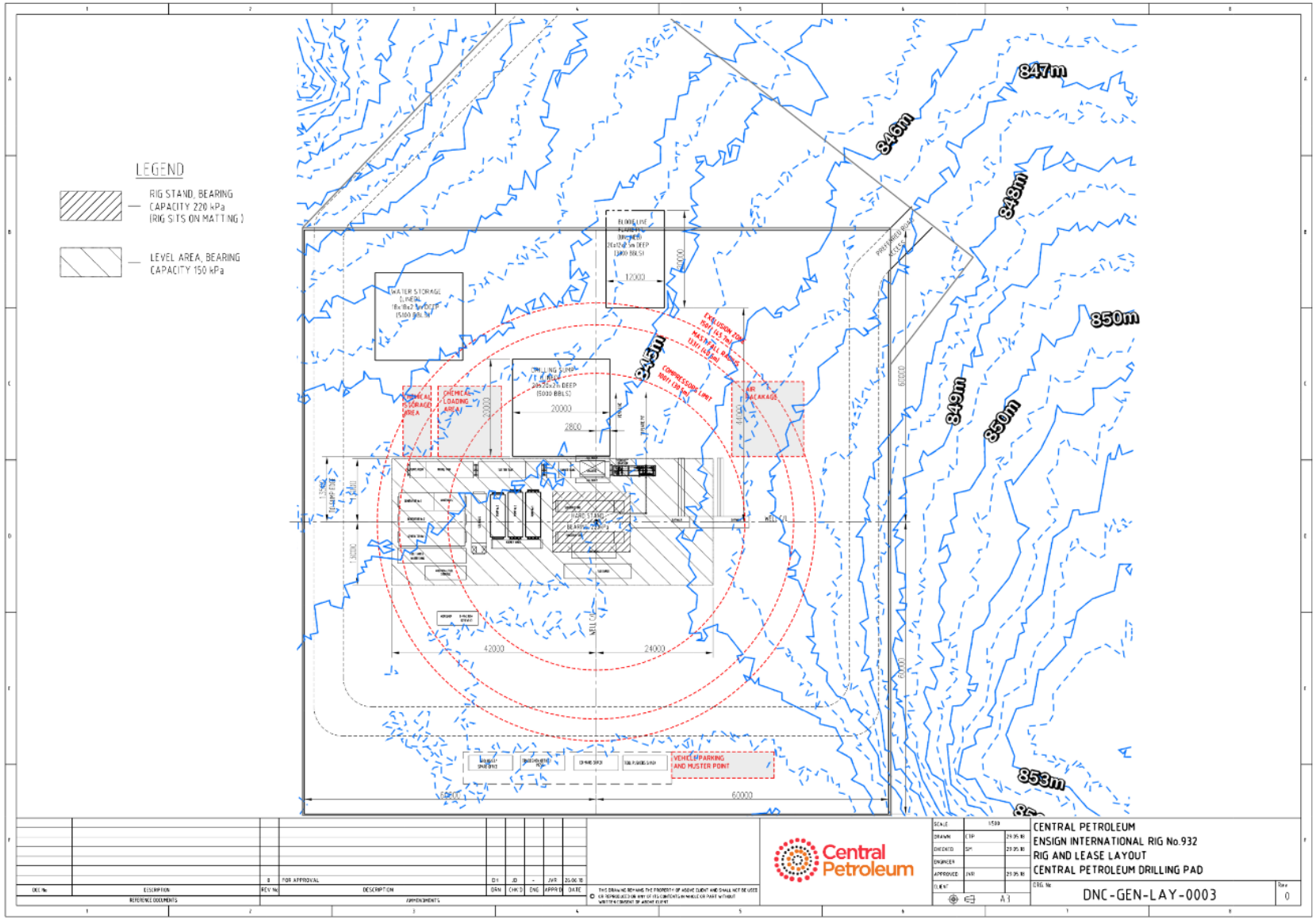

Figure 6-5. Detailed PV-13 lease lay out, truck turn around and contour diagram

6.3 Drill Rig

A Dreco Conventional Drilling Rig will be used to drill PV-13. The rig will include an air package, consisting of two compressors, booster, mist pump and blooie line. Additional back-up equipment may also be located onsite. Mobilization of the rig and associated equipment to the site will require approximately 45 to 55 triple trailer truckloads. A summary of the drill rig specifications is provided in Table 6-2 and Figure 6-6.

Table 6-2. Dreco Conventional Drilling Rig Specifications

GENERAL RIG SPECIFICATIONS	
Mast:	Dreco Cantilever - 40.54m 500,000lbs (10 lines) Static Hook Load Capacity 467,000lbs (8 lines) Static Hook Load Capacity
Substructure:	Dreco four section box style, Working Height – 6.1m
Draw works:	Tri-Service oilfield TSM 1200 HP rating 1200 HP/input power 1000HP
Top drive:	Tesco HMI-250
Mud pump:	2 x National 8P-80 Triplex, 800HP Powered by G.E. 752 DC motors
Mud tanks:	Total Volume: 1302bbls 1 x Shaker tank: 324bbls 1 x Suction tank: 556bbls 1 x Mixing tank: 422bbls
Day tank:	1 x 640bbls
Shale shaker:	3 x SWACO Mongoose, Desilter
BOP:	13-5/8” x 5000psi Shaffer Annular 13-5/8” x 5000psi Shaffer Double Gate
Catwalk:	2 sections 7’-8” wide x 40’ Long x 3’-6” high
Fuel tank:	1 x 64,000L, Double skinned, Skid mounted
Air package:	2 X Compressors, 1 Booster, Mist Pump, Blooie Line, RCD

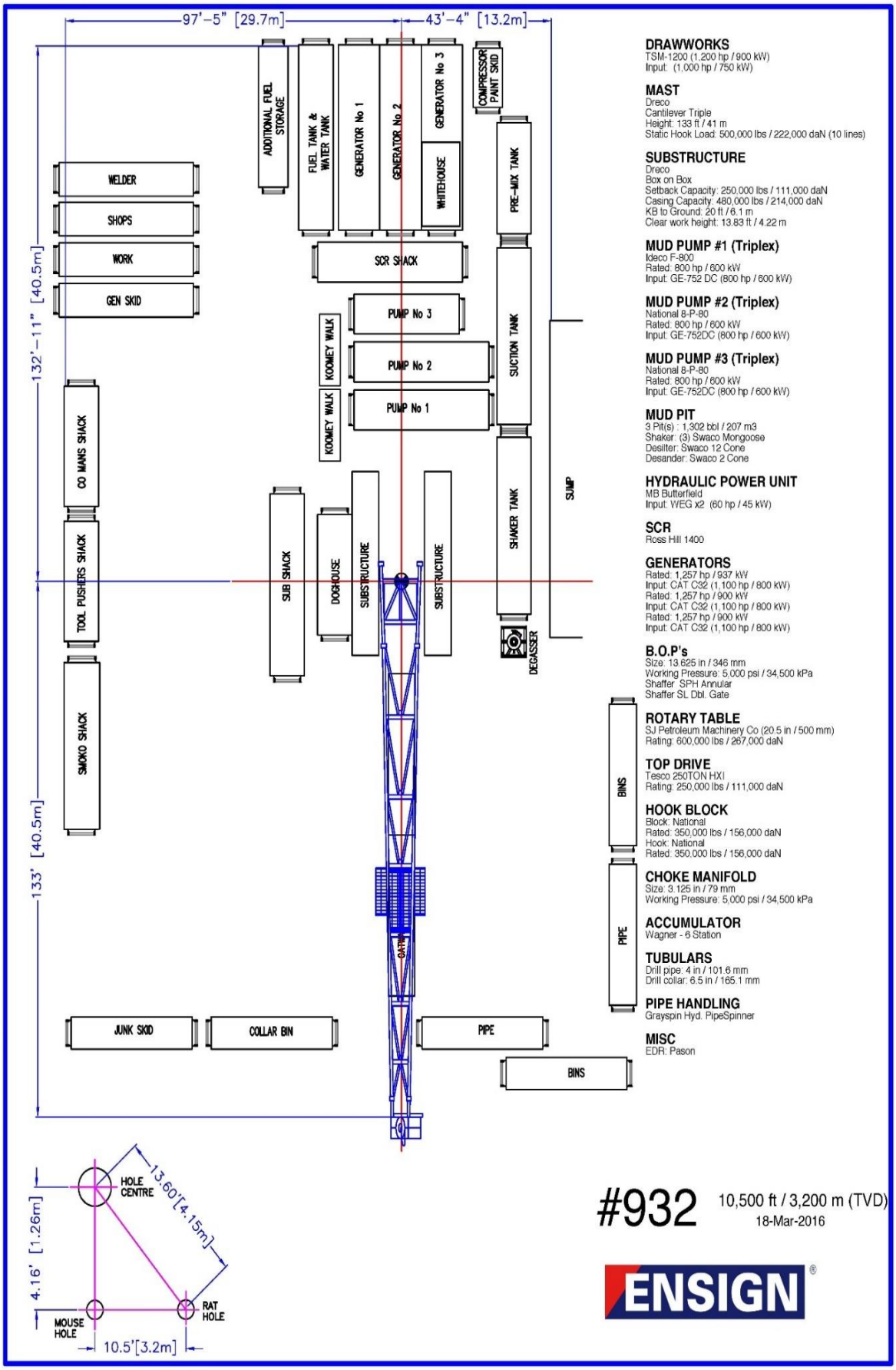

Figure 6-6. General Ensign Rig layout

6.3.1 Proposed Appraisal Well Site

Clearing activities will be limited to the removal of vegetation over an area of 18,423sqm as outlined in the yellow dashed lined in Figure 6-2 to cover the 120m x 120m lease pad and additional clearing around the flare pit and the access road to address safety concerns with respect bush fire management. Cleared vegetation and top soil will be piled separately around the edge to clearly denote the cleared area in low profile mounds under 1.5 to 2m in height. The top soil and vegetation stockpiles will be used to denot the boundary of the well site (refer to Figure 6-2 & 6-4 and Appendix 13 Hazard ID 9, 11 & 13).

The well pad has been designed to accommodate the drilling rig, associated equipment, materials and consumables and provides space for all personnel. The design also ensures adequate drainage and a safe work environment during operations. Excavation activities will be completed for the construction of an LLDPE Geomembrane lined drilling sump (approximately 15x10x2.5m), flare pit (approximately 18x10x2.5m), lined (HDPE) water storage pit (approximately 20x20x2m), and the installation of a cellar. A rig layout for Rig 932 is shown in Figure 6-5, 6-5 & 6-7 illustrating the positioning of the drill rig and associated equipment.

From the construction drawings (Figure 6-3 & 6-4) the majority of the gravel will be produced on site via a rock crusher that will convert the cut into fill. If there is additional gravel requirement for hardstand to support the drill rig substructure foundation under maximum load conditions (80 x 80m) some gravel shall be imported from a local Hermannsburg region gravel pit. It will be then removed on final rehabilitation of the site.

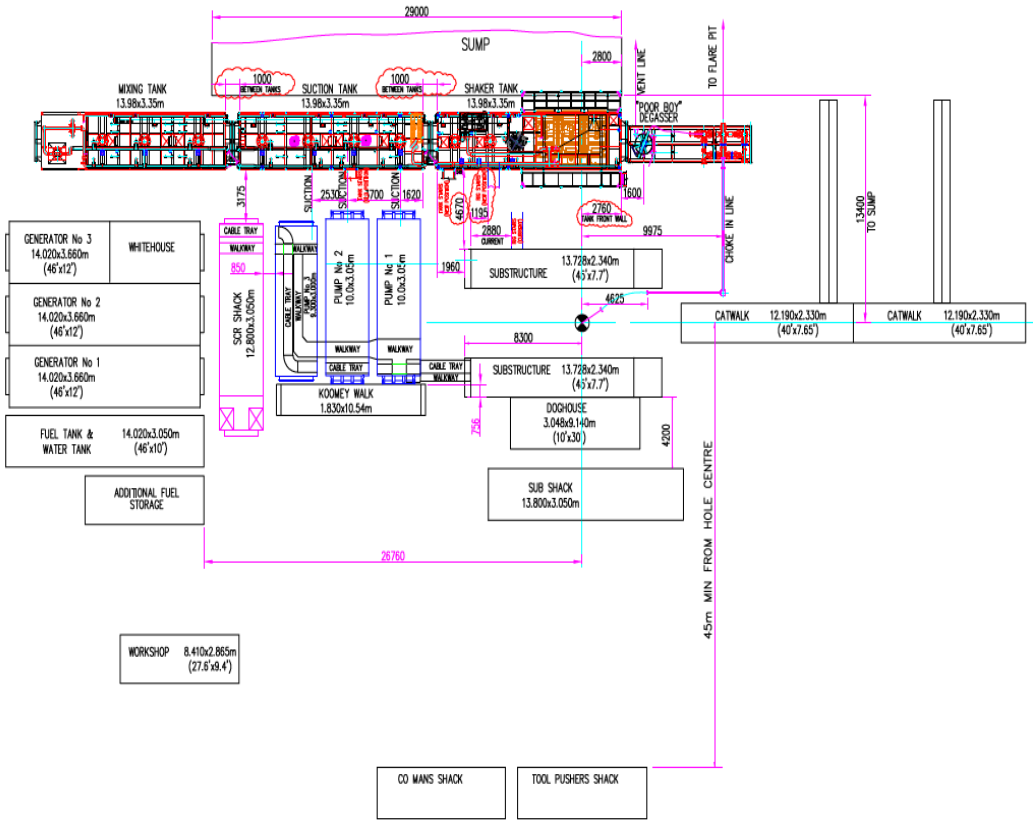

Figure 6-7. General Rig/Lease layout illustrating the positioning of the drill rig and other associated equipment

6.3.2 Camp

The drilling camp will be located at PV9 (Figure 6-9) with a capacity to accommodate up to 68 people. The camp will be equipped with a fully self-contained sewage treatment plant (Ozzi Kleen) furnished with an irrigation sprinkler system. The full discharge specifications of the sewage system can be found in Appendix 7 and waste management is dealt with in Appendix 10. Sewage water disposal is further discussed in Section 6.3.5. Below is a general site layout illustrating the camp and associated equipment (Figure 6-8).

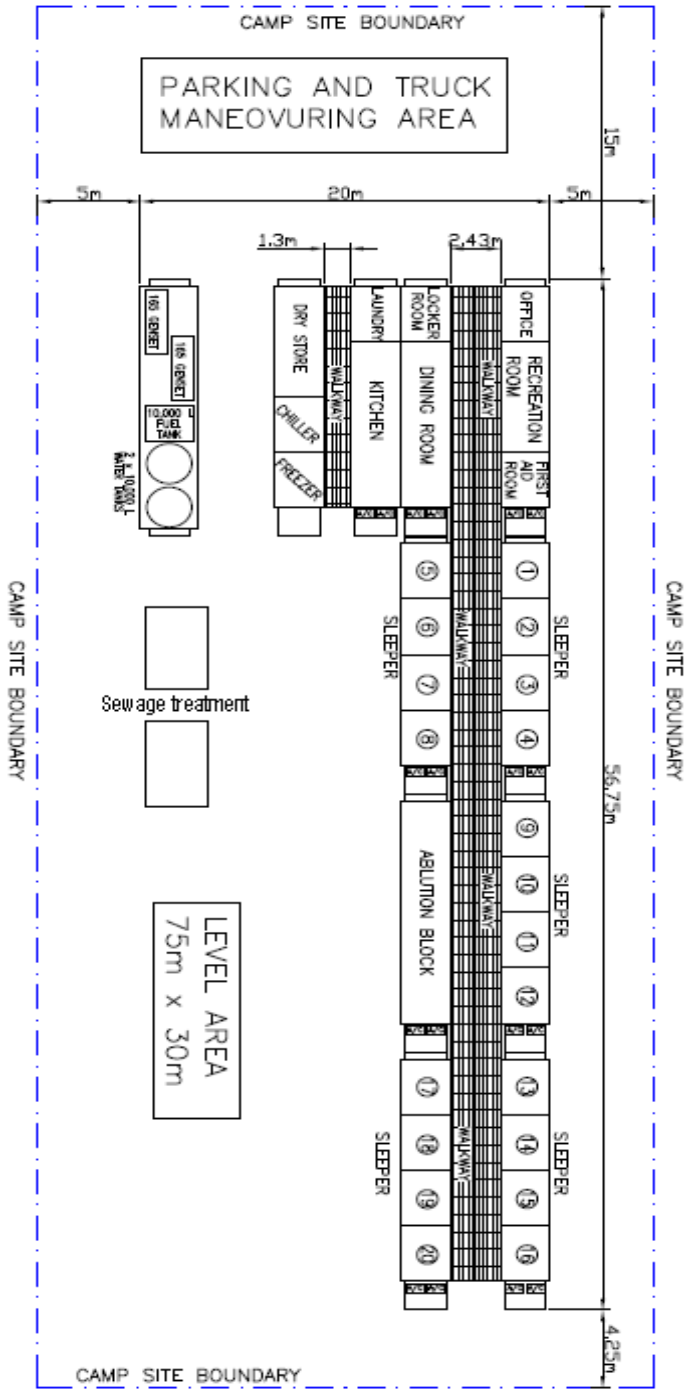

Figure 6-8 General site layout illustrating potential temporary camp and associated equipment

Figure 6-9. Proposed camp area

6.3.3 Water Use

The amount of water required to drill the proposed appraisal well will be approximately 8,000bbls. PV-13 will be drilled as a sub horizontal borehole using a combination of mud drilling and compressed air and mist drilling, depending on the hardness of the rock and having regard to preserving the production capability of the target reservoir. Water will be sourced from the council in Alice Springs and surrounding areas. The water will be trucked in by local registered water carters (Appendix 14). Water will not be abstracted from water bores on site. Water will be stored in temporary water storage facilities within the proposed drill site. All standing water will be fenced to deter fauna.

6.3.4 Grey Water Disposal

Any grey water produced from the temporary camp and office facilities at the drill rig will be dispersed into the surrounding environment with a movable temporary sprinkler. The sprinkler will be moved daily to avoid pooling of water which may attract pest and fauna. Any detergents or cleaning fluids used will be biodegradable and low-nutrient formulations where possible.

6.3.5 Sewage Water Disposal

All sewerage water produced at the PV-13 camp will be treated by an onsite treatment plant for ultimate disposal in accordance with Appendix 10 or transported offsite as required.

Discharge from the Drilling temporary camp will be treated to achieve the specifications given in Appendix 7. The effluent storage compartment of each unit holds approximately 300 litres of water. Once the liquid has reached the predetermined level of decontamination, the submersible pump within the unit, which is controlled by a float switch, will activate to allow the water to be sprayed 50-100m away from the camp location to the surrounding environment using a sprinkler system. The estimated volume of treated water released per day is approximately 8000 litres. The discharge sprinkler system and treated water will be managed so that there will be no pooling, no runoff, no vegetation die off and no releases within 100m watercourses or drainage features.

6.3.6 Waste Management

Waste will be segregated into listed and non-listed waste as determined in Schedule 2 of the Waste Management and Pollution Control (Administration) Regulations before final disposal. Non-listed waste will be transported off-site and disposed of at the appropriate waste transfer stations. All listed waste will be transported off-site by an NT EPA approved and registered waste contractor for disposal at the nearest appropriate and licenced waste management facility (Appendix 14). Where transport is required across state or territory borders, the NEPM 2013 guidelines will be adhered to as well as local regulations.

If required, waste will be placed in sealed containers for transport to the locations indicated in Table 6-4. All waste will be removed weekly.

Table 6-3 Waste disposal locations and facilities currently used for disposal of listed and non-listed wastes by Central

Type of Waste	Disposal Location
General and food	JJ Richards, Alice Springs NT
Empty IBCs	JJ Richards, Alice Springs NT
Metal and plastic drums	JJ Richards, Alice Springs NT
Waste metal	Alice Metal Recyclers, Alice Springs NT
Batteries and Tyres	Cleanaway 6, Alice Springs NT
Listed Waste	Any waste prescribed wastes under the *Waste Management and Pollution Control Act* as specified as a listed waste by the NT EPA as found at https://ntepa.nt.gov.au/waste-pollution/approvals-licences/listed-waste, will be disposed of in accordance with the regulations and by a company licensed to handle and dispose of this waste.

Any other waste not covered in the above table to be separated and removed from site for final disposal in accordance with Appendix 10.

6.3.7 Mud Sump and Flare Pit

The drilling of PV 13 will encompass both mud drilling and compressed air and mist drilling operations.

During mud drilling operations, the fluid is re-circulated down the hole following the removal of drill cuttings from the returns by passing over / through solids control equipment at the surface. The cuttings will be directed into the drilling sumps and the fluids directed to the mud tanks which will have a capacity of approximately 1000bbls (Figure 6-6).

During air and mist drilling operations, all the cuttings will be directed through a blooie line to the flare pit which will have a capacity of approximately 3,000-4,000bbls. A de-duster will be installed on the blooie line. This device will wet the air stream as the cuttings exit the blooie line, minimizing dust output.

The total volume of rock removed during the drilling operations of the well (mud and air drilling) is approximately 1000bbls. When drilling and associated activities have been completed on the site, the lined sumps and flare pit are left to dry out before backfilling. Testing will be undertaken of the cuttings to determine suitability for backfilling or if removal and offsite disposal is required.

A mud system may be required during the drilling of the well and a fluid system will always be on site for standby for well control. Details of this mud system can be found in Appendix 1. This fluid is stored in the contractor's steel mud tanks during the well construction phase. During mud drilling operations, fluid and cutting returns are taken to the shale shakers where the mud is separated, and the cuttings discharged to the drilling sumps. As the drilling muds are very basic with biodegradable additives, this fluid is also discharged as per standard industry practice into the lined drilling sumps. Baseline soil samples will be taken prior to sump construction. Liquids in the sump will also be sampled and tested with test results sent to DPIR from an independent third party confirming that in-situ burial is acceptable in accordance with the following criteria:

- pH of 6-10.5 (prior to mixing with soil)
- Electrical conductivity of 20,000 uS/cm (prior to mixing with soil)
- Chloride of 8000 mg/L (prior to mixing with soil)

- Metals as per the NEPM 2013 (once mixed with soil).

The sumps and cuttings are allowed to dry out before back filling. The specific process for backfilling is as follows:

- the base of the subsoil and residual solid mixture will be separated from the Alice Springs groundwater table by at least 730 metres of a continuous layer of impermeable subsoil material (kw=10–8m/s) or subsoil with a clay content of greater than 20% (note that the nearest aquifer 730m as identified in section 7.1.5),
- the dried drilling mud will be mixed with subsoil in the sump and covered
- the subsoil and drilling mud will be mixed at least three parts subsoils to one-part waste (v/v)
- a minimum of one metre of clean subsoil will be placed over the subsoil and muds mixture
- top soil will be replaced.

The criteria and methodology proposed are consistent with the standards set by the Queensland Department of Environment and Science for onshore oil and gas activities. The mud sumps will be backfilled prior to the wet season or, if not fully evaporated, appropriately tested and managed so that waste materials are either safely relocated and disposed or buried on site.

In situ burial of drilling cuttings where appropriate quality criteria can be met is considered to represent an acceptable and low as reasonably practical environmental risk when considered holistically. Other options such lining ponds and removing the drilling muds for off-site disposal generate more waste plastic, generate more greenhouse gases and importantly add significantly more road kilometres which represent one of the largest safety risks to staff and the community associated with onshore oil and gas activities.

6.3.8 Storage of Drilling Fluids and Chemicals

Chemicals required for the water-based drilling fluids are stored in self-bunded trailers called Tautliners, or on specifically designated and bunded storage areas onsite away from any potential hazards. Where possible, all chemicals used for drilling will be biodegradable. The rig contractor will have double lined mobile storage diesel tanks onsite, total capacity will be 67000L.

At the end of the program, any unused chemicals will be removed from site and returned to the vendor.

Water based drilling fluid is mixed onsite and stored within integrated mud tanks. Mud tanks volumes will total approximately 1000bbls. Tanks integrity will be verified before commencement of drilling program.

Air or mist will be used while drilling the target formation to prevent possible formation damage that could be caused from a water-based drilling fluid. Possible formation damage within the reservoir may include surface tension or swelling of clays, which can restrict gas flow.

6.3.9 Chemicals used

A drilling mud system will be used which consists of additives for fluid density (Potassium Chloride or Sodium Chloride), filtration control, viscosifiers, hole stability and pH control will be used. Where possible, all additives will be biodegradable.

SDS, which have been provided to DPIR, will be available on site for all chemicals used on site. Chemicals used, and the mud composition will be documented in the daily mud report and daily drilling reports.

Chemical usage will be optimised through an onsite mud engineer to ensure adequate hole cleaning, well control and well bore stability. Appendix 1 provides detailed information of proposed chemical composition and toxicity of drilling muds. Drilling contractors' standard operating procedures (SOP), full material safety data sheets (MSDS), appropriate PPE and handling procedures will be available on site. MSDS sheets have been provided to the DPIR.

6.3.10 Number of Staff

During drilling operations there will be approximately (but not limited to) 30 personnel onsite. During specific stages there will be a higher number of personnel onsite; up to approximately 47 people. A summary of personnel onsite including drilling rig personnel and other service providers, is summarised in Table 6-4.

Table 6-4. Summary of approximate number of personnel onsite during proposed drilling activities, including drill rig personnel and other service providers

PERSONNEL ONSITE	
Drilling Rig Personnel	**Total Onsite**
Senior Toolpusher	1
Night Toolpusher	1
Driller	2
Assistant Driller	1
Derrickman	2
Motorman	2
Floorman	2
Leasehand	2
Electrician	1
Mechanic	1
RSTC (HSE)	1
TOTAL	**16**
OTHER SERVICE PROVIDERS	**Total Onsite**
Mudlogging	4
Air Package	3
Cementing	3
Directional Drillers	4
Wireline	5
Wellsite Geologist	2
Wellsite Supervisor	2
Additional Personnel	8
TOTAL	**31**
GRAND TOTAL	**47**

6.3.11 Contractor Details

Table 6-5 Contractor details and contact information (personnel subject to change but contact numbers will remain the same)

Company & Contact	Service	Work Number	Mobile
Ensign Energy - Dave Murphy	Rig Contractor	08 8209 3142	0408492 318
Halliburton - Travis Alkek	Cementing	07 3811 6045	0426 226 751
RMN Drilling Fluids - Andre Skuijns	Drilling Fluids		0428 833 872
Newpark Drilling Fluids - Hennie Potgieter	Drilling Fluids		0408 623 341
Baroid (Halliburton) - Mohamed Magdy	Drilling Fluids		0410 221 675
Sperry Drilling (Halliburton) - Brian Huston	Directional Drilling	07 3811 6033	0448 048 593
Schlumberger - Nicole Cooper	Directional Drilling	08 9420 4602	0467 008 079
Schlumberger - Omar Mansour	Wireline Logging	08 9440 2987	0498 009 644
Kenetic - Sean Williams	Wireline Logging	07 4622 2511	0400 222 511
Halliburton - Travis Alkek	Mudlogging	07 3811 6045	0426 226 751
Wetherford - Scott Bremner	Air Package	07 2674 5800	0811706807
BlackCat Civil **Lachlan McCullough**	Earthworks	04 0839 8614	
Low Ecological Services **Bill Low**	Environmental Inspections	08 8955 5222	0417 870 868
Orange Creek Station **Wally Klein** **WANNA LIFT CRANE HIRE AND WATER HAULAGE** **Russel Dehne**	Water transport (Drill water – non regulated) Water transport (Potable water haulage – Licenced potable water hauler)	08 8956 0924 08 8953 5900	
J.J. Richards **Brendan Hall**	Regulated or listed Waste		0448734366

6.3.12 Timing and Duration

Drilling activities are proposed to commence in June 2018. The anticipated duration of the drilling program is approximately 45 days. Drilling operations will run 24 hours a day during this time.

6.3.13 Staging Area and Drilling Activities

Once the drill pad is cleared and excavation works are completed (installing all drilling sumps, flare pit, water storage pit, and the installation of a cellar to house the wellhead and BOP) the drilling rig will be mobilised to the site. Main staging of the rig will occur at the previous cleared area at the right-hand side of the main access road to PV site.

6.3.14 Drilling Program Activities

Drilling program activities will include:

1. Installation of a conductor pipe by either pilling or auger methods or drilling with a water / polymer drilling fluid. The conductor pipe will be set and cemented within a competent formation, isolating the unconsolidated surface sediment.
2. Installation of a second conductor string across the Hermannsburg Sandstone and the shallow freshwater aquifer (Mereenie Sandstones) identified in section 7.1.5. The conductor casing will be set in a competent formation and cemented to surface. The Conductor-2 hole is intended to be drilled using a water-based drilling fluid. If performance objectives are not met due to the hardness of the formation or water aquifer during mud / fluid hammer drilling operations, the hole section may be drilled with air and a hammer bit by Direct Circulation Air Drilling techniques to maximise the rate of penetration.
3. Following the installation of the second conductor, the surface hole will be drilled using a simple water-based mud system or Direct Circulation Air Drilling techniques depending on performance objectives. The water-based mud will consist of additives for fluid density (Potassium Chloride or Sodium Chloride), filtration control viscosifiers, hole stability and pH control.
4. A surface casing string will be run and cemented to surface adding a barrier over the potential deep-water aquifer.
5. A Formation Integrity Test (FIT) will be conducted prior to drilling below the surface casing to determine the strength and integrity of the open hole formation below the casing shoe. The FIT test ensures and confirms that the formation directly below the surface casing shoe will not break down during a well control event.
6. The intermediate hole (build section) drilling will involve directionally drilling until the Pacoota Sandstone is intersected horizontally. This section will be drilled with a water-based drilling fluid consisting of additives for fluid density (Potassium Chloride or Sodium Chloride), filtration control viscosifiers, hole stability and pH control.
7. Following completion of the build section, a liner will be run to section Total Depth and set within the previous casing string. The liner will be set in place with a liner hanger and packer assembly and cemented in place.
8. A Cement Bond Log (CBL) will be run measuring the cement integrity behind the liner and surface casing.
9. Prior to drilling the production hole, a FIT will be conducted below the liner shoe.
10. The formation hole will be horizontally drilled using Direct Circulation Air / Mist Drilling techniques. Flow tests may be conducted during the drilling of the formation hole to test potential gas flow rates. This process involves a controlled release / flow of hydrocarbon (gas) diverted to a flare pit for combustion. Flaring will last for the entire drilling of the production hole, approximately 17 days.
11. A decision will be made to either run a completion or to plug and abandon the well based on the results obtained from flow tests.

6.3.15 Completion Activities

If gas flow rates to surface are satisfactory during flow testing, the well will be completed as production well. The well uses “open hole completion” which does not require any perforating activities. Completion activities will include:

- Installation of a production tubing string and production packer; and
- Installation of wellhead assembly enabling the well to safely flow gas to surface.

6.4 Closure and Rehabilitation

6.4.1 Suspension or Production

If the well is successful or the well is cased and suspended, the drill pad will remain cleared at 120m x 120m for approximately three years allowing for future works such as completion or standard production and remedial well work that may be required. After this time, the well pad size will be assessed. If the well remains on production, the drill pad will be reduced to approximately 50m x 50m to allow for standard production operations for the life of the well.

6.4.2 Plug and Abandon Activities

If flow rates to the surface are unsatisfactory, the well will be Plugged and Abandoned (P&A) after being logged. . Logging involves electrically powered tools being run over the production hole (horizontal section), where continuous measurements of the formation properties will be conducted to gather further information regarding the formation characteristics.

Once logging operations are completed the well will be P&A, which will involve:

- Placing cement plugs within the open hole over porous formations and any hydrocarbon bearing zones (minimum of 100m of cement above and 50m cement below any significant gas or fresh water zones);
- Placing a cement plug of at least 50m in height above the 7” liner hanger;
- Placing a surface cement plug extending at least 15m below the surface within the innermost string of casing that extends to surface;
- Cutting casing strings that extend to surface 2m below the surface and removing the wellhead;
- Welding a steel plate on top of casing stub that details the well name, date of completion and total depth;
- Removing cellar and backfilling; and
- All top soil will be respread evenly over the well pad, with vegetation stockpiles used as a final layer as soon as practical in accordance with Section 12. Also refer to Appendix 13 “Detailed mitigation measures”.

All casing strings will be left in the hole (no casing cuts or removal of casing sections downhole are required).

6.4.3 Rehabilitation

Refer to Section 12 and Appendix 9 for rehabilitation details.

7 DESCRIPTION OF THE ENVIRONMENT

7.1 Physical Environment

7.1.1 Climate

The climate of the proposed well site is described by (Slatyer, 1962) as semi-arid with 70% of precipitation being received between October and March, mainly from monsoonal depression systems in Northern Australia. Climatic conditions are indicated by those experienced in Alice Springs shown in Figure 7-1. The site experiences low and variable rainfall and high diurnal and seasonal temperature fluctuations. The mean annual rainfall for Palm Valley is 300 mm, with most of rainfall in summer.

Temperatures vary from very hot in summer to below freezing in winter, and frosts occur regularly during the winter months. The mean annual evaporation rate at Alice Springs is 3066 mm per year. The dominant wind directions are southeast to northeast with not much seasonal variation.

Climatic conditions for Alice Springs and Hermannsburg, the two closest reliable weather stations, are shown in Figure 7-1.

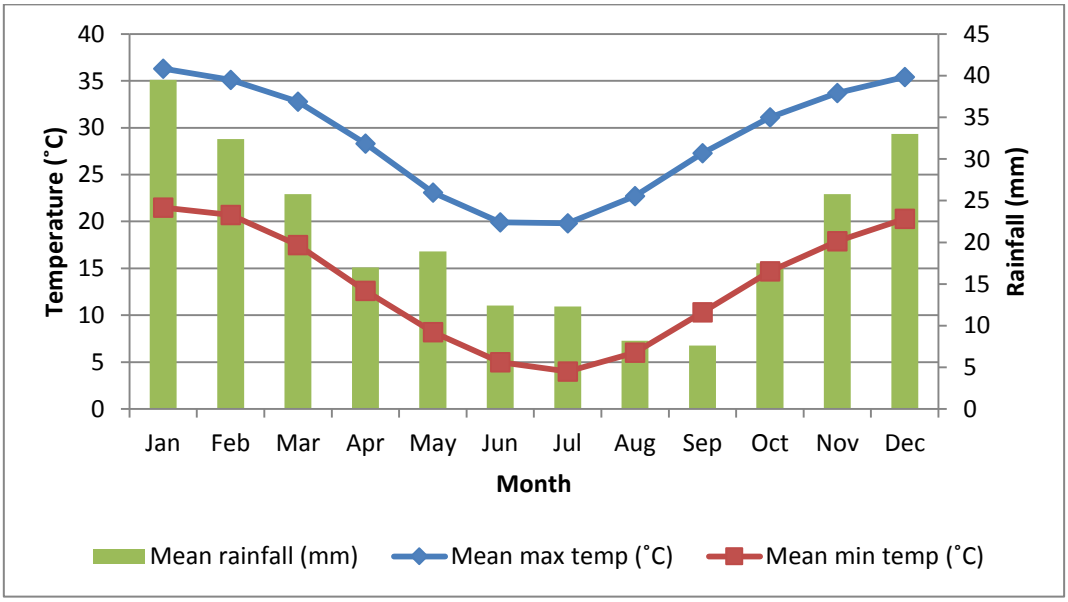

Figure 7-1: Alice Springs (1942 – 2016) weather data showing mean minimum and maximum temperature and Hermannsburg (1888 – 2016) mean monthly rainfall (Bureau of Meteorology, 2017).

7.1.2 Landscape and Topography

The proposed well site is in the Krichauff land system (Table 7-1, Figure 7-2) characterised as a partially dissected erosional weathered land surface with strongly dissected high plateaus, and superimposed drainage, narrow gorges and joint-controlled tributaries. Relief in the area surrounding the proposed well site is up to 500ft with the proposed well site itself on an elevated plateau area.

Table 7-1. Description of land systems associated with the proposed well site as described by (Perry, et al., 1960).

Land System	Code	Geology	Topography	Soils	Erosion Hazard
Krichauff	Kr	Flat lying sandstone, siltstone and conglomerate. Upper Proterozoic age, Amadeus trough (Heavitree quartzite)	Partially dissected erosional weathered land surface, relief up to 500ft	Shallow stony or gravelly soils and some red sands or red clayey sands	Moderate erosion hazard

Ghee & Low (2007) developed a land unit map for the PVGF area based on the Biophysical Mapping in Parks Project conducted by NT Parks prior to 2007 and the development of a land unit map for the Finke Gorge National Park area (including the southern portion of the Krichauff range). The proposed well site falls within the land unit DSS and is immediately adjacent to land unit GWRDL, described in Table 7-2.

Table 7-2. Description of land units (sub-sections of land systems) associated with proposed well site and adjacent area as described by (Ghee and Low, 2007).

Land Units (sub-sections	Land Form	Soil	Vegetation
DSS	Dissected slopes and summits; flat-crested plateau remnants, spurs and buttes; indented escarpments with rock faces, structural benches and gullied hill slopes, above 25%.	Outcrop with very little shallow stony soil	*Acacia macdonnelliensis* and *Eucalyptus sessilis* over *Acacia melleodora* and *Triodia brizoides*. Occasional *Capparis mithcelli*. Heterogeneous habitat with several unique species including *Dicrastylis gilesii*
GWRDL	Gorge walls, cliffs and rocky drainage lines in sandstone grading into creek lines with sandy to rocky bases.	Outcrop with very little shallow stony soil	Variable vegetation species within changing topography. *Eucalyptus camaldulensis*, *Atalyis hemiclauca* and *Corymbia opaca* common towards base. Rocky gorge walls containing *Acacia aneura, A.kempeana, Eremophila freelingii, Rhagodia eremaea, Santalum lanceolatum, Indigofera leucotricha* over mixed grasses and *Triodia*.

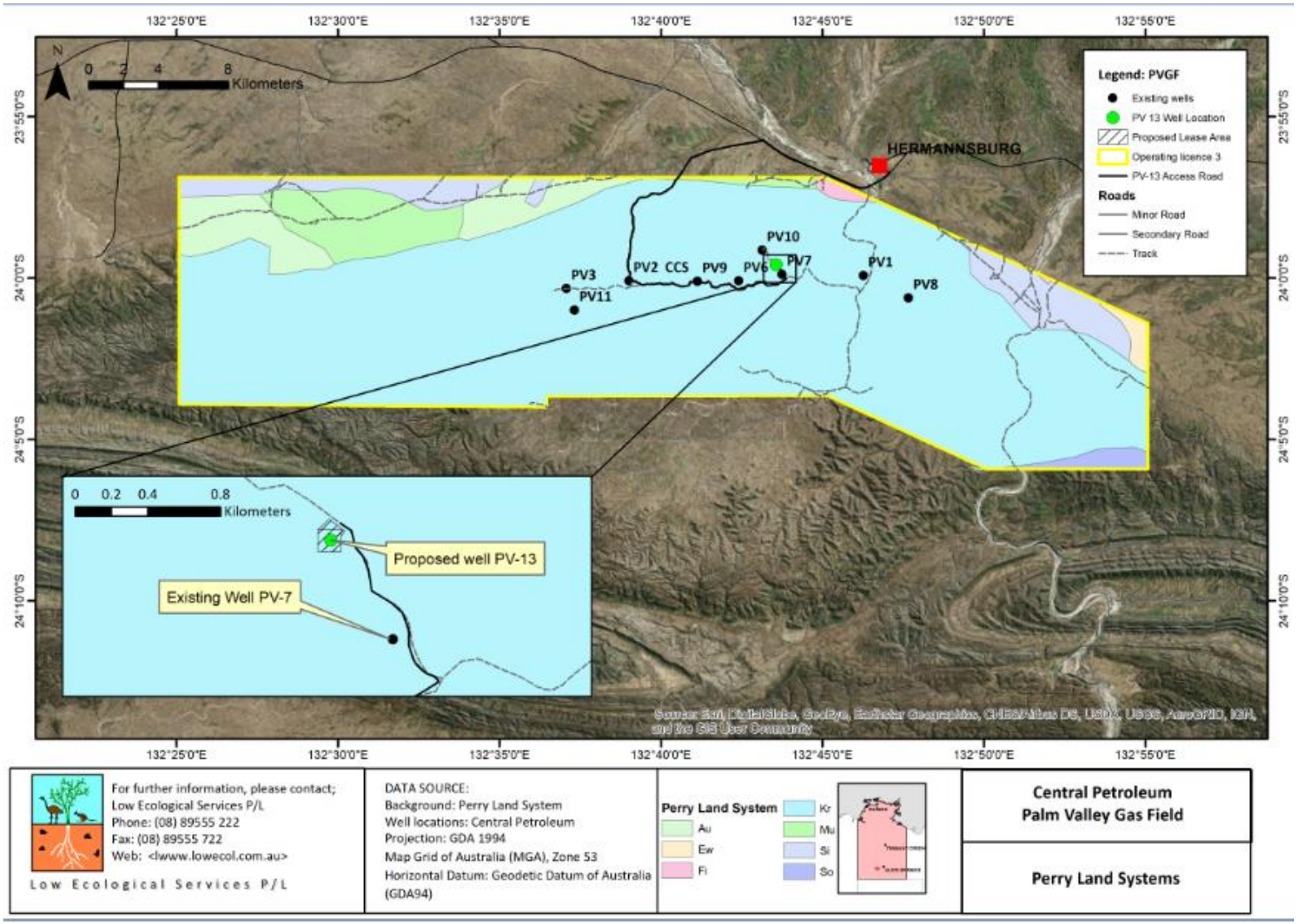

Figure 7-2. Perry Land Systems (Perry, et al., 1960) in relation to proposed well site and existing wells.

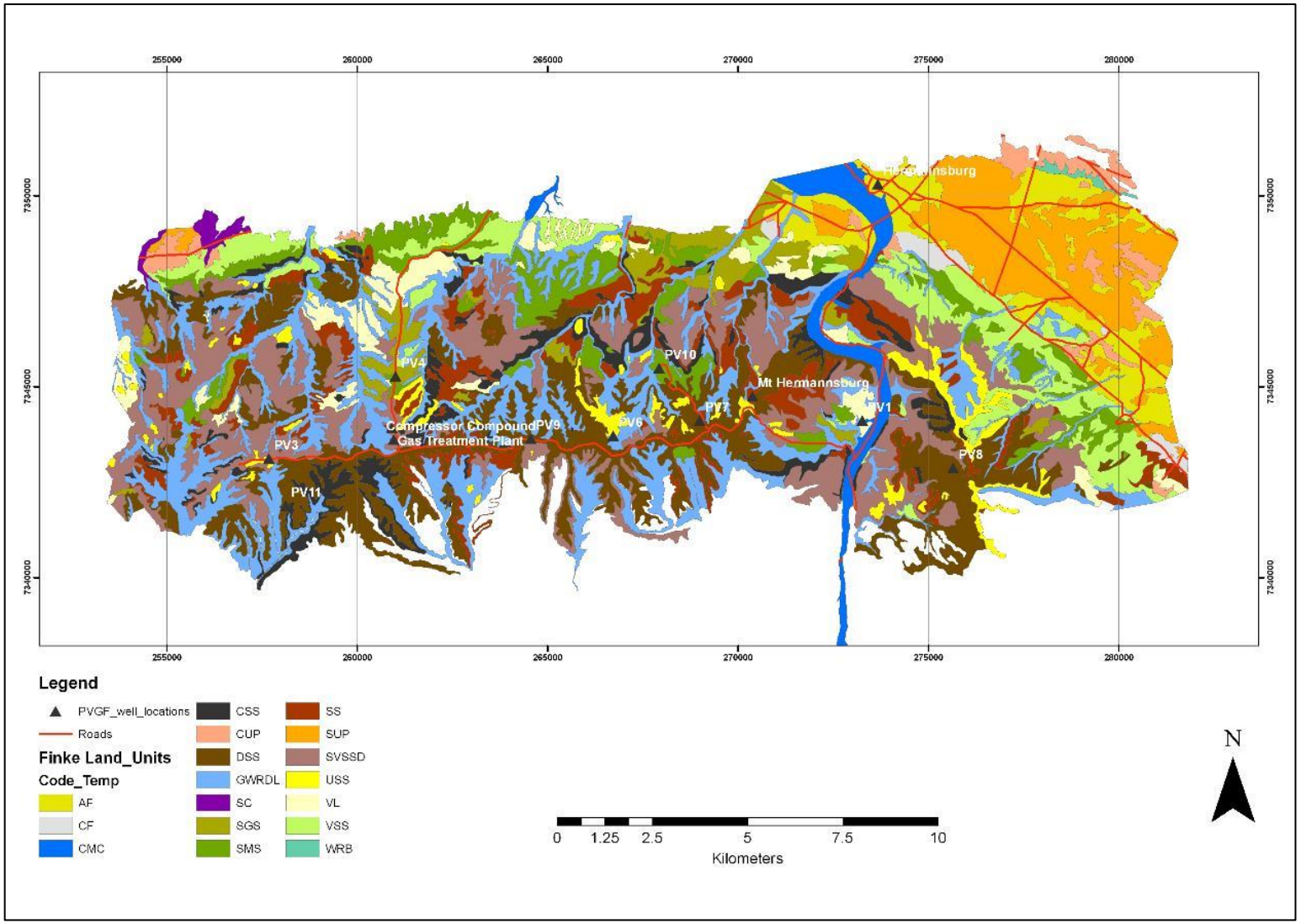

Figure 7-3. Land unit mapping of the PVGF and surrounding area.

7.1.3 Soils

In a 1982 assessment of the PVGF, conducted by Dames and Moore, three soil types were identified within the operating area; alluvial soils, lithosols and sands. Alluvial soils occur predominantly within drainage lines whilst lithosols form the major soil type across the OL3 area. Lithosols are described as "shallow skeletal sands with little pedological development" that are "chemically and physically infertile". An Environment Assessment and Management Report developed for PVGF in 1982 highlighted the soil erodibility rating of the proposed well site area is generally high and will increase to very high to extreme if disturbance occurs (Ghee & Low, 2007). Run-off potential and siltation of vegetation and waterways surrounding disturbed development areas is a high risk at the proposed well site.

Soil types in the proposed well site area have been mapped using the Atlas of Australian Soils (mapped by Bureau of Rural Sciences after Commonwealth Scientific and Industrial Research Organisation, 1991; described by (Northcote, 1968)). However, because the currently accepted classification system is the Australian Soil Classification (ASC) (Isbell & National Committee on Soil and Terrain, 2016) a conversion from the Atlas of Australian Soils to Australian Soil Classification was developed by (Ashton & McKenzie, 2001). The proposed well site is characterised by soil type BA28, reclassified as a Rudosol under the ASC Conversion (Ashton & McKenzie, 2001). Soils are described in Table 7-3 and mapped in Figure 7-4.

Table 7-3. Description of soil types within the proposed well site area, including Australian Soils Atlas Description by Northcote (1968) and Australian Soil Classification conversion by Ashton & McKenzie (2001)

Map unit	Location	Australian Soils Atlas Description	ASC Conversion
BA28		Bold ranges, ridges, cuestas and hills on sandstones and quartzites with broad areas of sandstone plateaux; very extensive areas of bare rock: chief soils are shallow stony sands. Small areas of other soils are associated in areas of gentler relief.	Rudosol: Soil with negligible (rudimentary) pedologic organisation apart from a) minimal development of an A1 horizon or b: the presence of less than 10% *B horizon* material (including pedogenic carbonate) in fissures in the parent rock or saprolite. The soils are apedal or only weakly structures in the A1 horizon and show no pedological colour changes apart from the darkening of an A1 horizon. There is little or no texture or colour change with depth unless stratified or buried soils are present.

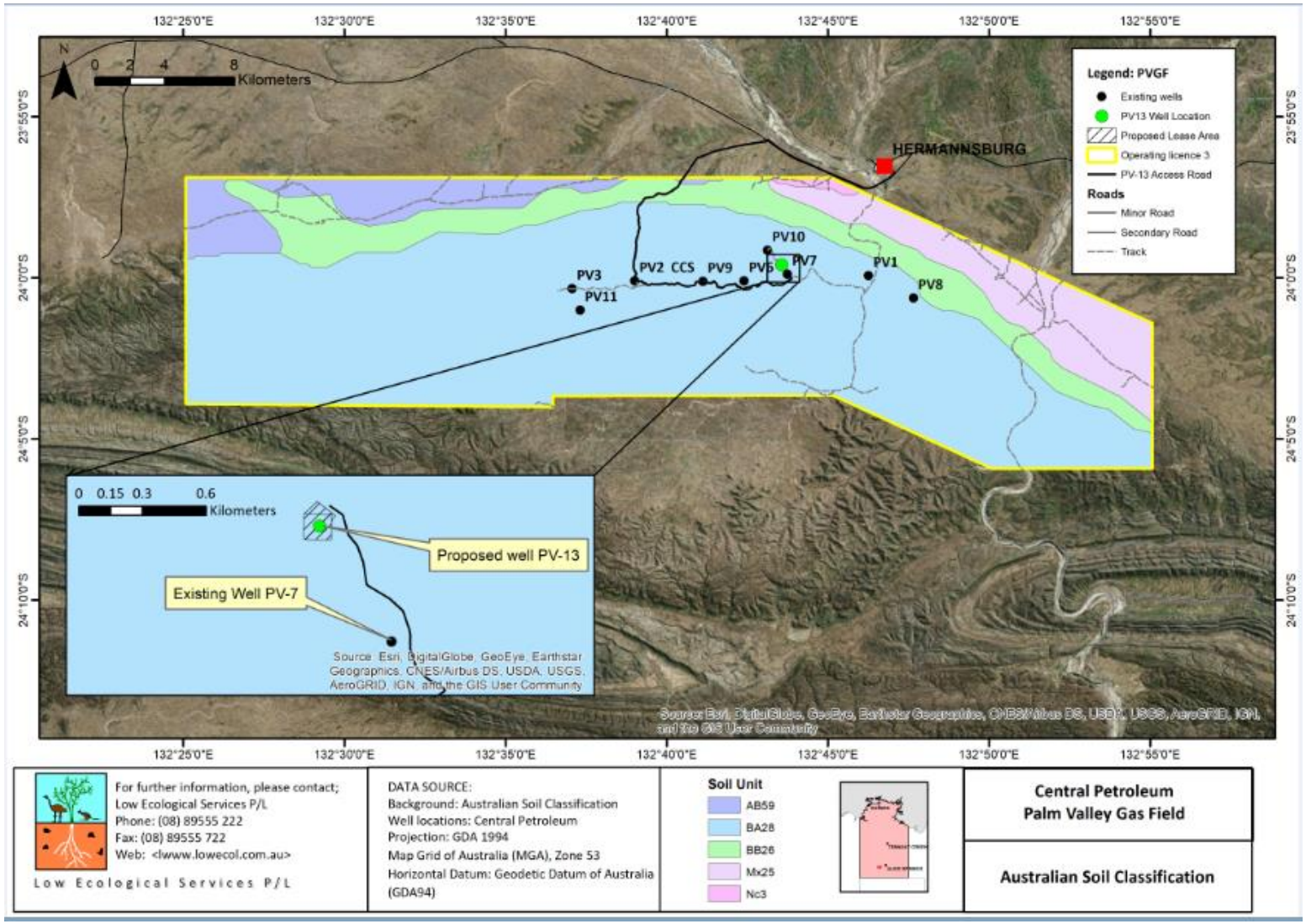

Figure 7-4. Australian Soil Atlas soil types mapped over the proposed well site and existing wells. Refer to Table 7.3 for description of soil types and conversion to the current Australian Soil Classification system.

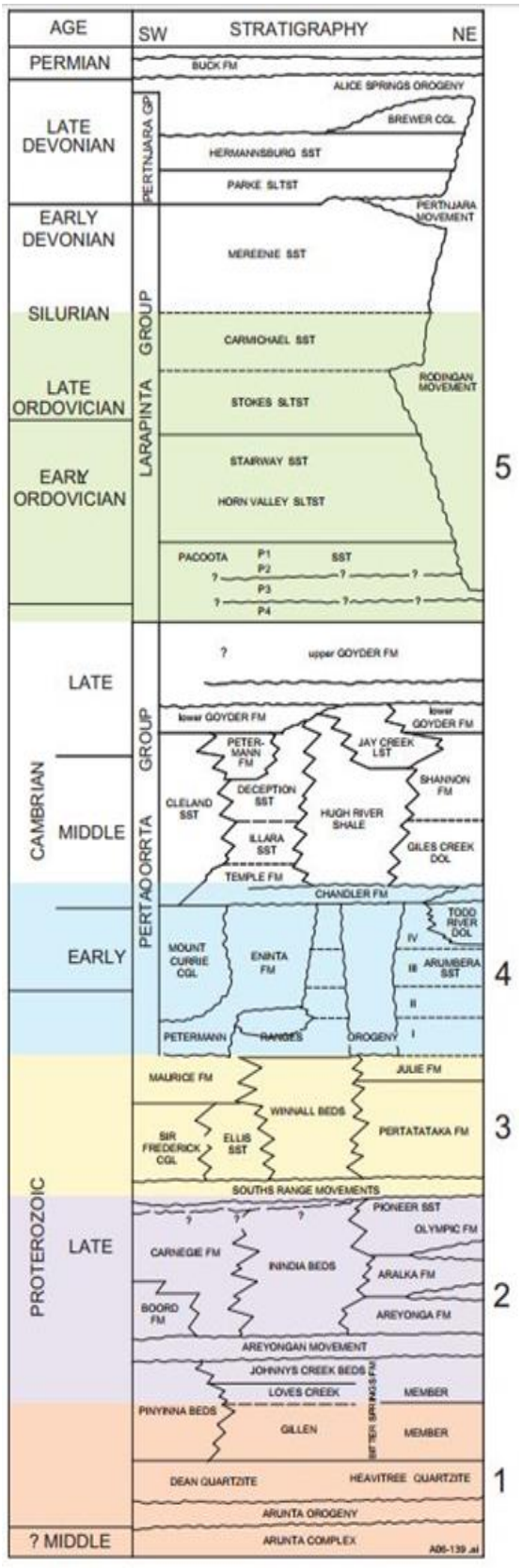

Figure 7-5 Generalised stratigraphy of the Amadeus Basin

7.1.4 Geology

The geology of the OL3 area is dominated by a large anticline that forms the Krichauff Range. The anticline contains a thick layer of Hermannsburg sandstone (approximately 500m), which has been carved into gullies and ridges over time. The topographic relief of the area ranges from approximately 18m (800m above sea level). The anticline within the OL3 area also has major fracture lines and joints, especially along the northern limb. A complex jointing pater of these fracture lines has locally contributed to the creation of deeply incised gullies (Low, et al., 2004). The geological units associated with the proposed well site is described in Table 7-4. For a geological map of the OL3 area see Figure 7-6.

The Krichauff Range has a moderate to extremely high erosion potential due to the combination of steep terrain, shallow soils and intense periods of rainfall. Disturbance of the rock and soils by construction have a potential to increase the sediment loads of the drainage lines. Since the gullies and valleys within the Krachauff Range harbour a high number of rare and relic species that are environmentally sensitive, they may be adversely affected if an increased sediment load is experienced. This highlights the need for efficient planning and management to ensure that surface runoff is minimised and controlled during the road construction and proposed well drilling program.

The stratigraphy of proposed well site is expected to be similar to that encountered in the previous PVGF well locations, especially its nearest neighbours PV-7 and PV-10. Target gas reserves for proposed well lie in the Lower Stairway Formation, an Ordovician sandstone which forms part of the Larapinta Group at a depth of around 3.5km (see Figure 7-6).

The proposed well will be drilled to the depth of the Stairway Formation through overlying layers including Hermannsburg Sandstone, Park siltstone, Mereenie Sandstone and Stokes Siltstone before drilling horizontally towards target hydrocarbon reserves.

Table 7-4. Geological units present at the proposed well site and surrounding region as described by Ahmad (2000).

Map unit	Rock type	Description of Lithology	Age
475	Sedimentary	Sandstone	Late Devonian

7.1.5 Groundwater

Regionally, PVGF lies within the Devonian, Silurian and Ordovician fold systems in the north of the Amadeus Basin. The Ordovician-Devonian part of the Amadeus Basin sequence, with its relatively uniform, basin-wide, layer-cake distribution, contains thick porous aquifers, including the Mereenie Sandstone, Hermannsburg Sandstone and Pacoota Sandstone (see Figure 7-5).

More locally, PVGF is situated on an area of gently folded Hermannsburg sandstone, on a large anticline forming the Krichauff Ranges. The Hermannsburg Sandstone is usually reliable when drilled for groundwater supplies (Lau and Jacobson, 1991) however low hydraulic conductivity of this unit often means deep bores are required for only modest yields. Enhanced permeability zones such as fractures and joints do occur in some portions of the Hermannsburg Sandstone, providing greater yield if encountered (Wischusen, et al., 2002). Wischusen et al. (2002) highlight that while having low hydraulic conductivity, drilling data suggests that Hermannsburg Sandstone is a “saturated intergranular aquifer” with the porosity, areal extent and thickness indicating the storage of large volumes of water within the formation.

The Mereenie sandstone, a high yielding potable aquifer, is considered the most important aquifer in the Amadeus basin - providing most of the Alice Springs water supply. In Palm Valley, below the Krichauff Range, the predicted depth of the aquifer is 730m below ground level with depth beneath the PVGF likely significantly greater. Previous drilling in PVGF has indicated water is encountered approximately 200-300m into the Mereenie formation.

The Pacoota formation, the basal aquifer of the Ordovician sequence, is a known source of hypersaline water with salt levels up to 200,000ppm. The formation lies directly below the target Lower Stairway Sandstone and penetration of the formation should not occur during drilling. However, precautions should be taken to minimise potential risk of contamination of the Mereenie and Hermannsburg aquifers with hypersaline water, should drilling extend deeper than the target formation.

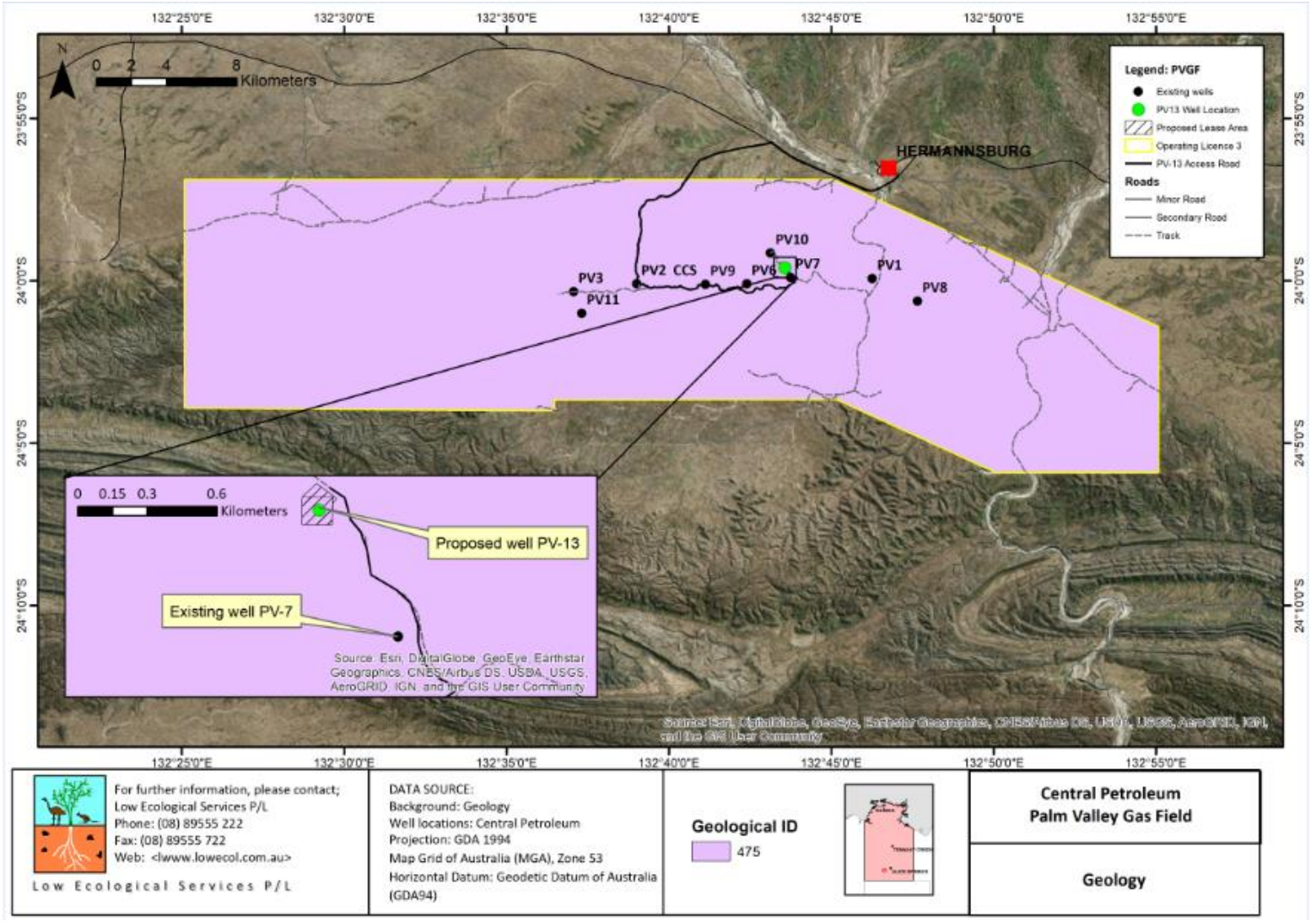

Figure 7-6. Geological units at a scale of 1:250,000 mapped over the proposed well site and existing well sites.

7.1.6 Surface Hydrology

The OL3 area is situated within the Finke River Basin, connected to the nationally significant Lake Eyre basin. The Lake Eyre basin covers almost one-sixth of Australia and is one of the world's largest internally draining river systems. The area supports a range of nationally important natural, social and economic values. All community sectors across the Lake Eyre Basin, scientists and governments, are involved in a collaborative effort (principally under the *Lake Eyre Basin Intergovernmental Agreement*) to ensure that the health of the unique river systems of the basin can be maintained (Australian Government, 2011).

There are several major ephemeral streams that join the Finke and Little Palm Creek from the OL3 area. Ellery Creek and the Finke River run through the eastern third of OL3; Ellery Creek joins up with the Finke River south of OL3. The Finke River runs out into Lake Eyre during extreme events. Smaller drainage lines are also present within the OL3 area.

The Finke River headwater gorge system is nationally recognised as a significant site, due to the abundance of conservation significant and endemic species. The rock holes and water springs at Palm Valley are within the protection of the Finke Gorge National Park and include the red cabbage palm (*Livistona mariae ssp. Mariae*). The surface water in Palm Valley is a combination of rainfall run-off and shallow groundwater recharge. A map of the surface hydrology of the proposed well site area is available in Figure 7-7.

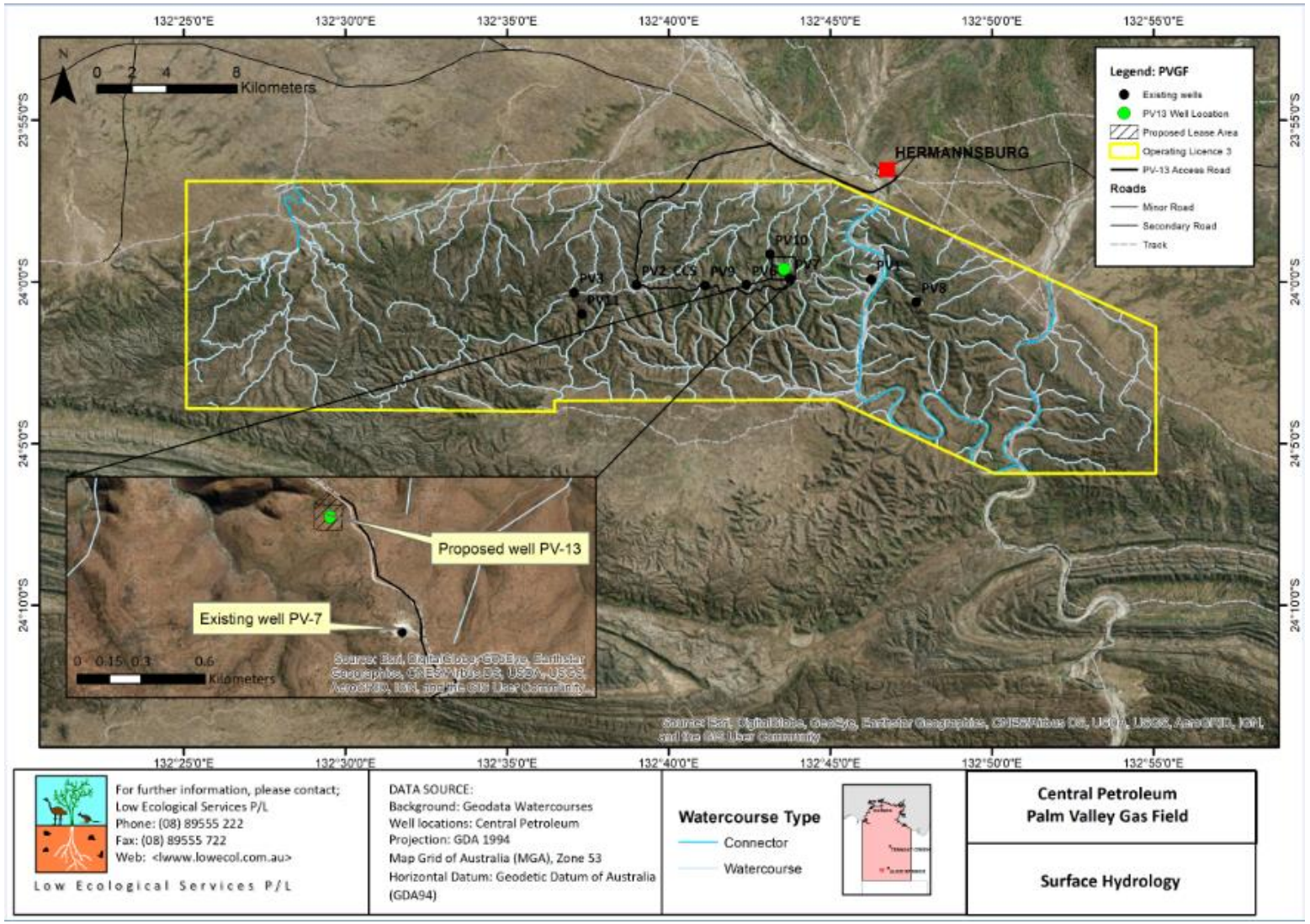

Figure 7-7. Surface hydrology mapped over the proposed well site and existing well sites.

7.2 Biological Environment

7.2.1 Bioregion

The OL3 area is in the MacDonnell Ranges Bioregion shown in Figure 7-3 and described in Table 7-1 (Baker et al. 2005).

This bioregion contains the highest number of species listed with a conservation status nationally or locally, of all NT bioregions. It includes the small but nationally significant Finke River headwater gorge system (10ha); an important set of perennial waterholes in a rugged range. This headwater gorge system lies outside and upstream of the PVGF area.

The MacDonnell Ranges bioregion is one of the most important refugial areas in arid Australia and is known to support many endemic plant taxa and isolated occurrences of plants more typically associated with higher rainfall areas (Bastin, 2008). As such the area is deemed to have particularly special value in the arid zone.

Table 7-5. Characteristics of the MacDonnell Ranges Bioregion (Baker et al. 2005)

Bioregion	Topography	Geology	Soils	Vegetation
MacDonnell Ranges	High relief ranges and foothills	Mostly sedimentary rocks in the Amadeus Basin	Generally skeletal or shallow sands on the rocky hills with earthy sands and deep loamy alluvium on the lowlands	Dominant vegetation spinifex hummock grassland, sparse acacia shrub lands and woodlands along watercourses.

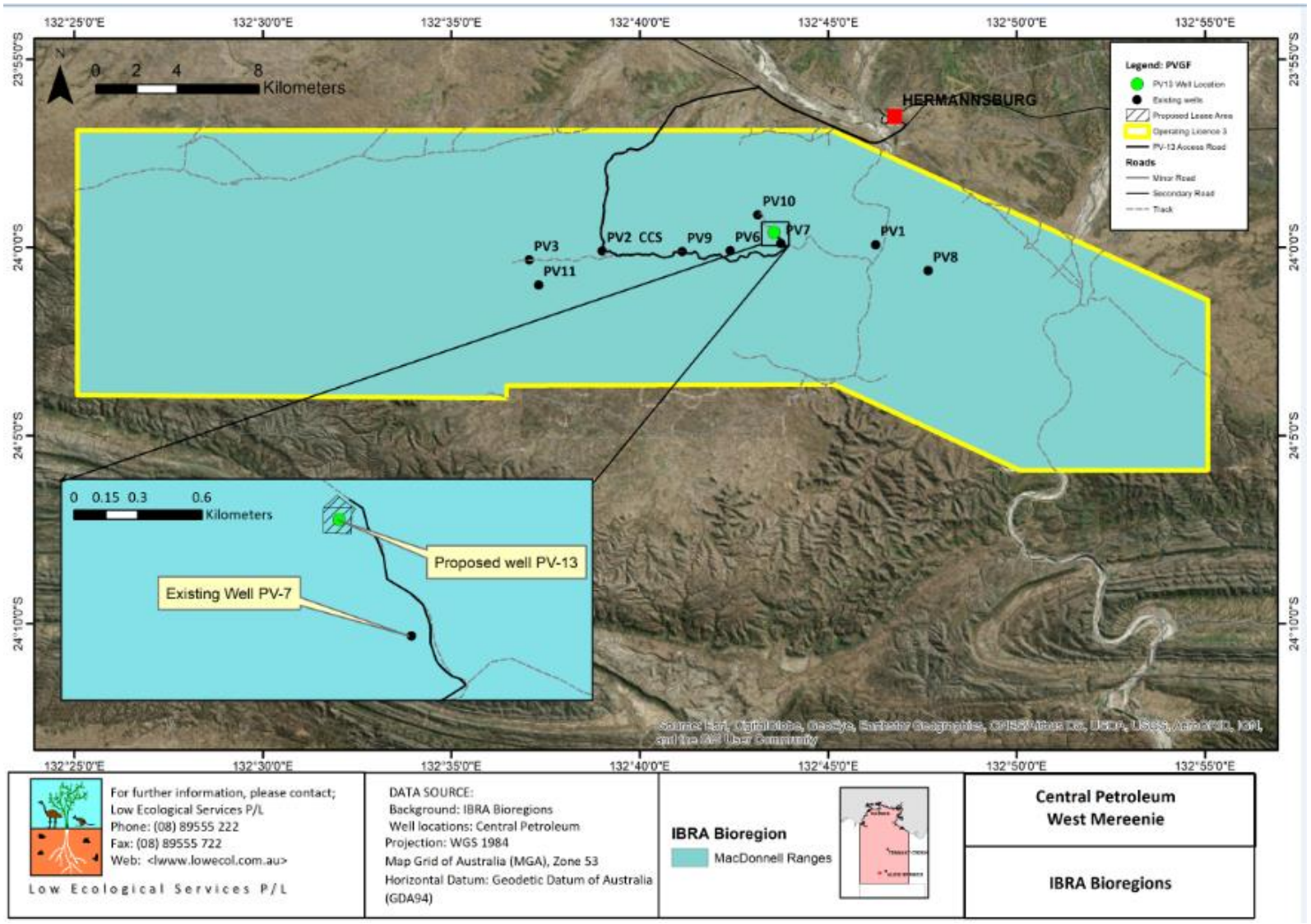

Figure 7-8. IBRA Bioregion of site PV-13 and surrounding OL3 area.

7.2.2 Vegetation types

The proposed well site falls within the widespread Krichauff land system. This land system supports distinctive vegetation associations dependent on local landform and soil characteristics. The proposed well site is situated on an elevated sandstone plateau, with plateau margins, with steep escarpments adjacent to the proposed site. Vegetation communities associated with these landforms are presented in Table 7-6 as described by (Wilson, et al., 1991).

Table 7-6. Vegetation associations as described by Wilson et al. 1991, at the proposed well site and the surrounding area within OL3.

Map Unit	Description	Landform	Soils	Vegetation
1	Spinifex Plateau	Plateau	Bare rock or with thin veneer of red sand	Sparse trees (*Acacia spp.* and mallee) and low shrubs overs spinifex (*Triodia sp.*) or minor mulga Mitchell, woollybutt grass and kerosene grasses.
2	Plateau margin	Dissected and gullied escarpments	Rock outcrop and shallow stony soil	Bare or scattered trees (white cypress pine, mulga, witchetty bush) and shrubs (*Acacia spp.*, *Eremophila sp.*) over sparse spinifex, woolybutt grass, annual grasses and forbs.

These vegetation classes are well represented in the surrounding area and operations associated with the proposed well site are considered unlikely to significantly impact the integrity of these vegetation communities at a regional scale. Operations within OL3 have to date had no significant impact on flora communities of conservation communities. A map of vegetation at the proposed well site and surrounding area is present in Figure 7-9.

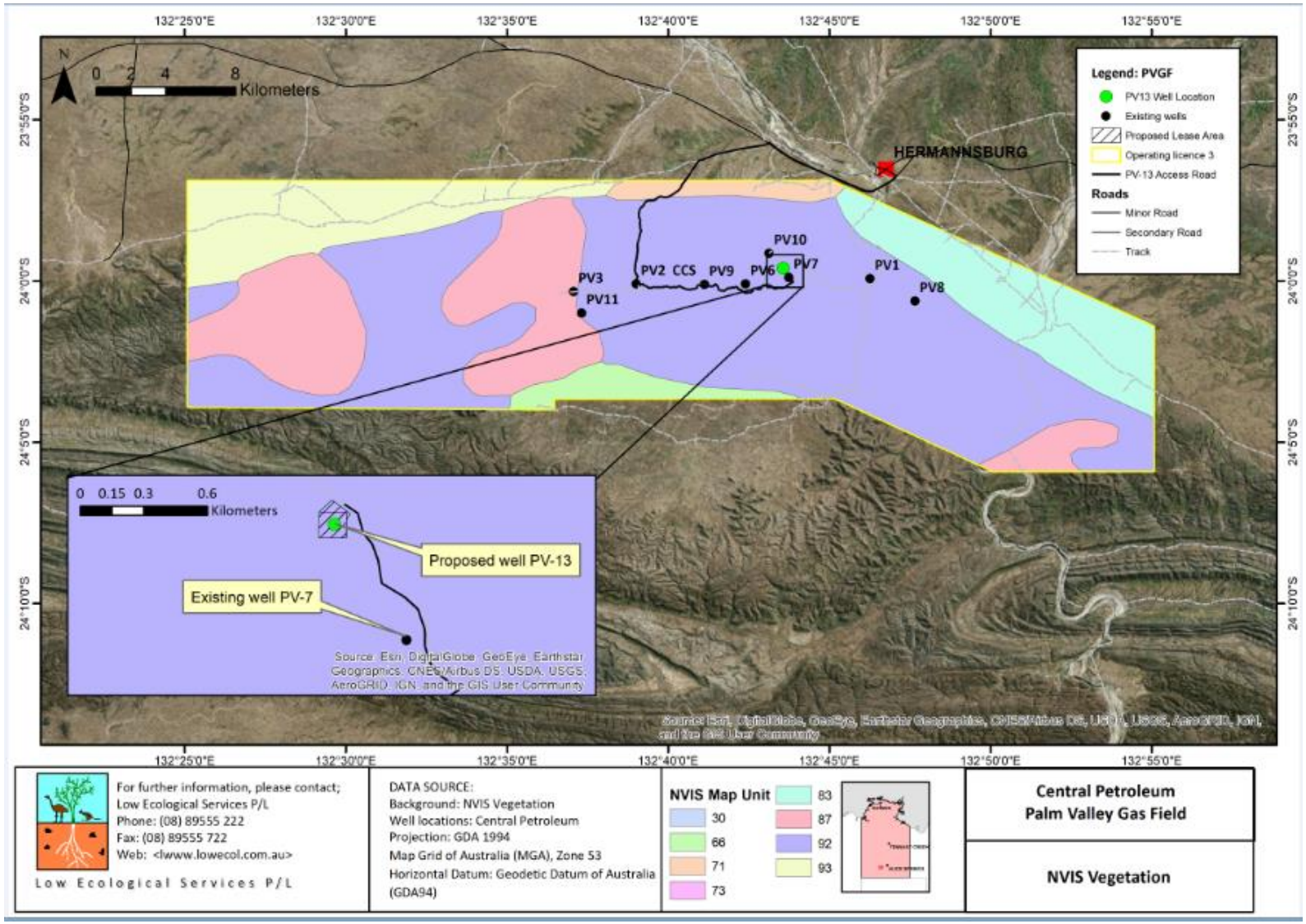

Figure 7-9. Vegetation types in the proposed well site and existing wells as mapped by (Wilson, et al., 1991).

7.2.3 Flora

7.2.3.1 Flora records

A search of the DENR managed NT Fauna Atlas and an EPBC PMST was conducted within a 20km radius of the proposed well site. A total of 8,818 records of 631 flora species were identified within 20 km of the proposed well site. Full details of the PMST report is available in Appendix 2.

7.2.3.2 Flora species of conservation significance

Conservation significant species identified through the desktop assessment were assigned a likelihood of occurrence (low, moderate or high) based on habitat characteristics of each species and the proximity of nearest records. A summary of all flora species of conservation significance and species listed as near threatened (Nt) and data deficient (DD) within 20km of the proposed well site is provided in Table 7-7. A map of flora records within 20km of the proposed well site from the NT Flora Atlas is presented in Figure 7-10.

Species identified in the desktop assessment within 20km of the site and determined to have a moderate or high likelihood of occurrence based on available habitat included:

- Two species listed as near threatened under the TPWC Act; Shiny-leaved eucalyptus (*Eucalyptus lucens*) and *Euphorbia sarcostemmoides* were determined to have a high likelihood of occurrence; and
- Two species listed as near threatened under the TPWC Act; *Acacia species Krichauff Range* and *Hibbertia species Chewings Range* and two species listed as data deficient; *Brachyscome ciliaris* and *Olearia species Waterhouse Range*, have a moderate likelihood of occurrence at PV-13.

No flora species of conservation significance listed under the TPWC Act or EPBC Act were determined to have a moderate or high likelihood of occurrence within the proposed well site.

7.2.3.3 On-Ground Survey

An on-ground walkover survey of the proposed well site will be completed by LES staff prior to the construction of the proposed appraisal well. Numerous surveys have been completed in the PVGF area by LES throughout its operations including a recent 2015 survey of the PV-7 and proposed PV-12 sites adjacent to the proposed well site as well as nearby creek lines and undisturbed rocky scree slopes. An additional extensive survey was undertaken in 2007 of the broader PVGF region, with results of the 2015 and 2007 surveys summarised below.

2015 Survey: Flora and Vegetation

A three-night flora and fauna survey was conducted of the proposed PV-12 well site, existing site PV-7 and adjacent creek lines and undisturbed slopes (see Figure 7-11). No flora species of conservation significance were recorded (see Appendix 4 for a complete list of species recorded). Two TPWC listed Near Threatened species were recorded in the project area; shiny leaved mallee (*Eucalyptus lucens*) and *Stenanthemum centrale*. Flora species identified were consistent with the vegetation communities typical of the rocky plateau landform, with Witchetty Bush (*Acacia kempeana*) and Hillside spinifex (*Triodia brizoides*) the most common species. The vegetation communities identified

are considered widespread. Localised clearing associated with the proposed well site is thus considered unlikely to have a significant impact on vegetation or habitat availability.

2007 Survey: Flora and Vegetation

An extensive series of flora and fauna surveys were conducted in 2007 at a total of 27 sites across the PVGF lease area representing ridge and cliff habitat and creek/drainage line habitat areas. One target site from this series of surveys was immediately adjacent (to the west) of the existing PV-7 well site, near the proposed well site. No flora species of conservation significance were identified in during this survey. Two species listed as near threatened under the TPWC Act were identified; shiny-leaved mallee (*Eucalyptus lucens*) and *Stenanthemum centrale*.

Table 7-7. Flora species of conservation significance identified by the TPWC Act as occurring within 20km of the proposed well site and likelihood of occurrence within disturbance area. Note the PVGF is on the range north of Palm Valley and Finke Gorge National Park which has many specialised species occurring in the habitat associated with the Finke and Palm Valley gorges.

Family	Scientific name	Status		NT Flora Atlas	Habitat	Description	Likelihood
		TPWC	EPBC				
AMARANTHACEAE	*Einadia nutans subsp. nutans*	NT			Wide range of soils	Low growing perennials with distinctive ovate to triangular leaves and globular fruits.	Low
	Macrozamia macdonnellii	NT	VU		Occurs on rocky sites, predominantly in gorges and on steep sheltered slopes but occasionally on exposed hills or mountain tops.	Distinctive dioecious cycad, often to 2m but sometimes much taller.	Nil
	Sclerolaena birchii	NT			Largely restricted to soils of light surface texture	Densely branched, hemispherical, short-lived perennial shrub about 1m in height, with stout woolly branches	Nil
ARALIACEAE	*Hydrocotyle sp. Harts Range*	DD			Restricted to seasonal seepage areas in somewhat sheltered rock gullies where the metamorphic rocks have a white coating of calcium	Prostrate annual or short-lived perennial herb. Glabrous stems, orbiculate leaves and pale-yellow to greenish yellow clustered flowers.	Low
ARECACEAE	*Livistona mariae*	EN			Adjacent permanent water courses in Palm Valley	Red Cabbage Palm	Nil
ASPARAGACEAE	*Lomandra patens*	NT	-	X	Confined to sheltered environments. Typically grows in gorges, rocky pavements in watercourses and at the base of cliffs and rock slabs.	Perennial species with evergreen usually rigid leaves. Cream(ish) coloured flowers.	Low
	Murchisonia volubilis	DD					Low

Family	Scientific name	Status		NT Flora Atlas	Habitat	Description	Likelihood
		TPWC	EPBC				
ASTERACEAE	*Brachyscome ciliaris*	DD	-	X	Grows in river floodplains, margins of salt pans and disturbed areas.	Common sporadic Perennial daisy to 60cm tall, leaves alternating up stem. Flowers blue to mauve or purple.	Moderate
	Minuria tridens	VU	VU		Occurs on dolomite, limestone and calcrete impregnated sandstone hills, rises and ranges.	Perennial subshrub to 30cm high with lilac florets.	Low
	Olearia sp. Waterhouse Range	DD			Occurs on protected south-facing slopes of sandstone hills and ranges, usually in areas where there is evidence of calcrete impregnation	Low shrub or subshrub to 0.5m high. Petiolate, elliptical to obovate leaves; heads with purples ligules; hairy fruits.	Moderate
	Sonchus hydrophilus	DD			Grows in temporarily wet ground, edges of lakes and stream	Erect, robush, fleshy annual or biennial perennial herb. Flowers yellow.	Low
	Vittadinia obovata	NT				Woody annual or biennial herb to 0.6m high. Flower white and purple	Low
BORAGINACEAE	*Heliotropium inexplicitum*	DD			Sandy and clayey, often stony soils	Annual to short-lived perennial herb, ascending to spreading to 12cm tall. White hars on stem, leaves linear to oblong. Flowers white	Low
CARYOPHYLLACEAE	*Spergularia diandroides*	NT			Damp sandy soils and salt pans	Annual herb, decumbent branches arising from base. Leaves obtuse, sparsely hair. Inflorescence white flowers on stalk	Nil
CYPERACEAE	*Bolboschoenus caldwellii*	EN			Damp soils adjacent to permanent or semi-permanent water	Rhizomatous perennial sedge with three-angled stems, compound inflorescence and red-brown to golden spikelets	Nil
DILLENIACEAE	*Hibbertia sp. Chewings Range*	NT			Steep rocky gorges, on rock slabs and cliffs and along watercourses	Distinctive shrub to 2 or 3m high. Alternate sessile leaves. Flowers bright yellow	Moderate
EUPHORBIACEAE	*Euphorbia sarcostemmoides*	NT			Sandstone ridges, quartzite hills	Erect, multi-stemmed, semi-succulent shrub to 2m high	High

Family	Scientific name	Status		NT Flora Atlas	Habitat	Description	Likelihood
		TPWC	EPBC				
EUPHORBIACEAE	*Monotaxis luteiflora*	NT			Red sandy soils, plains.	Erect shrub, 0.15 – 0.6m high. Flower yellow	Nil
FABACEAE	*Acacia sp. Krichauff Range*	NT	-	X	Grows in heath and mallee communities in sandy soil and on clay lake beds.	Prickly shrub or tree (rarely), 0.5 – 3m high. Yellow flowers.	Moderate
	Crotalaria eremaea subsp. eremaea	NT	-	X	Sand dunes with *Triodia*	0.7m tall shrub, leaves pinnate, flowers yellow-orange	Nil
	Indigofera sp. Areyonga	DD			MacDonnell Ranges	-	Low
	Senna artemisioides subsp. James Range	DD			Great Sandy Desert, MacDonnell Ranges		Low
	Senna artemisioides subsp. Kuyunba	DD			Finke, MacDonnell Ranges		Low
	Swainsona colutoides	NT			Sandy and clayey soils	Short lived shrub to 1.5m tall with reddish stems. Flowers purple along a long flower spike.	Low
HEMEROCALLIDACEAE	*Corynotheca licrota*	NT	-	X	A dune specialist, frequently on dune crests and never on sandplains.	Minutely roughened grass like leaves arising from a basal tuft.	Nil
JUNCACEAE	*Juncus kraussii var. australiensis*	DD			Saline habitats restricted to the edge of spring fed permanent water and seepage	Tussock forming perennial, flowers clustered	Low
LAMIACEAE	*Spartothamnella canescens*	NT			Sandstone ranges	Stems glabrous, flowers sessile	Low
	Teucrium grandiusculum subsp. grandiusculum	NT	-	X	Sandplains and dune fields	Stiffly erect, multi-stemmed perennial shrub to 50cm high. Flowers white.	Nil

Family	Scientific name	Status		NT Flora Atlas	Habitat	Description	Likelihood
		TPWC	EPBC				
MYRTACEAE	*Eucalyptus lucens*	NT			Rocky slopes and mountain tops high in the landscape	Mallee to 4.5m high. Bark smooth, white, leaves glossy green	High
	Maireana brevifolia	NT	-	X	Occurs in red or brown/pink sand, alluvium, clay or limestone in sand dunes and mangrove swamps.	Scrambling or prostrate shrub, 0.3-3m high. Pink/purple-blue flowers.	Nil
	Melaleuca faucicola	NT			Sheltered watercourses	Shrub or small tree to about 10m high	Low
	Thryptomene hexandra	NT			'Slot' gorges and sheltered south facing aspects of steep sandstone	Erect shrub to 2.5m high. Leaves opposite, green and glabrous; flowers stalked, white	Low
	Thryptomene wittweri		VU	-	Inhabits steep slopes, rock scree and breakaways near the summits of prominent hills.	Open rounded shrub to 2.5m high. Leaves thin with pointed tips. Flowers, five white to cream.	Low
PHYLLANTHACEAE	*Phyllanthus lacunellus*	DD			Sand Dunes and Plains	Prostrate to erect perennial herb or subshrub, glabrous woody base, flowers clusters white.	Low
	Sauropus rigens	NT			Skeletal soil on dry sandstone hills or red earths	Shrub to 1m high, leaves clustered on short cranchlets, flowers solitary.	Low
POACEAE	*Aristida strigosa*	DD	-	X	Sands and sandy loams, often near watercourses and waterholes.	Perennial, 60-90cm tall. Leaf blades strait. Leaf blade surface glabrous	Nil
PORTULACEAE	*Sedopsis filsonii*	NT	-	X	Occurs predominantly on sandplains and dune fields (sometimes perched).	Shrub to 2m high. Glabrous stems, alternate bluish leaves. Flowers white with yellow and sometimes purple markings.	Nil
PROTEACEAE	*Hakea grammatophylla*	NT	-	X	Yellow or red sand. Sand plains.	Erect shrub 1.5-4m high. Flowers white-cream.	Low

Family	Scientific name	Status		NT Flora Atlas	Habitat	Description	Likelihood
		TPWC	EPBC				
RHAMNACEAE	*Stenanthemum centrale*	NT	-	X	Gravelly rises, intermittent watercourses, fertile alluvial plains, mulga-dominated red-earth plains, sandplains and low sandy rises and dune fields.	Distinctive small tree to about 8m high with roundish canopy. Flowers orange disc and cream segments, fruit red.	Low
SOLANACEAE	*Datura leichhardtii subsp. leichhardtii*	NT			watercourses and floodplains		Nil
THYMELAEACEAE	*Pimelea interioris*	NT			Heavy soil plains dominated by Mitchell grass	Erect annual herb to approximately 0.5m with young stems hairy. Flowers dull pale yellow or white.	Nil
	Pimelea microcephala subsp. microcephala	NT			Shallow sandy soils	Erect shrub 0.8-2.5m high. Flowers white-cream-yellow-green	Nil
URTICACEAE	*Parietaria cardiostegia*	NT			Variety of soils over limestone, granite or ironstone	Annual herb, 0.07-0.6m high. Flowers green-cream	Nil
VERBANACEAE	*Verbena macrostachya*	DD			Freely draining, often calcareous soils.	Erect herb 0.5-1m high, much branched from base. Flowers pale purple to pinkish lilac or white.	Low
ZYGOPHYLLACEAE	*Zygophyllum iodocarpum*	DD			Clay, loamy clay, stony loam		Low

1 TPWC Act Status: VU: Vulnerable, NT: near threatened, DD: data deficient.

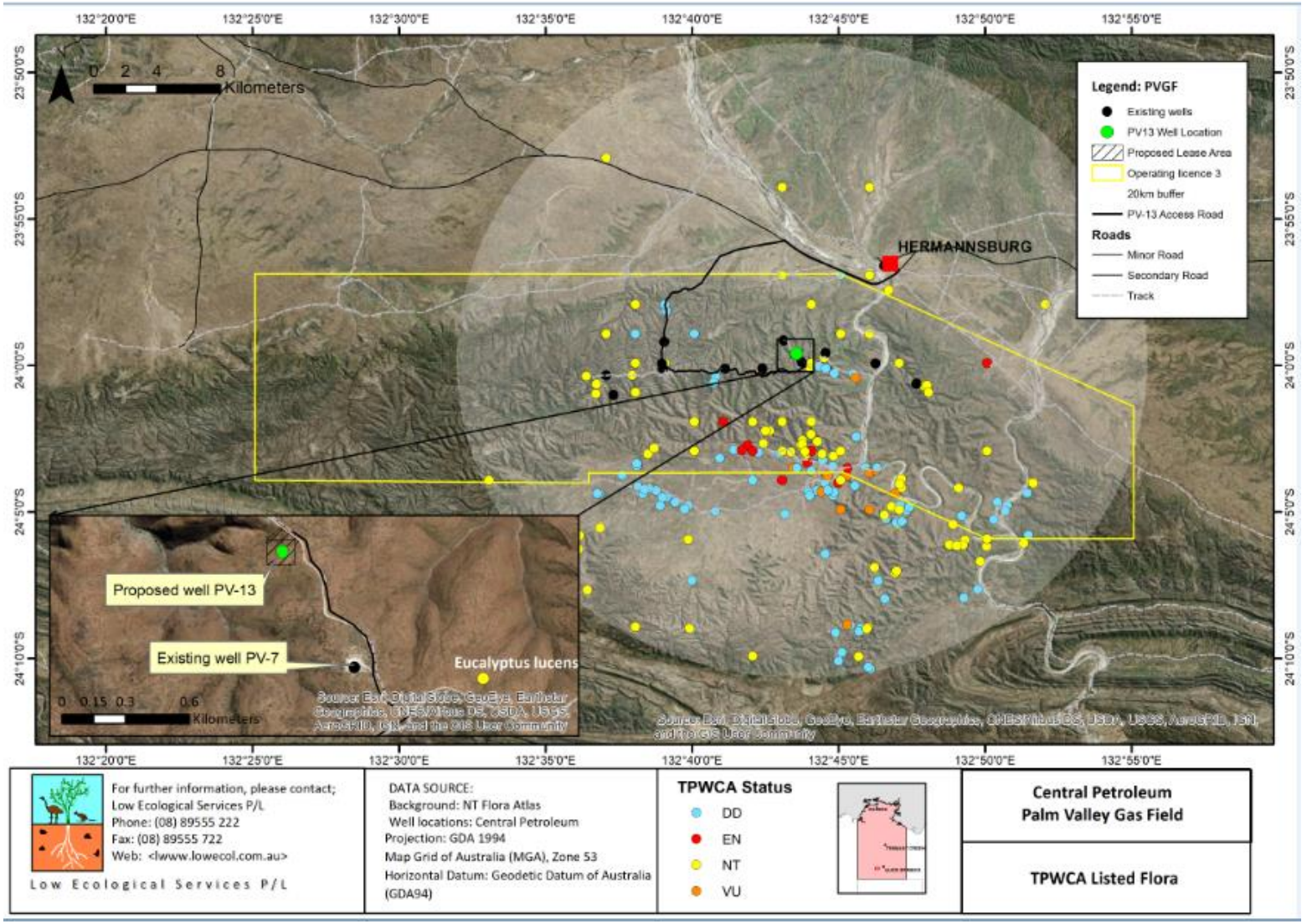

Figure 7-10. TPWC listed Flora records from the NT Flora Atlas identified within 20km of the proposed well site.

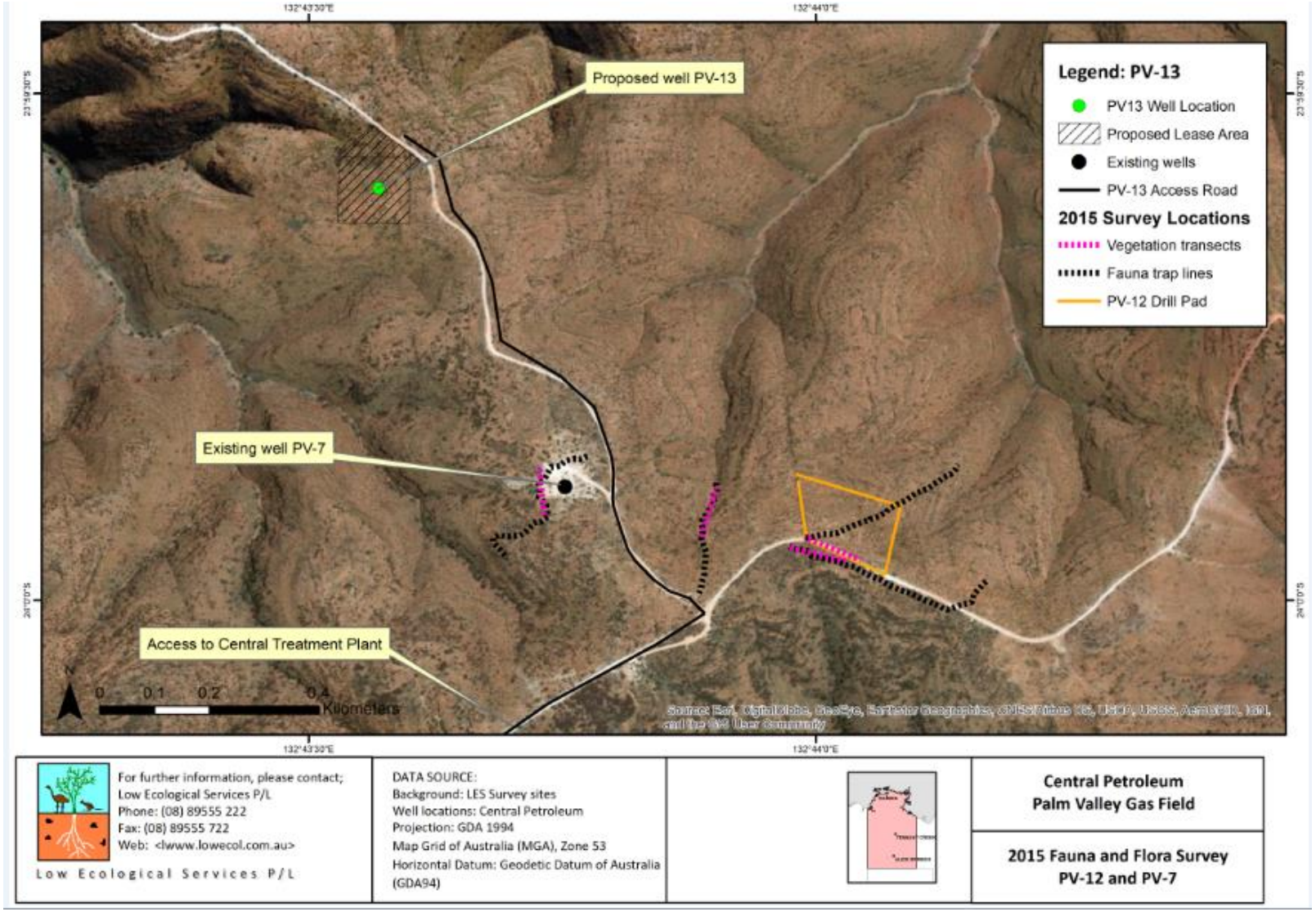

Figure 7-11. Location of 2015 flora and fauna survey undertaken by LES of well sites PV-7 and proposed PV-12 in relation to proposed well site.

7.2.4 Threatened Ecological Communities

No threatened ecological communities were identified within 20km of the proposed appraisal well site.

7.2.5 Sites of Conservation Significance

The OL3 area is located within the Greater MacDonnell Ranges Site of Conservation Significance (SoCS) which covers an area of 31,395 km2 in the NT. The SoCS is rated as Internationally Significant and has high ecological value based on the number of threatened and endemic species, particularly short-range endemics and the permanent water sources which act as habitat refuges. SoCS do not have specific legislation attached at this stage but are recognised as important areas.

7.2.6 Sites of Botanical Significance

The PVGF area is also within a Site of Botanical Significance (SOBS), Palm Valley. The Palm Valley SOBS is regarded as nationally important due to the number of species of conservation significance and endemic species in the area. Flora and fauna surveys in the OL3 area conducted by LES since it was operated by Magellan Petroleum Ltd; including approximately 16 years of quarterly environmental surveys, have not identified any species of conservation significance within impact distance from the PVGF.

The risk assessment in Section 8 of the EMP identifies all activities at PVGF that may impact the environmental significance of these SoBS and SoCS. Mitigation measures to reduce these risks are provided in Section 8 as well.

7.2.7 Introduced and weed species

There are no declared weeds or WoNS identified within 20km of the proposed well site in the NT Flora Atlas or identified during on ground surveys. Five species listed as introduced or invasive were identified as occurring within 20km of the proposed well site area by the NT Weeds Atlas.

Table 7-8. Weed or invasive species identified through an EPBC PMST or NT Flora Atlas search as potentially occurring within 20km of the proposed well site.

Species		Status	PMST	NT Weeds Atlas
Scientific Name	Common Name			
Cenchrus Ciliaris	Buffel grass	-	X	
Chloris vergatus	Feathertop	-		X
Opuntia spp.	Prickly Pears	WoNS	X	
Prosopis spp.	Mesquite	WoNS	X	
Tamarix aphylla	Athel Pine	WoNS	X	

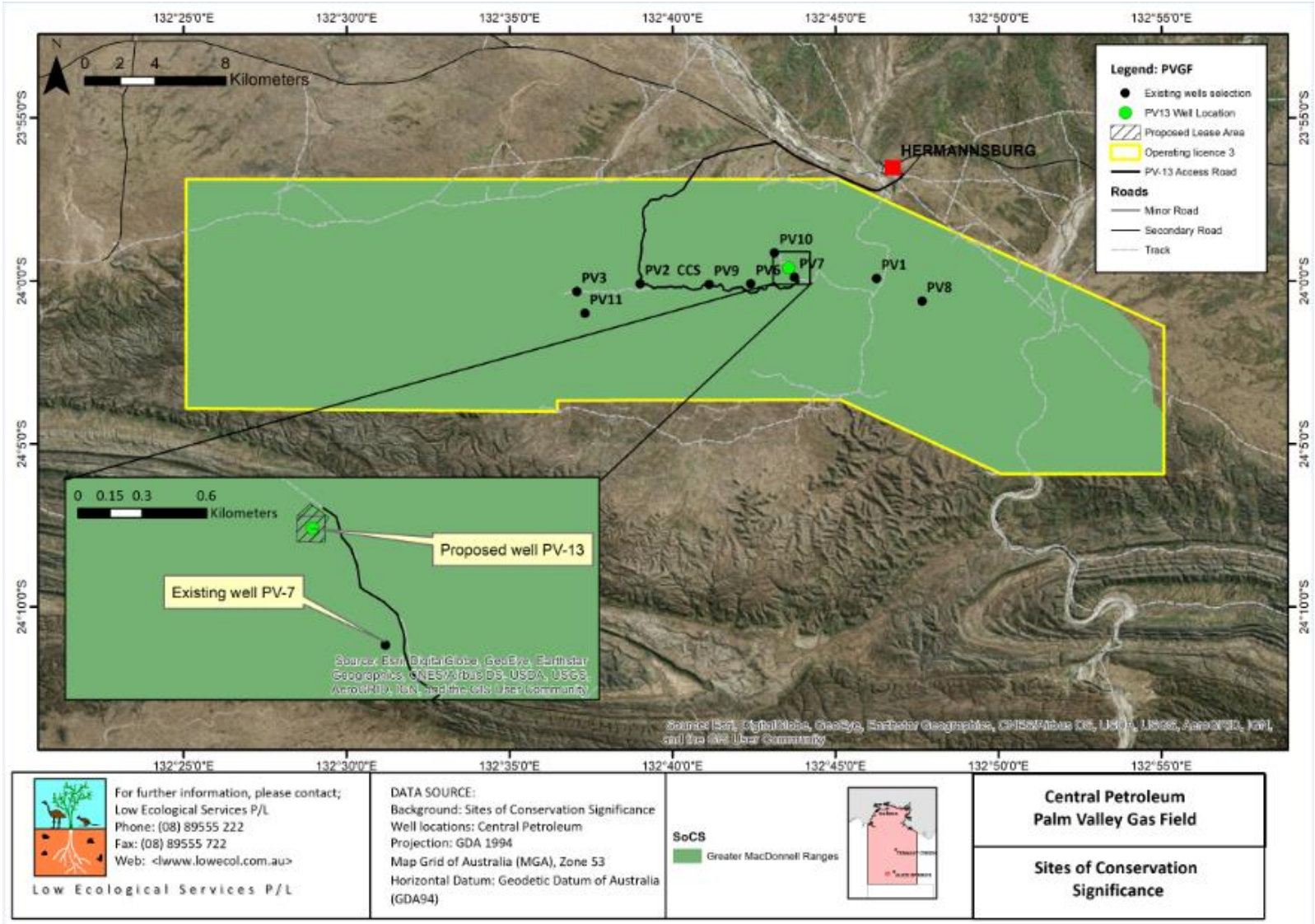

Figure 7-12. Sites of Conservation Significance (SoCs) in relation to the proposed well site and existing wells

7.2.8 Fauna

7.2.8.1 Fauna Records

A search of the DENR managed NT Fauna Atlas and an EPBC PMST was conducted within a 20km radius of the proposed well site. A total of 19,026 records of 346 fauna species were recorded within 20 km of the project. Records of conservation significant species within 20km of the proposed well site area are mapped in Figure 7-13.

7.2.8.2 Fauna Species of Conservation Significance

Conservation significant species identified through desktop searches as likely to occur within 20km of the proposed well site, were assessed for the likelihood of occurrence within the proposed well site area based on the availability of suitable habitat, distance to the nearest record and the known distribution of each species. Species were assigned a likelihood of occurrence ranking as "low", "moderate" or "high" (see Appendix 3 for an assessment of the likelihood of occurrence of each species). The preferred habitat and likelihood of occurrence of species identified in the desktop assessment are summarised in Table 7-9. The species considered to have a moderate or high likelihood of occurrence in the proposed well site include:

- One species listed as vulnerable under the EPBC Act are considered moderately likely to occur:
    - Black-footed rock wallaby (*Petrogale lateralis*); and
- Four species listed as vulnerable under the TPWC Act are considered low-moderately likely to occur within the proposed well site areas:
    - Snail (*Semotrachia esau)*
    - Snail (*Divellomelon hillieri)*
    - Snail (*Basedowena squamulosa)*
    - Snail (*Bothriembryon spenceri)*
- Three species listed as near threatened or data deficient are considered moderately or highly likely to occur within the proposed well site area:
    - Grey honeyeater (*Conopophila whitei*) data deficient -NT;
    - Red throat (*Pyrrholaemus brunneus)* near threatened - NT*;*
    - Scarlet chested parrot (*Neophema splendida);*
    - Red-tailed black cockatoo (*Calyptorynchus banksia samueli);* and
    - King brown snake (*Pseudechis australis*)

Table 7-9. Threatened or near-threatened fauna species of conservation significance identified by the EPBC PMST and NT Fauna Atlas as recorded or potentially present within 20km of the proposed well site.

Species name	Common name	Status		PMST	NT Fauna Atlas	Habitat	Likelihood of Occurrence	Notes
		TPWC	EPBC					
Mammals								
Antechinomys laniger	Kultarr	NT			X	Open country including stony and sandy plains with sparse shrubs and grass.	Nil	Habitat unsuitable
Bettongia lesueur	Burrowing Bettong	EX			X	Calacareous plains	Nil	Extinct – will not be considered further
Dasycercus cristicauda	Crest-tailed mulgara	VU		X		Sand dune habitats	Low	Habitat unsuitable
*Leporillus apicalis^*	lesser stick-nest rat	EX	EX		X	Extinct	Nil	Extinct – will not be considered further.
Macroderma gigas	Ghost Bat	NT	VU		X	Wide range of foraging habitats, from rainforests, monsoon and vine scrub to open woodlands.	Nil	Records from pre-1970. Current range restricted to Northern Australia. Will not be considered further.
Macrotis lagotis	greater bilby	VU	VU	X	X	Occurs in a wide variety of habitats, classified into three major groups; sparse grassland / forbland on uplands and hills with low fire frequency, mulga scrub/woodlands on ridges and rises with an infrequent fire interval and hummock grassland/mixed shrub or woodland steppe on plains and alluvial areas with a high (4-10 year) fire frequency)	Low	No suitable habitat within project area.
Notomys cervinus	Fawn Hopping-mouse	EX			X		Nil	Extinct regionally- will not be considered further.

Species name	Common name	Status		PMST	NT Fauna Atlas	Habitat	Likelihood of Occurrence	Notes
		TPWC	EPBC					
Petrogale lateralis	black-footed Rock-wallaby	NT	VU	X	X	The species favours steep slopes, cuestas, deep gorges and boulder scree slopes, common in quartzite and sandstone ranges near a permanent water supply.	Moderate	
Trichosurus vulpecula	common brushtail possum	EN	-		X	Gorges with large trees.	Low	No suitable habitat in project area
*Zyzomys pedunculatus^*	central rock-rat	EN	EN	X		Confined to high elevation (>1000m) quartzite ridges and mountain peaks in the West MacDonnell Ranges.	Low	All recent records within West MacDonnell National Park
Birds								
Acrocephalus australis	Austrlaian Reed Warbler	NT			X	Dense vegetation along water	Low	No suitable habitat in project area
Amytornis striatus	Striated Grasswren	NT			X	Mature spinifex plains	Low	No suitable habitat in project area
Ardeotis australis	Australian bustard	NT			X	Inhabits grasslands, spinifex, open scrublands, grassy woodlands, sandhills, pastoral lands, burned ground and occasionally crops and airfields.	Low	No suitable habitat in project area
Burhinus grallarius	Bush-stone curlew	NT			X	Semi-open shrubby or treed areas	Low`	No suitable habitat in project area
Calidris ferruginea	curlew sandpiper	VU	CR	X			Low	No suitable habitat in project area
Calyptorynchus banksia samueli	Red-tailed Black-cockatoo	NT			X	Inhabit a wide variety of habitats, especially forests and woodlands dominated by eucalypts or casuarinas	Moderate	

Species name	Common name	Status		PMST	NT Fauna Atlas	Habitat	Likelihood of Occurrence	Notes
		TPWC	EPBC					
Conopophila whitei	grey honeyeater	DD			X	Inhabits mature mulga woodland, open mulga with spinifex, tall open acacia scrubland and sand hills with red mulga, cane grass, beefwood and desert bloodwood.	Moderate	Irregular vagrant
Dromaius novaehollandiae	emu	NT			X	Inhabits plains, scrublands, open woodlands, coastal heaths, alpine pastures, semi-deserts, margins of lakes and pastoral and cereal growing areas.	Low	No suitable habitat
Erythrotriorchis radiates	red Goshawk		VU	X			Low	May pass overhead but no suitable habitat in project area
Falco hypoleucos	Grey Falcon		VU		X	Lives in areas of lightly timbered lowland plains, typically on inland drainage systems	Low	No suitable habitat in project area
Leipoa ocellata	Malleefowl		VU		X	Plains	Low	No suitable habitat in project area
Lophoictinia isura	Square-tailed kite	NT			X	Mixed woodland area	Low	May pass overhead but no suitable habitat in project area
Neophema splendida	Scarlet-chested parrot	NT			X	Open woodlands of eucalypts, she-oak, mulga with spinifex and saltbush	Moderate	
Pezoporus occidentalis	night parrot	CR	EN	X		Records are primarily from spinifex hummock grasslands on stony or sandy areas and chenopod shrublands on floodplains, salt lakes and clay pans.	Low	No suitable habitat
Polytelis alexandrae	princess parrot	VU	VU	X	X	Recorded from sandplain environments with vegetation characterised by *Eremophila, Grevillea* and *Hakea* shrubs with scattered trees.	Low	No suitable habitat

Species name	Common name	Status		PMST	NT Fauna Atlas	Habitat	Likelihood of Occurrence	Notes
		TPWC	EPBC					
Porzana flumina	Australian Spotted Crake	DD			X		Low	No suitable habitat
Porzana pusilla	Baillon's Crake	DD			X		Low	No suitable habitat
Pyrrholaemus brunneus	redthroat	NT			X	Inhabits inland scrubs with mulga and other acacias, mallee associations with spinifex, eucalypt regrowth, tea-tree, saltbush and bluebush.	Moderate	
Rostratula australia	Australian painted snipe		EN	X		May occur in any shallow ephemeral wetlands in central or southern NT, either fresh or brackish, which may be temporarily or ephemerally filled.	Low	No suitable habitat
Stictonetta naevosa	Freckled Duck	NT			X		Low	No suitable habitat
Reptiles								
Liopholis slateri slater	slater's skink		EN		X	Occurs on plains in the valleys of major drainages. Inhabits shrubland and open shrubland on alluvial soils close to drainage lines.	Low	No suitable habitat but known individual downslope from PVG compressor site 7km west
Pseudechis australis	king brown snake	NT			X	Inhabits a wide variety of habits from closed tropical monsoon forest to *Triodia* hummock grassland, chenopod shrubland and almost bare giver or sandy desert. Occupies abandoned burrows, soil cracks and hollow logs.	Moderate	

Species name	Common name	Status		PMST	NT Fauna Atlas	Habitat	Likelihood of Occurrence	Notes
		TPWC	EPBC					
Fish								
Chlamydogobius japalpa	Finke desert goby	VU			X	River systems	Nil	Restricted to Finke River system and no suitable habitat in project area. Will not be considered further.
Craterocephalis centralis	Finke Hardyhead	NT			X			
Mogurnda larapintae	Desert Mogurnda	NT			X			
Invertebrates								
Basedowena squamulosa	Land snail	VU			X	Restricted to Krichauff and James Ranges – associated with leaf litter under fig trees	Low-Moderate	Very small range and no suitable habitat
Bothriembryon spenceri	Snail	VU			X	Restricted to the Krichauff and Chewings Ranges, notably occurring in Palm Valley – in leaf litter under fig trees	Low-Moderate	Very small range and no suitable habitat
Croitana aestival	Desert Sand-skipper	EN		X		Mulga dominated, low open woodland; sites associated with moister, rock areas that are buffered from climatic extremes	Low	Very small range and no suitable habitat
Divellomelon hillieri	Snail	VU			X	Recorded only along a few hundred metres of cliff face in Palm Valley in the Krichauff Ranges	Low-Moderate	Very small range and no suitable habitat
Granulomelon arcigerens	Snail	VU			X	From a restricted area in the Finke River Gorge – found well above the river level	Low	Very small range and no suitable habitat
Semotrachia elleryi	Snail	VU			X	Finke Gorge, West MacDonnell National Park	Low	Very small range and no suitable habitat
Semotrachia esau	Snail	VU			X	Known only from a small area along the Finke River and Palm Creek in the Krichauff Ranges	Low-Moderate	Very small range and no suitable habitat

Species name	Common name	Status		PMST	NT Fauna Atlas	Habitat	Likelihood of Occurrence	Notes
		TPWC	EPBC					
Semotrachia euzyga	Snail	EN			X	Highly restricted to locations along the Todd River in Alice Springs, Choritza Hill and Mt Gillen	Low	Very small range and no suitable habitat
Sinumelon bednalli	Bednall's Land Snail	NT			X	Restricted to areas around fig trees	Low	Very small range and no suitable habitat

*LES identified. EW: extinct in wild, EX: extinct, CR: critically endangered, EN: endangered, VU: vulnerable, NT: near threatened, DD: data deficient.

7.2.8.3 Migratory and Marine Species

The EPBC PMST identified 14 migratory and/or marine species as occurring or potentially occurring within 20km of the proposed well site (Appendix 2). One of these 14 species was recorded in the NT Fauna Atlas within 20km of the proposed well site, the Rainbow bee-eater. The Rainbow bee-eater is a commonly recorded migratory species in the Northern Territory. There is a high likelihood that this species will occur. There is also a moderate likelihood of occurrence of the Fork-tailed swift (*Apus pacificus*).

Table 7-10. Fauna species listed as migratory under the EPBC Act as identified by the PMST as having potentially suitable habitat within 20km of the proposed well site, their listing under international agreements, and likelihood of occurrence.

Scientific name	Common name	EPBC	PMST	International agreement	Likelihood
Actitis hypoleucos	Common sandpiper	Mi, Ma	X	J, C, R	Low
Apus pacificus	Fork-tailed swift	Mi, Ma	X	J, C, R	Moderate
Ardea alba	Great egret	Ma	X	-	Low
Ardea ibis	Cattle egret	Ma	X	-	Low
Calidris acuminate	Sharp-tailed sandpiper	Mi, Ma	X	J, C, R	Low
Calidris ferruginea	Curlew sandpiper	Mi	X	J, C, R, B	Low
Calidris melanotos	Pectoral Sandpiper	Mi, Ma	X	J, C, R, B	Low
Charadrius veredus	Oriental plover	Mi, Ma	X	C, J, R, B	Low
Glareola maldivarum	Oriental pratincole	Mi, Ma	X	C, J, R	Low
Merops ornatus	Rainbow bee-eater	Ma	X	-	High
Motacilla cinerea	Grey wagtail	Mi, Ma	X	C, J, R	Low
Motacilla flava	Yellow wagtail	Mi, Ma	X	C, J, R	Low
Pandion haliaetus	Osprey	Mi	X		Low
Rostratula benghalensis	Painted Snipe	Ma	X	C, J, R	Low

EPBC Listing: Mi: Migratory; Ma: Marine International Agreement: J: Japan-Australia Migratory Bird Agreement; C: China-Australia Migratory Bird Agreement; R: Republic of Korea-Australia Migratory Bird Agreement; B: Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals)

7.2.8.4 On-Ground Survey

An on-ground walkover survey of the proposed well site will be completed by LES staff prior to the construction of the proposed appraisal well. Numerous surveys have been completed in the PVGF area by LES throughout its operation including a recent 2015 survey of the PV-7 and proposed PV-12 sites adjacent to proposed well site, as well as nearby creek lines and undisturbed rocky scree slopes. Additional extensive surveys were undertaken in 2007 and 2003 of the broader PVGF region.

No fauna species of conservation significance or other EPBC listings were recorded in the 2015 survey of well site PV-7, proposed site PV-12 and adjacent creek lines. The 2007 survey recorded one EPBC listed species, the black-footed rock wallaby (*Petrogale lateralis* MacDonnell Ranges Race). This species was recorded adjacent to sites PV-11 and PV-3. These sites are located south-west of the proposed well site and are immediately adjacent to the protected Finke Gorge National Park area. There is a moderate likelihood this species may move into the proposed well site area however given the lack of permanent water supplies nearby it is likely individuals would only pass through.

Slater's Skinks (*Liopholis slateri slater*) are known to occupy an area downslope the PVGF compressor site, 7km west of proposed well site. The species occur in alluvial areas adjacent to creek lines. Creek lines and drainage channels in gorges adjacent to ridges in the Krichauff Ranges are ecologically sensitive habitats and run-off from site should be carefully managed to minimise impacts on habitat for threatened fauna species inhabiting these areas.

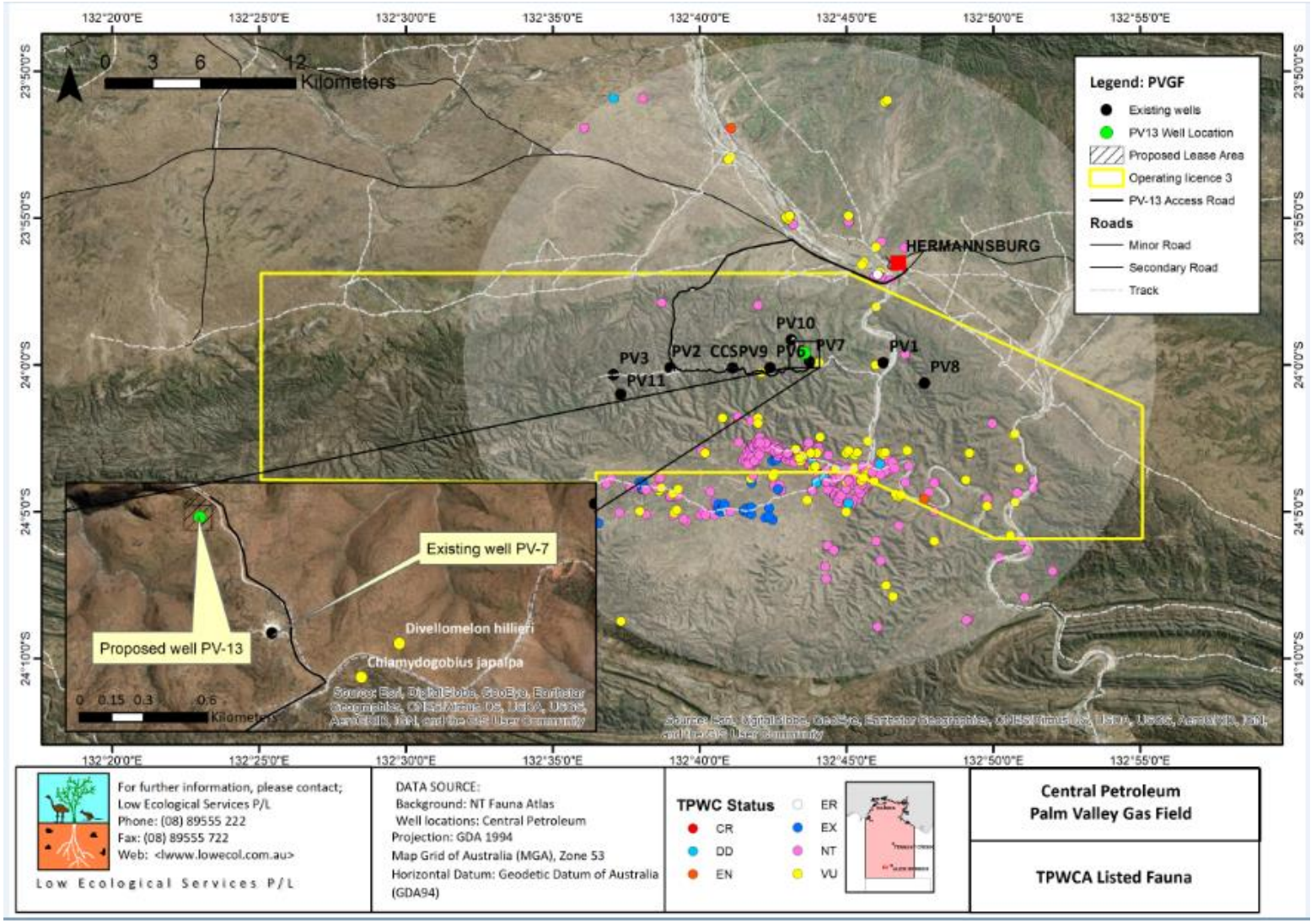

Figure 7-13. TPWC listed Fauna records from the NT Fauna Atlas identified within 20km of the proposed well site

7.2.9 Introduced Fauna Species

An introduced fauna species is considered in this report to be of management concern if it is:

- Listed in the NT Fauna Atlas as "Introduced" and has been recorded within a 20km buffer zone of the proposed well site; or
- Identified as an invasive species by a PMSR report for the area within a 20km buffer of the proposed well site areas; or
- Has been recorded on field surveys of the area.

In total of eight introduced fauna species were identified by the EPBC PMST or NT Fauna Atlas as occurring or potentially occurring within 20km of the proposed well site (Figure 7-3).

Table 7-11: Introduced fauna species identified as occurring or potentially occurring within 20km of the proposed well site, by the NT Fauna Atlas or the EPBC PMST.

Species name	Common name	PMST	NT Fauna Atlas
Bos Taurus	Domestic Cattle	X	
Camelus dromedarius	Camel	X	X
Canis lupus familiaris	Dog	X	
Equs caballus	Horse	X	X
Felis catus	Cat	X	X
Mus musculus	Mouse	X	X
Oryctolagus cuniculus	Rabbit	X	X
Passer domesticus	House Sparrow		X
Sus scrofa	Pig	X	
Vulpes	Fox	X	

7.2.10 Fire History

Mapping obtained from the North Australia Fire Information website (North Australia and Rangelands Fire Information, 2017) indicates that the proposed well site has not been burnt over the past 10 years (see Figure 7-14). Fire has occurred within the OL3 in 2011 predominantly around the edge of the lease area. In 2012 a small portion of the lease area adjacent to PV-2 and PV-9 was burnt whilst in 2014 there is some evidence of fire in the lease area. Overall the proposed well site is considered a low fire risk due to the sparse nature of vegetation and high elevation.

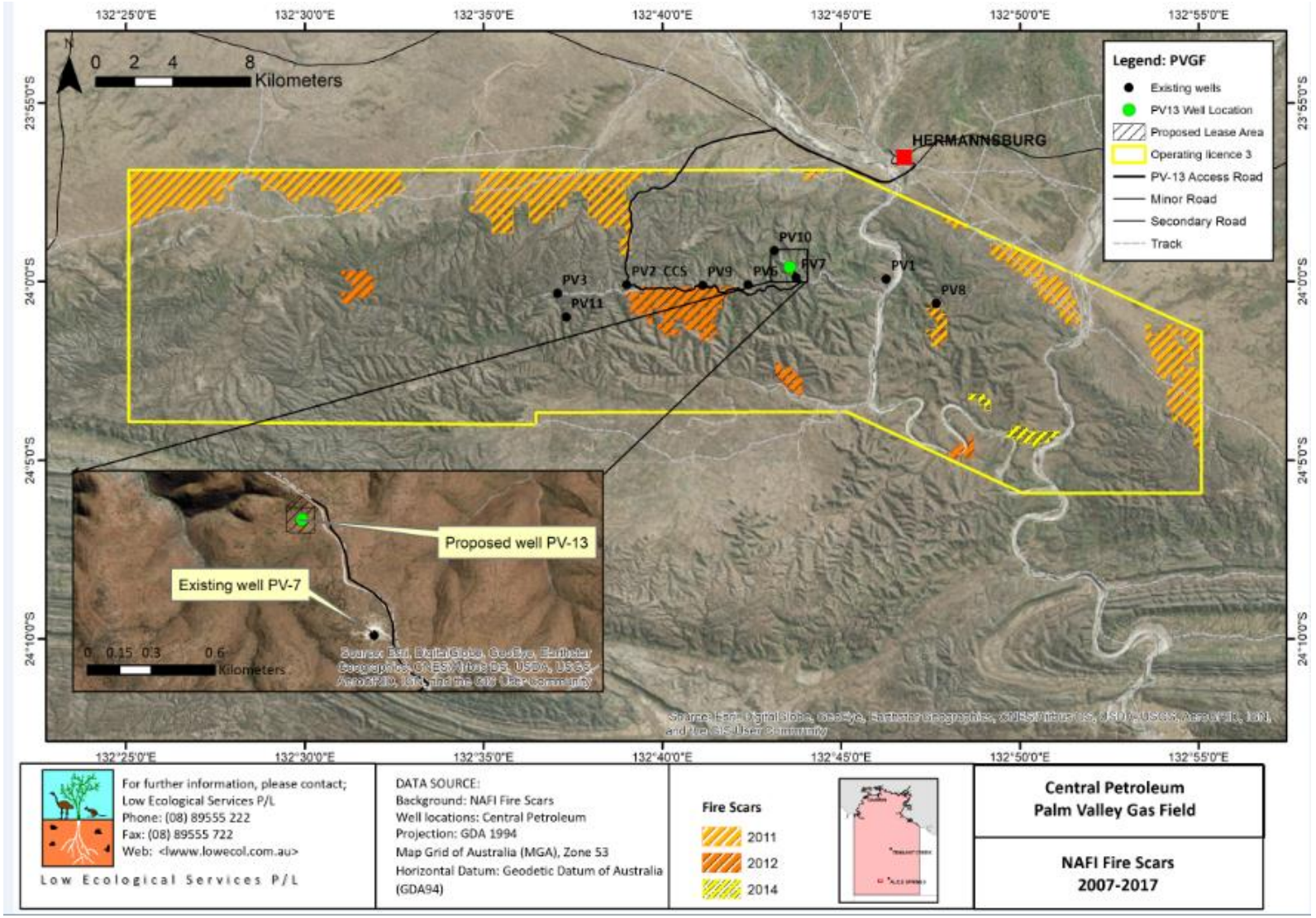

Figure 7-14. 2007-2017 Fire scars in the proposed well site area from the Northern Australian Fire Information (NAFI) records

7.3 Social Environment

7.3.1 Surrounding Land Tenure

The Palm Valley and Finke River areas surrounding PVGF are part of the Finke Gorge National Park (which is 4.74km to the south) and have a rich cultural history. PVGF lies on Aboriginal land of the Western Arrente People.

Land access agreements with surrounding land holders are current and as approved in Appendix 11. Furthermore, Central has received approvals specifically from the CLC to drill PV-13 who consulted the appropriate custodians of the land for approvals.

7.3.2 Surrounding Populated Places

Populated areas close to PVGF include:

- Hermannsburg (the nearest population to the well) approximately 8km to the north east;
- Glen Helen Resort, approximately 35km to the north; and
- Alice Springs, approximately 130km to the north-east

Operations at PVGF for the proposed well site are likely to cause minor temporary disturbance to the Alice Springs community with extra triple trailer trucks passing through. Glen Helen and Hermannsburg may be impacted by the activities due to extra traffic along the main public access road connecting these two places and PVGF. However, this is likely to be of short duration and limited where possible.

7.3.3 Heritage Areas identified EPBC PMSR

An EPBC PMST retrieved for the OL3 area identified one National Heritage Place, the Hermannsburg Historic Precinct (see Appendix 2), which is located within 25km of the PVGF. No operations at PVGF will impact on this place as it is outside of all operational areas and not located on any access track or road associated with PVGF operations.

7.3.4 Archaeological Surveys

As the area is on Aboriginal Land Trust, a CLC clearance is required before any new works are commenced. CLC completed the appropriate on-site clearance reviews and an authorisation of SSC certificate to conduct drill pad preparation and clearance has been conducted.

Central has also consulted with AAPA for the clearance of the area and letters recognising CLC SSC certificate has been received.

7.3.5 CLC Sacred Sites Clearance Certificate

Central has a current CLC Sacred Site Clearance Certificate for the PVGF existing operations in OL3 (C2015-035). Central also has the necessary approvals and CLC Sacred Site Clearance for the new proposed drill site and operations within the OL3 area (refer to Appendix 11 “Stakeholder Consultation”).

8 ENVIRONMENTAL RISK ASSESSMENT AND MITIGATION MEASURES

8.1 Scope

The scope of the environmental impact and risk assessment covers all aspects of the activities associated with exploration drilling at the proposed appraisal well site not already covered in the Appendix 13. Environmental impacts resulting from activities associated with the proposed drilling program include:

- Flora and fauna
- Soil and landform
- Surface hydrology
- Groundwater
- Waste
- Air and noise emissions

The management and mitigation measures are in accordance with Central's Health, Safety and Environmental Management System (HS&E MS).

8.2 Environmental Hazard Identification, Risk Assessment and Management

Activities (or elements of activities) that have the potential for environment impact[1] have been identified and assessed for the proposed well site in accordance with *MSTD09-01 v1 – Hazard Identification, Risk Management and Control*. The risk assessment process defined under *MSTD09-01* includes:

- Identification of all environmental hazards associated with operations;
- Consideration of the pathway of impact upon environment receptors for each hazard and the potential maximum consequence if no control measures are implemented;
- Consideration of controls that are appropriate, industry best practise and implemented to manage each hazard;
- Consideration of the likelihood (probability) of the consequence occurring with these controls in place;
- Re-consideration of the final maximum consequence that is credible once controls are implemented;
- Calculation of the environmental risk; and
- Assessment to determine if the risk is ALARP. If it is not, then consideration of further risk control measures will be implemented to reduce the risk to ALARP or to an otherwise acceptable risk level.

The following activities are addressed:

- Land clearing
- Road and track construction, maintenance and access

[1] An environmental impact is any change to the environment, whether adverse or beneficial, resulting from an activity.

- Well drilling and associated exploration activities
- Water supply and use
- Well bore management
- Campsite and associated accommodation facilities
- Fuel and chemical management
- Waste management

8.3 Key Definitions

Key definitions relating to risk management are provided in Table 8-1.

Table 8-1 key definitions in relation to risk management

Key Definitions	
Incident Event	An event capable of causing critical, major, moderate or minor damage to the environment or negligible damage with no significant environmental effect.
Hazard	A physical situation with the potential for damage to the environment, human injury, damage to the property or some combination of these.
Risk	The likelihood of specific undesired event occurring within a specified period or in specified circumstances. It may be either a frequency (the number of specified events occurring in a time unit) or a probability (the probability of specified event following a prior event), depending upon circumstances.

8.3.1 Risk Assessment Methodology

The purpose of this risk assessment is to identify hazards and develop risk-reducing measures to prevent and mitigate impacts from operational activities. The ratings used and resulting scores were determined in accordance with the risk assessment matrix in Table 8-1. This assessment also outlines recommended management actions that help to reduce the risk to ALARP.

Environmental risk assessment consists of five basic steps:

- Hazard identification;
- Risk analysis;
- Risk evaluation;
- Risk management; and
- Residual Risk Analysis.

These steps are described briefly below.

8.3.1.1 Hazard Identification

Hazard identification involves identifying the sources of risk i.e. those activities or incidents that could result in an environmental impact. Hazards are categorised into those arising from routine operations, and those arising from incidents.

8.3.1.2 Risk Analysis

Risk analysis determines the likelihood of an activity or event occurring, and the consequences of that activity or event on the environment. The risk ranking matrix in Table 8-2 was used to assess the

consequence and likelihood of all identified events. The matrix is based on six classifications of consequences and six for the likelihood of a hazard.

8.3.1.3 Risk Rating

Risk evaluation prioritises the risks i.e. determining if the risk of an activity or incident is acceptably low, or if management actions are required to reduce the risk to ALARP. The risk evaluation presented in Table 8-3 takes existing safeguards/management measures into consideration i.e. represents the residual risk with existing or planned safeguards in place. If there are any uncertainties in the risk rating then a safety factor has been applied to the score, increasing the risk rating.

8.3.1.4 Risk Management

Table 8-3 presents the detailed assessment of risks, impacts and their management for the proposed appraisal well. These management measures will reduce the risks to ALARP by implementing industry best practice standards and the APPEA onshore oil and gas environmental code of practice.

8.3.1.5 Residual Risk Analysis

Residual Risk is the risk rating once additional management measures have been implemented. This rating will be ALARP.

8.4 Key Environmental Issues and Risks

The surrounding area of the proposed well site PV-13 is classed as containing environmentally sensitive species. The potential environmental issues involved with the proposed well site PV-13 are:

- Soil conservation and Erosion control:
    - The area has a moderate to high erosion potential due to steep terrain, large areas of rock and sometimes torrential rains, which can produce large volumes of run-off and can adversely affect the water quality in drainage lines if water spills from the drill site.
- Water management:
    - The proposed well drilling may adversely impact on the local surface and ground waters through the contamination of surface run-off and the disposal of wastewater if not appropriately controlled, complying with all regulation requirements.
    - The drilling of the proposed well site PV-13 may lead to cross formation contamination of fresh water aquifers that would not occur under normal conditions
- Flora and Fauna Conservation:
    - There is a diversity of rare plants located within the Krichauff Range. Creek lines tend to accommodate the greatest diversity of species, for example some gullies can contain up to 5 rare species. Therefore, as the creek bed is susceptible to changes in water quality, the associated flora are also vulnerable.
    - There are some disjunct populations of species that are more common in other regions (such as the Tanami) but are relatively rare in Palm valley.
    - Knowledge of the location and distribution of rare and vulnerable species within the proposed well site.

8.5 Cumulative Impacts

Cumulative impacts of the construction of proposed appraisal well are low due to the lack of surrounding developments and industry. The surrounding communities have small populations and limited infrastructure with most of the services provided in Alice Springs. The only potential cumulative impacts would be in relation to flora and fauna, which are discussed in more detail in Table 8.3.

8.6 Risk Assessment and Mitigation Measures

Table 8-2 Risk Assessment Matrix

		Low Risk / Moderate Risk / High Risk	LIKELIHOOD – Probability of Harm / Loss					
			1	2	3	4	5	6
		Environmental Impact	Unlikely / Unknown Not expected to occur	Remote Potential May occur only on exceptional circumstances	Possible Could occur at some time	Probable Expected to occur at some time	Frequent Likely to occur regularly	Highly Likely Ever present; occurs in most circumstances
CONSEQUENCES – Severity of Harm / Loss	1	Alteration/disturbance within the limits of natural variability; effects not transmitted or accumulating; resources not impaired. Minimal pollution effect contained locally.	1	2	3	4	5	6
	2	Temporary alteration/disturbance beyond natural variability; effects confined to site and not accumulating; resources temporarily affected. Minor pollution, slight or negligible impact, negligible remedial or recovery work. Short term, localised and insignificant impacts to habitat or populations. Rapid recovery – measured in hours.	2	4	6	8	10	12
	3	Alteration/disturbance of a component of an ecosystem; effects not transmitted or accumulating. Pollution with some onsite impact and recovery work; possible outside assistance to contain. Incidental changes to abundance/biomass of biota in affected area; insignificant changes to overall ecological function. Recovery period measured in days – months.	3	6	9	12	15	18
	4	Alterations to one or more ecosystems or component levels, but which are recoverable; effects can be transmitted/accumulating. Significant pollution with offsite impact and recovery work. Impact that will cause a detectable effect in local ecosystem factors. Recovery period measured in months.	4	8	12	16	20	24
	5	Irreversible alteration to one or more ecosystems or several component levels; effects can be transmitted, accumulating; lost sustainability of most resources. Massive site impact and recovery work. Detrimental effect that will cause a significant effect on local ecosystem factors. Recovery period measured in years.	5	10	15	20	25	30
	6	Irreversible alteration to one or more ecosystems or several component levels; effects can be transmitted, accumulating; lost sustainability of most resources. Massive pollution with significant recovery work. Large scale detrimental effect that is likely to cause a highly significant effect on local ecosystem factors such as water quality, nutrient flow, community structure and food webs, biodiversity, habitat availability and population structure. Long term recovery period measured in decades	6	12	18	24	30	36

Table 8-3 Detailed risk assessment for the drilling operations at the proposed well site PV-13

Environmental aspect	Potential Impacts	C	L	Risk Rating	Mitigation Measures	C	L	Residual Risk
Impact on Infrastructure	Drilling rig and bulldozer mobilization to site may impact existing main access road from Mereenie Loop Road highway to the proposed well site PV-13.	4	3	12-Med	All over-dimension loads will be moved in accordance with the traffic management plan (TMP) and Department of Transport applicable permits and escorts as required.	2	2	4 - Low
Soil and topography	Loss of nutrient rich top soil from clearing operations	4	3	12-Med	All roads and cleared areas designed with erosion and sediment control devices as required to meet IECA and Department of Land Resource Management (DLRM) guideline and best practise principles. All roads and tracks developed along the contour where possible. Diversion bunds and roll over banks developed across the contour to disperse run-off away from the tracks. Diversion bunds and roll over banks to be designed in accordance with DLRM and IECA best practise guideline principles. All top soil (top 30 cm of soil profile) stored around the edges of the lease area in low profile mounds under 1.5-2m high for reinstatement as soon as required (see Section 6.3.1). All drains to be flat bottom and cleaned out following significant rainfall events, to ensure that laminar surface flow is maintained. Roads, tracks and general lease area to be checked for any signs of erosion following significant rainfall. Diversion banks and bunds in appropriate location, particularly on lower margins of drill pad, and at a spacing frequency in accordance with DLRM guidelines. Ensure site environmental inductions for all site personnel and contractors include the requirement to use only approved access tracks. Driving will be avoided where practical following significant rainfall. Release of hydrocarbons will be reported to the DPIR as required: 80L or greater to inland waters, 300L or greater to land; and 500m^3 of petroleum in gaseous state.	2	2	4 - Low
	Degradation to infrastructure and existing roads from erosion	3	3	9-Med		2	1	2 - Low
	Change in water courses and drainage channels due to land clearing and access track developments	3	2	6-Med		2	1	2 - Low
	Increase in sediment loads in water courses	3	2	6-Med		2	1	2 - Low
	Uncontrolled release of water and hydrocarbon (liquid or gas) to surface contaminating soil	4	3	12-Med		2	2	4 - Low

Environmental aspect	Potential Impacts	C	L	Risk Rating	Mitigation Measures	C	L	Residual Risk
	Soil contamination due to spills/leaks from vehicles, fuel and chemical storage, drilling fluid, lubricants, mud, cuttings and produced water.	3	3	9- Med	Fuel tanks on-site will be self-bunded (double-lined). Chemicals will be stored in bunded trailers, off the ground or designated fit-for-purpose storage areas. Drilling fluid mud tanks will be surrounded by a drain that terminates in the lined mud sumps. Waste management measures will be implemented (including for drilling cuttings) as per Appendix 1 and 13 All drill cuttings to be contained in the lined mud sump during operation. Soil testing before rehabilitation will determine if suitable for burial on site or if disposal off-site is required. All contaminated soil will be rehabilitated in accordance with the NEPM 2013 guidelines. Emergency spill response plans in place. Regular inspections will be conducted to identify erosion and repair where observed. This will include an audit conducted during the drilling program. Control access of feral or native animals to site through fencing where required.	2	2	4 - Low
	Erosion from access tracks and cleared well pad areas	3	2	6 -Med		2	1	2 - Low
	Increase in feral animal access causing erosion	3	2	6 -Med		2	2	4 - Low
Surface water	Change in water courses and drainage channels from proposed well pad and access tracks clearing	3	1	3 - Low	Strict adherence to Central's engineering standards and relevant government department requirements for technical drilling activities. Ensure adequate bunding around fuel and chemical storage locations, drilling fluid mud tanks, mud sumps, flare pits, waste pits and drill pad boundary (downslope). Monitoring local weather and climate information to make informed decisions regarding site operations on expected rainfall. Existing main road to drill site has been in place for 30+ years and diversion bunds or roll over banks at the top of entry and exit from water course crossings to reduce erosion are installed and functioning; following IECA and DLRM guidelines and best practise.	2	1	2 - Low
	Contamination to surface water from waste disposal or spill	3	1	3 - Low		2	1	2 - Low
	Uncontrolled release of water and hydrocarbon (liquid or gas) to surface contaminating surface water	3	2	6 - Med		2	2	4 - Low

Environmental aspect	Potential Impacts	C	L	Risk Rating	Mitigation Measures	C	L	Residual Risk
	Disruption to natural surface flow impacting downstream receptors	3	2	6 - Med	Ensure all cleared surface have appropriate diversion banks, erosion and sediment controls in place in accordance with IECA best practise principles ad DLRM guidelines to reduce sediment load in surface water run-off. Note: The PV-13 well location is on the northern side of the range and therefore run-off to the Finke George National Park, which is on the southern side of the range, is not possible. Testing of drilling cuttings will be conducted once fluids have evaporated from the mud sumps, to determine if salinity and heavy metals are below NEPM 2013 trigger guideline concentrations to be buried on site without impacting surface water run-off in the area.	2	1	2 - Low
Ground water	Contamination due to cross formation aquifer flow from drilling operations	5	3	15 - Med	Proposed appraisal well to be constructed and tested to comply with industry best practise standards and APPEA standards. The well will be drilled and constructed in accordance with the DPIR approved Drilling program. Strict adherence to Central's engineering standards and the regulatory department requirements including installation of cement casing to protect water bearing rock formations encountered (API 2009 recommends the depth of casing should be at least 22m below the bottom of the lowest aquifer to be protected). Two casing strings will be cemented across the Hermannsburg, Mereenie and other aquifers known from drilling of PV-7 and PV-10 within 200m and 1600m respectively of the proposed PV-13 well site. Drill casing will be tested for integrity through both a pressure test and a Formation Integrity Test (FIT) prior to drilling below surface and prior to drilling the production hole to determine the strength and integrity of open hole formation and the liner shoe. Testing of cement integrity behind the Liner and Surface casing by running a Cement Bond Long (CBL). Results of both above integrity tests will be provided to the DPIR. If the proposed well is unsuccessful it will be plugged with cement plugs over the porous formations and any hydrocarbon bearing zones to a minimum of 100m above and 50m below any significant gas or fresh water zones.	3	1	3 - Low
	Contamination due to loss of drilling fluids and chemicals	5	3	15 - Med		3	1	3 - Low
	Contamination from mud sump, flare pit or improper storage and handling of wastes	4	3	12 - Med		3	1	3 - Low
	Aquifer drawdown from abstraction	3	3	9 - Med		2	2	4 - Low

Environmental aspect	Potential Impacts	C	L	Risk Rating	Mitigation Measures	C	L	Residual Risk
	Drawdown on aquifer due to abstraction, impacts on vegetation	3	3	9 - Med	Any water required for drilling operations will be trucked in from Alice Springs (potable) The Surface Hermannsburg sandstone is separated by over 200m from the surface location. This formation is porous and quickly drained, so no groundwater dependant ecosystem is likely to be impacted. No other users of groundwater directly within or nearby the proposed drill locations and no groundwater will be abstracted at the proposed drill site. CP will not be using water from the nearby bores; all water will be transported from Alice Springs by a commercial arrangements. Testing of solid drilling cuttings will be conducted once fluids have evaporated from the mud sumps, to determine if pH is 6-10.5 (prior to mixing with soil); electrical conductivity is less than 20,000 uS/cm (prior to mixing with soil) and chloride of 8000 mg/L (prior to mixing with soil) and heavy metals are below NEPM 2013 trigger guideline concentrations to be buried on site without impacting groundwater. Soil and cuttings will be tested for compatibility before backfilling and burying the cuttings. Limits to be defined at time of sampling by independent soil expert. All chemicals used are biodegradable where possible. A full list of all chemicals used in the drilling program and their MSDS will be provided to the DPIR daily in the daily mud reports. Refer to Appendix 1 for further details of toxicology.	2	1	2 - Low
Air quality	Air drilling releasing dust from drilled rock formations	3	3	9 - Med	All air drilling cuttings to be wet down with de-dusting device on blooie line before release of cuttings into mud sump. Vehicles maintained and operated in line with Work Safe NT guidelines and Motor vehicle NT registry requirements. Amount of gas flared recorded for greenhouse gas calculations and reported through the National Greenhouse and Energy Reporting system. Routine inspection of all flow lines and well heads. Flaring only used during testing and in case of an emergency. Flaring into designated flare pit.	2	2	4 - low
	Increase in dust particles reducing air quality	2	3	6 - Med		2	2	4 - Low
	Increase in greenhouse emission from flaring	2	3	6 - Med		1	3	3 - Low
	Fugitive emissions	2	2	4 - Low		2	1	2 - Low
	Pollution from vehicles	2	2	4 - Low		2	1	2 - Low

Environmental aspect	Potential Impacts	C	L	Risk Rating	Mitigation Measures	C	L	Residual Risk
	Impact to human health and safety from reduced air quality	4	3	12 - Med	Appropriate personal protective equipment used in areas of low air quality. Dust suppression by water truck used as required. Only minimal amount of land cleared as necessary for safe operation. Vehicles properly maintained and not left idling.	3	1	3 - Low
Fire	Impact to human health and safety from increased frequency of bushfires and site fires	4	3	12 - Med	Appropriate firefighting equipment maintained and stocked at appropriate locations at the proposed well site; staff trained in its use. Regular fire and emergency drills conducted as per approved emergency response plan. Mobile fire truck located on site in case of emergency. Internet weather and fire monitoring websites checked daily to assess fire danger and operations planned accordingly. No open flames outside of designated areas. Designated smoking area. Flaring restricted where possible in low wind conditions and low fire danger periods. Fire break of at least 4m around all buildings and infrastructure. Fire management as per Appendix 13 Hazard ID 9.	2	2	4 - Low
	Destruction of infrastructure due to increase in bushfire and site fires due to activities involved with the proposed exploration wells	4	3	12 - Med		3	1	3 - Low
	Loss of conservation significant flora	4	2	8 - Med		3	1	3 - Low
	Loss of conservation significant fauna	4	2	8 - Med		2	2	4 - Low
Noise and vibrations	Impacts to surrounding stakeholders	2	1	2 - Low	Nearby stakeholders are the aboriginal residences on Missionary Plan at the base of the Krichauff Range near Tjuwanpa, approximately 6km from the proposed well site. Industrial noise from the drill rig and generator of approximately 100dbA will attenuate to less than 25dbA which is equivalent to recommended level for a standard bedroom. With intervening mountain ranges and vegetation, the level will be further reduced. Proposed drilling program is of temporary nature and any impacts on local fauna will be short lived (maximum 45 days) Native fauna is mobile and will be able to relocate to adjacent undisturbed habitat during drilling activities.	1	1	1 - Low
	Disturbance to local fauna from activities	3	2	6 - Med		2	1	2 - Low
	Impacts to health and safety of workforce	4	3	12 - Med		2	2	4 - Low
	Impacts on surrounding industry and business	2	1	2 - Low		1	1	1 - Low

Environmental aspect	Potential Impacts	C	L	Risk Rating	Mitigation Measures	C	L	Residual Risk
					Impact on health and safety of Central staff will be managed by PPE, location of camp and offices, timing of activities and other measures as appropriate.			
Cultural heritage	Disturbance to known cultural significant site	4	2	8 - Med	AAPA approval and certificate obtained before any proposed activities on ground Any area of cultural significance signed and fenced off so as to not be damaged Consultation with CLC and TO's before any works undertaken and authorisation obtained Proposed drilling activities to occur completely within the PVGF. Specific drill area has been surveyed by CLC and approval has been granted for this specific drilling activity. Staff inductions to highlight any areas of cultural significance and no-go zones Upon identification of a potential culturally significant object, work will cease until the supervisor has investigated and called the CLC to wait for further advice. Either a permit to remove and destroy will be sought if no other alternative exists, or an alternative location will be sought for transferral.	2	2	4 - Low
	Impacts to unknown culturally significant site	4	3	12 - Med		2	2	4 - Low
Stakeholders	Impacts to surrounding stakeholders due to lack of consultation	3	2	6 - Med	A full stakeholder consultation log will be maintained by Central in accordance with the Appendix 6. This will indicate all consultations and meetings with impacted stakeholders on proposed rig mobilisation and drilling program and any resolutions or conflicts resolved through the process. Signage on Mereenie Loop road will be constructed and maintained during the proposed drilling operations, particularly at turn off to PVGF, to advise of traffic hazards and increased use. Access agreements are in place with the traditional owners.	3	1	3 - Low
	Disturbance or impedance of surrounding stakeholder's regular activities	3	2	6 - Med		2	1	2 - Low

Environmental aspect	Potential Impacts	C	L	Risk Rating	Mitigation Measures	C	L	Residual Risk
Flora	Significant impact to flora of conservation significance	4	3	12 - Med	Flora survey conducted prior to mobilisation to site to identify any threatened species and suggest alterations to layout to minimise impact if appropriate. Environmental site inductions to include identification of potential threatened species in the area. Where possible all mature trees will be avoided or left in place and fenced off Mud sump will be positioned a minimum of 3 meter or at least two canopy lengths (whichever is greatest) from mature tree individuals. Soil testing of solid drilling cuttings will be conducted prior to burying onsite to ensure surrounding significant vegetation will not be impacted. No off road driving. Vehicle weed free cleaning either in Alice Springs or on a sealed road before mobilisation to site. Travel to occur on sealed roads only from wash down location to site. Any area of existing weed infestation noted and land clearing to occur into this area to stop further spread, where it cannot be avoided Any weeds are to be removed and disposed appropriately.	2	2	4 - Low
	New infestations of weed species	4	3	12 - Med		3	1	3 - Low
	Increase in feral animals causing degradation to native flora	4	3	12 - Med		2	2	4 - Low
Fauna	Significant impact to population of fauna of conservation significance	4	2	8 - Med	Fauna walkover survey completed prior to commencement of construction of proposed drill site to ensure no threatened species have moved into the area since a detailed fauna survey was last conducted in the area. Environmental site inductions to include identification of potential threatened fauna species in the area and ensure all personnel are aware of obligations and responsibilities for any fauna encounters If any threatened species is recorded on site, LES or appropriate Parks and Wildlife staff to be called	2	2	4 - Low

Environmental aspect	Potential Impacts	C	L	Risk Rating	Mitigation Measures	C	L	Residual Risk
	Open unfenced water sources encouraging feral animals into new areas	4	3	12 - Med	For removal of any fauna from the area either LES or CLC Tjuwanpa rangers to be called to remove. Fauna strike register developed and maintained. Avoid driving at night, dawn and dusk. Speed limits enforced. No off-road driving. Feral animal control as per Appendix 13 Hazard ID #6, 10 & 12. Any open water fenced to exclude kangaroos and dingoes (ensure if barbed wire leave top wire unbarbed for local avifauna). Ensure all waste receptacles are fauna proof. Call CLC or Tjuwanpa rangers to remove feral animals as required.	2	2	4 - Low
Waste	Contamination to land or water	4	2	8 - Med	Drilling waste managed as per sections 6.3.7, 6.3.8 and Appendix 1. General waste and general waste from the drilling process will be managed as per Appendix 10. Ensure site environmental inductions for all site personnel and contractors include the appropriate storage of wastes according to Appendix 13. All waste receptacles to have fauna proof lids. All waste removed as required for disposal off site in accordance with Appendix 10. All hazardous waste managed in accordance with the Appendix 10 guidelines and the *Waste Management and Pollution Control Act*. No waste to be stored within 10m of a watercourse. Waste to be separated in accordance with Appendix 10 for recycling All waste to be removed from site on completion of the proposed drilling program and in accordance with the *Waste Management and Pollution Control Act (*Including listed Wastes). Any liquid waste to be contained in either self-bunded containers or in a container in a bund that can contain 120% of stored volume.	2	2	4 - Low
	Significant impact to population of fauna of conservation significance	3	3	9 - Med		3	1	3 - Low
	Significant impact to flora of conservation significance	4	3	12 - Med		2	2	4 - Low

Environmental aspect	Potential Impacts	C	L	Risk Rating	Mitigation Measures	C	L	Residual Risk
					No disposal of wastes on site unless in accordance with this EMP or approved by the DPIR. If disposal occurs across territory or state borders, transport will be by an NT EPA approved contractor following NEPM 2013 guidelines.			
Visual amenity	Loss of visual amenity to surrounding stakeholders	2	2	4 - Low	Remote location entirely within the PVGF OL3. No public access. Only temporary infrastructure developed. Rehabilitation will eventually result in site returning to surrounding landscape if unsuccessful; if successful proposed well pad will be reduced to 50mx50m and all other areas rehabilitated to surrounding environment.	2	1	2 – Low
	Impact other industry and stakeholder's operations	2	2	4 - Low		2	1	2 - Low
Rehabilitation	Erosion and sediment issues impacting surrounding soil, landscape and water courses	4	3	12 - Med	Ensure topsoil stripped and preserved prior to civil works. Topsoil is removed and stored in appropriate low mounds for later respreading Ensure all compacted areas are deep ripped. Remove all general waste from site on completion of the proposed drilling program for disposal in accordance with Appendix 10. Drill cuttings will be disposed of in accordance with Appendix 1. Ensure soils are free of contamination and stable. Any external fill removed. Topsoil is re-spread over entire cleared area. All vegetation stockpiles are respread to enhance moisture retention and capture surrounding seed stock as a final layer.	2	2	4 - Low
	Lack of regrowth of vegetation	3	4	12 - Med		2	2	4 - Low
	New infestations of weeds	4	3	12 - Med		3	1	3 - Low

Environmental aspect	Potential Impacts	C	L	Risk Rating	Mitigation Measures	C	L	Residual Risk
	Contamination of soil	4	3	12 - Med	Lightly scarify all rehabilitated surface to encourage moisture retention and seed capture. Follow up inspection following first wet season for erosion and presence of weed species and assessment of cover and species regenerating. Follow up on second year wet season to assess signs of native vegetation regrowth of perennial native species, if extensive bare areas, assess for seeding or spreading of local topsoil. If any weed species identified they are to be removed in accordance with the Appendix 13 guidelines Any erosion to be corrected using control devices in accordance with the IECA and DLRM guidelines and best practise principles. The status of the ESC devices will be checked prior, during, after completion of the drilling program and then annually as part of the Environmental audit process. All infrastructure removed and cleared areas rehabilitated unless another agreement is reached with the landholder/traditional owners. Only small area near the drill pad and access will remain.	2	2	4 - Low
	Contamination of groundwater	4	3	12 - Med		3	1	3 - Low

9 ENVIRONMENTAL OUTCOMES, PERFORMANCE STANDARDS AND MEASUREMENT CRITERIA

This EMP has been developed to specifically protect and ensure the integrity of the existing and surrounding environment from risks associated with the drilling activities at proposed well site PV-13. This is achieved through establishment and implementation of:

- Environmental Objectives;
- Environmental Performance Standards; and
- Measurement Criteria.

The principles and practises developed in this EMP are based on Ecologically Sustainable Development (EcSD).

- *'Using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased' (Ecological Development Steering Committee, 1992)*.

This EMP provides measurable procedures and practises, implemented at defined frequencies to reduce the identified risks in Section 8 to residual risks that are ALARP and acceptable by Central management and the DPIR for operations to proceed. This will ensure that the proposed drilling operations will have minimal negative environmental impacts as possible, and at completion of operations, the environment within the OL3 area will be returned to a suitable landscape conductive to future rehabilitation success and utilisation by stakeholders. It is specifically noted that fracking will not be undertaken during drilling of the proposed well site PV-13; in keeping with the current NT moratorium.

This EMP is a legally binding document and Central will provide full disclosure of this EMP and result of audits and conformance checks against this EMP to the DPIR as required.

9.1 Environmental Objectives and Outcomes

Central operation standards require that environmental objectives be developed, each with corresponding targets against which performance can be measured. The environmental objectives relevant to the drilling activities at the proposed well site PV-13 are presented below.

The implementation of the mitigation and preventative measures to reduce environmental risks presented in Section 8 of this report are as prescribed in the table below. The Environmental risks are:

- Biodiversity – Flora and fauna;
- Land and soil – Erosion and sediment control;
- Water – Hydrology and hydrogeology;
- Waste – Operational and produced;
- Air and noise – Emissions, vibration and lighting;
- Fire – Bushfire and operational; and
- Culture and heritage – Indigenous and non-indigenous.

BIODIVERSITY – Flora and fauna	
ENVIRONMENTAL OBJECTIVE: To prevent a loss of biodiversity because of activities conducted in the OL3 area through adoption of EcSD principles and practices.	
Environmental outcomes	
1	Minimise injury to native fauna
2	No unauthorised loss or disturbance to native flora, fauna and fauna habitat
3	Weed species spread and occurrence controlled as per NT and Commonwealth government requirements; and no new species introduced
4	No increase in level of predator species
5	Reduce or have no increase in level of introduced fauna
6	Register and Closeout of Correcting Actions (RCCA) maintained and up to date
7	No interference with fauna

LAND AND SOIL – Erosion and sedimentation	
ENVIROINMENTAL OBJECTIVE: To prevent land degradation because of activities conducted in OL3 area.	
Environmental Outcomes	
1.	Control erosion and sedimentation on OL3 area
2	New roads and cleared areas to be approved and appropriate environmental clearances conducted
3	Construction, maintenance and any clearing to follow erosion and sediment control best practice guidelines as stipulated by the DENR and IECA
4	No new erosion and/or sedimentation issues
5	Any erosion and sedimentation control device to be designed and constructed following DENR and IECA guidelines and best practice principals
6	Maintain and conserve the integrity of nutrient rich top soil
7	Reduce wind borne erosion
8	Ensure EcSD principles and practises are employed

WATER – Hydrology and Hydrogeology	
ENVIRONMENTAL OBJECTIVES: To prevent surface and ground water degradation, contamination or alteration because of activities conducted in the OL3 area by following EcSD principles and practises.	
Environmental outcomes	
1.	Maintain natural drainage patterns and flow lines
2.	No contamination to ground or surface water
3.	No impact on downstream water courses
4.	No significant increase in sediment loads in existing watercourses

WASTES – Operational and Produced	
ENVIRONMENTAL OBJECTIVES: To ensure all waste streams generated in the OL3 area are dealt with and contained; to have minimal impact on the environment.	
Environmental Outcomes	
1.	No uncontrolled releases of wastes
2.	No fauna interaction with waste
3.	Waste streams separate and stored appropriately for offsite disposal as required
4.	Handling and disposal of waste by appropriately licensed contractor
5.	No unregulated release of wastes

AIR AND NOISE – Emissions, Vibrations and Lighting	
ENVIRONMENTAL OBJECTIVES: To minimise the adverse effects on air quality and noise to surrounding receptors from the operation in the OL3 area.	
Environmental Outcomes	
1.	No uncontrolled release of gas
2.	No unauthorised flaring of gas
3.	No open flames
4.	Smoking restricted to designated areas
5.	Noise complaints register maintained and accessible to surrounding stakeholders
6.	All vehicles running at optimum performance
7.	No increase in levels of airborne soil particulate matter
8.	No impact to human health
9.	No loss of air quality due to fire

FIRE – Natural and Operational	
ENVIRONMENTAL OBJECTIVES: To minimise the adverse effects on people, infrastructure and the surrounding receptors from fire, either caused by operations in the OL3 area or natural causes.	
Environmental outcomes	
1.	No death or injury to human life or health from fire
2.	No impacts to infrastructure
3.	No excess damage to surrounding environment from operations at PVGF

HERITAGE AND CULTURE – Indigenous and Non-indigenous	
ENVIRONMENTAL OBJECTIVES: To ensure that all heritage and culturally significant sites are identified and protected within the OL3 area.	
Environmental outcomes	
1.	No impact to registered heritage or culturally significant site or object
2.	No impact to unregistered heritage or culturally significant site or object
3.	No unauthorised clearing or access

10 ENVIRONMENTAL MANAGEMENT IMPLEMENTATION SYSTEM

10.1 Central Health, Safety and Environment Integrated Management System

The feasibility, planning and assessment of the PVGF operations are undertaken within the framework of the CTP Health Safety and Environment Management System (CTP HS&E MS), which incorporates environmental management. The key elements of the CTP HS&E MS include:

- Matching of legal obligations to the practical needs of all operations;
- Assignment of responsibilities required to meet the commitments set out in the CTP HS&E MS Policy (Figure 4-1 & 4-2);
- A common measurement/audits process to check that standards are complied with;
- Encouragement of improvement in process and performance through feedback processes;
- Appropriate and comprehensive documentary support; and
- Application of the system to all levels and areas of the organisation (including work by contractors), and to all working conditions and any activities that may have the potential to affect the health and safety of people or harm the environment.

The system has been constructed in a hierarchical manner, with the following tiers or levels of documents:

- Standards;
- Policies;
- Procedures;
- Work instructions;
- Registers; and
- Other records and supporting documentation.

In order to provide for a comprehensive HS&E MS, the following procedure Standards have been developed:

Standard 1: Environment, Health and Safety Policies
Standard 2: Legal and Other Obligations
Standard 3: Objectives and Targets
Standard 4: Improvement Plans
Standard 5: Responsibility and Accountability
Standard 6: Training and Competency
Standard 7: Consultation and Communication
Standard 8: Document and Record Management
Standard 9: Hazard Identification, Risk Assessment and Control
Standard 10: Contractor and Supplier Management
Standard 11: Operations Integrity
Standard 12: Management of Change
Standard 13: Emergency Preparedness
Standard 14: Monitoring, Measurement and Reporting
Standard 15: Incident Investigation
Standard 16: Management System Audit and Assessment
Standard 17: Management Review

10.2 Roles and Responsibilities

Although it is everybody's responsibility to ensure the OL3 area's environmental standards are maintained, the Super Intendant at PVGF is responsible for maintaining and implementing this EMP. The General Manager of Operations is responsible for submitting new revisions of this document to the Department of Primary Resources and Industry (DPIR) and the Central Land Council (CLC).

A signed copy of CTP's Environmental Protection Policy is provided in Table 4-1 and CTP's corporate HS&E Policy in Figure 4-2.

All field operations are managed by CTP. The following sub-sections outline the responsibilities allocated to key personnel.

Generally, there are 2-3 persons in the field at any one time, with a work a roster of 2 weeks on 2 weeks off. Transport to the site is drive-in, drive-out from Alice Springs.

The established accommodation/messing facilities at the CTP are used to accommodate the workforce. All meals are provided onsite.

10.3 Training and Awareness

As minimum, HS&E meetings will be held 6 biannually with all personnel, including all contractors and visitors that are on site. HS&E meeting minutes will:

- Include a cover sheet including the names of all personnel in attendance;
- Be recorded in detail on the HS&E Meeting Minutes form ensuring all items discussed are recorded and tracked for close-out as appropriate;
- Itemise the main issues discussed at the meeting and agree on action items; and
- Assign a nominee to close out any action item, safety issue or other matter raised in the meeting.

All action items are to be transferred to the site Registering and Closeout of Correcting Actions (RCCA) for tracking and close out.

HS&E meeting minutes and the updated RCCA will be displayed on the site safety notice boards.

10.3.1 HS&E Reports

CTP Site Manager will send a quarterly HS&E MS report to CTP Management including the CTP Operations Manager and CTP HS&E Coordinator for their review and comment. The 6 monthly HS&E MS report will include:

- HS&E meeting minutes;
- Site HS&E statistics;
- RCCA; and
- Results of emergency simulation training exercises.

10.3.2 Pre-start (Toolbox) Meetings

A toolbox meeting will be held daily and prior to any change in activity commencing on the day of an activity occurring. These are designed for employees to discuss task HS&E issues and specific requirements for the day's operations, including work permits.

The meeting is designed to discuss the following issues daily:

- Operations to be conducted during the next 12 hours and any potentially hazardous activities associated to those activities;
- Any hazards identified in the last 24 hours that may affect the work force or operations; and
- Any incidents or accidents that have occurred in the last 12 hours.

10.3.3 Shift Handovers

CTP have developed and implemented a suitable handover procedure for shift changes and crew changes to ensure that relieving personnel are fully aware of their responsibilities and work status. Shift change handovers include the completion of checklists and other specified documentation. The handover checklist includes as a minimum:

- Any equipment damaged or out of service;
- Status of current operations;
- Any personnel or crew issues that the relief needs to be aware of; and
- Third party equipment or operation in the area.

10.3.4 HS&E Related Information

CTP makes relevant HS&E information available by display on the site safety notice board. This may include:

- Policies and environment and safety management documentation;
- Legislation, standards and guidelines;
- Emergency contact information;
- Appropriate signs being displayed relating to fire, safety and PPE requirements;
- Emergency evacuation plans for the site;
- Safety alerts and technical bulletins;
- HS&E minutes; from weekly site and monthly management HS&E meetings or at a minimum quarterly meeting;
- Emergency drill reports; and
- The RCCA.

10.4 Monitoring

The CTP Superintendent is responsible for organising and reporting on all monitoring undertaken at the proposed appraisal well site PV-13.

The specific activities to be monitored internally by Central in relation to potential impacts on environmental aspects are provided in Appendix 8.

10.5 Auditing

Environmental audits against the performance standards and measurement criteria set out in this EMP will be conducted by a suitable qualified person or internally during and after rehabilitation operations.

Results of these assessments form the basis for targeted improvement initiatives during the current proposed drilling operation as well as succeeding proposed drilling operations. The results of these audits will also be submitted to the DPIR should they be requested.

Corrective actions raised from audits and inspections are entered into the audit database for action assignment and tracking of action progress to closure.

- Audit conducted during operations
- Audit conducted following completion of operations
- Audit conducted after completion of rehabilitation activities
- Audit conducted 1 year after rehabilitation activities and if necessary, 2 years after.

The specific activities to be monitored externally by a suitably qualified environmental consultant or internally in relation to potential impacts on environmental aspects are provided in Appendix 8. Auditing conducted after completion of rehabilitation activities and one-year post rehabilitation will include auditing of all activities outlined in Section 12.3 of this EMP.

Table 10-1 Monitoring and auditing requirements for the proposed well site PV-13

Activity	Monitoring		Auditing	
	Action	Frequency	Internal/External	Frequency
ALL				
Site inductions	Records of site inductions show 100% participation by all personnel, contractors and visitors	For all new staff members and visitors before access to the site	Internal audit	At end of drilling program
SOIL AND TOPOGRAPHY				
Erosion and sedimentation on site	Records of location and size	Site inspection at beginning of operation and then following any significant rainfall events (>10mm in 24 hours)	Internal audit	Directly after site pack up and rig removal After rehabilitation, depending on outcome of the well Then one year after rehabilitation
Topsoil storage	Ensure topsoil stockpiled around edge of well pad clearing in mounds between 1.5-2m	Once after site preparation is complete	Internal audit	Once, at two weeks into drilling program
	Top soil re-spread over all cleared areas no longer required for safe operation	Once after rehabilitation, depending on outcome of the well.	Internal audit	1-year post rehabilitation
Erosion control	Visual inspection ensuring adequate control devices in place in accordance with DENR and IECA best practice guidelines No erosion occurring	Site inspection at beginning of operation Then following any significant rainfall events (>10mm in 24 hours)	Internal audit	Auditing will occur prior, during, after completion of the drilling program, 1-year post rehabilitation and annually for the next 5 years
Compaction	All areas of compaction deep ripped	Once at completion of rehabilitation, depending on outcome of the well.	Internal audit	1-year post rehabilitation

Activity	Monitoring		Auditing	
	Action	Frequency	Internal/External	Frequency
Soil contamination	Soil testing conducted in mud sump before onsite burial Soil testing on any area of remediation following spill or leak if applicable	One soil sampling after muds have dried and been mixed with topsoil before burial A further soil sampling event directly after cleaning up at any location where spill has occurred Follow up sampling if required until soil is classified as remediated in accordance with the NEPM 2013 guidelines for contaminated sites	Internal audit	1-year post rehabilitation and/or spill soil contaminating event.
SURFACE WATER				
Water storage	Record weekly checks of freeboard to ensure sufficient clearance	Weekly check of water levels to maintain free board.	Internal audit	Two weeks into drilling program
	Record any access by fauna	Daily check to ensure no fauna access		Two weeks into drilling program
Surface water contamination	If water course or drainage line in the area appears contaminated or is believed to potentially be contaminated, then soil to be tested	Directly after rehabilitation of contaminated soil Then one year later	External audit	If required
GROUNDWATER				
Groundwater contamination	No action planned as we are not fracking as part of this program.	N/A	N/A	N/A
AIR QUALITY				
Gas flare	Records kept of occurrence and amount of gas flared as required	Daily records taken when applicable	Internal audit	At completion of drilling operations
Dust suppression	Evidence of dust suppression activities in daily reports	Daily records taken when applicable	Internal audit	At completion of drilling operations
Complaints	Records of complaints from surrounding land users regarding air quality or visual amenity and subsequent investigation kept	Whenever a complaint is received and when complaint is closed out	Internal audit	At completion of drilling operations

Activity	Monitoring		Auditing	
	Action	Frequency	Internal/External	Frequency
FIRE				
Fire drills and training	Records show fire drills and training carried out and at what frequency	Frequency of at least once during drilling operations	Internal audit	At completion of drilling operations
Gas flare combustion	Regular inspection of flare pit to determine if any contamination occurring from unburnt fuel or external incidents.	Daily check of flare pit after flaring	Internal audit	At completion of drilling operations
Firebreaks	Visual inspection of fire breaks maintained to 4m	Once post pad construction	Internal audit	At completion of drilling operations
Evidence of designated smoking areas, diesel vehicles only and firefighting equipment on site.	Visual inspection	Once at start after rig mobilisation and set-up	Internal audit	At completion of drilling operations check records
Unauthorised open fires	Visual inspection	Daily site inspection	Internal audit	At completion of drilling operations check records
Fires resulting from operations	No fires because of Central's operations	Daily site inspection	Internal audit	At completion of drilling operations
NOISE AND VIBRATIONS				
Vehicle/generator/pump	Compliance with vehicle manufactures specifications	Before mobilisation of vehicle to site as required	Internal audit	At completion of drilling operations
Complaints	Records of complaints from surrounding land users regarding noise and vibrations from operations and subsequent investigations	Records kept of any incident when applicable	Internal audit	At completion of drilling operations check records
CULTURAL HERITAGE				
Cultural heritage clearance	Conducted prior to disturbance	Once prior to well pad construction	Internal audit	At completion of drilling operations check records

Activity	Monitoring		Auditing	
	Action	Frequency	Internal/External	Frequency
Interference with Aboriginal sacred sites, places or objects of archaeological significance.	Records kept of any incidents	Records kept of any incident when applicable	Internal audit	At completion of drilling operations check records
FLORA				
No unauthorised land clearing	All earthworks clearing in the field is conducted by external contractors and personnel are prohibited to enter the site until approvals are received All personnel movements are monitored daily through the ITV (Intention to Visit) process and by Site Supervisor	Once prior to construction activities	Internal audit	At completion of drilling operations check records
No unauthorised off-road driving, all drivers inducted into the potential impacts of off road driving on soil	Site inspection for evidence	Weekly site inspection	Internal audit	At completion of drilling operations
Change in health of existing vegetation and flora	Monitoring of existing flora and vegetation health to ensure no adverse impacts from operations	Pre-disturbance assessment and 1-year post rehabilitation.	Internal audit	1-year post rehabilitation
Weed wash downs	Every vehicle to have approved weed free certificate	Once before each mobilisation to site	Internal audit	At completion of drilling operations
Weed infestations	Location of any new weed infestations	Weekly during operations	Internal audit	Post rehabilitation and 1-year post rehabilitation
Declared weeds	Declared weeds managed in accordance with the *Weed Management Act*	As required	Internal audit	Post drilling operations if required

Activity	Monitoring		Auditing	
	Action	Frequency	Internal/External	Frequency
FAUNA				
Presence of introduced fauna	Record number and location	Daily during drilling operations as required	Internal audit	At completion of drilling operations
Fauna strike	Records kept in a fauna register of any sightings, near misses or strikes	Daily during drilling operations as required	Internal audit	At completion of drilling operations
Zone designated speed limits	Records of any failures to comply and corrective action taken	Daily during drilling operations as required	Internal audit	At completion of drilling operations
WASTE				
Mud sumps and flare pits	Record distance from mud sump to existing trees canopy	Once after well pad construction	Internal audit	At completion of drilling operations
Disposal of drill cuttings	Soil testing of drilling cuttings prior to disposal or burial to quantify salinity, heavy metals, hydrocarbons and radioactive content.	Once per sump after drilling operation completed, before rehabilitation	Internal audit	At completion of drilling operations
Containment of drilling cuttings	Visual inspection of mud sump and flare pit to ensure adequate bunding and containment strategies implemented	Daily during drilling operations, reported if breach occurs	Internal audit	At completion of drilling operations
Waste streams	Records kept of quantities in and out from site	Daily during drilling operations or as required if removal frequency is less	Internal audit	At completion of drilling operations
Wastewater treated, and amount removed or disposed on site	Records kept of quantity and frequency	Daily during drilling operations or as required if removal frequency is less	Internal audit	At completion of drilling operations
Grey water treatment and disposal	Records kept of quantity and disposal location, visual inspection of sprinkler movement.	Daily during drilling operations or as required if removal frequency is less	Internal audit	At completion of drilling operations
Waste receptacles	Visual inspection of waste receptacles to ensure no fauna accessing waste storage locations	Daily inspection during drilling operations	Internal audit	At completion of drilling operations

Activity	Monitoring		Auditing	
	Action	Frequency	Internal/External	Frequency
Clean up materials	Records of when clean-up material was removed from site	As required when applicable	Internal audit	At completion of drilling operations
CHEMICAL AND HAZARDOUS SUBSTANCE MANAGEMENT				
Hazardous chemical register	Records kept of quantities in and out from site	Daily during drilling operations or as required if removal frequency is less	Internal audit	At completion of drilling operations
	All hazardous chemicals stored in either ICBs or in a bunded area in accordance with Appendix 12 and 13	Daily during drilling operations or as required if access frequency is less		At completion of drilling operations
Emergency Response and Oil Spill Contingency Plans	Visual evidence of plans on site	Once at start of drilling operations	Internal audit	Two weeks into drilling program
Storage of fuel, chemicals and drilling fluid mud tanks.	Visual inspection to ensure adequate bunding and containment strategies implemented	Daily during drilling operations or as required if addition/removal frequency is less	Internal audit	At completion of drilling operations
Spills and leaks of hazardous materials	Routine visual inspection of waste and chemical storage areas to ensure no leaks or spills	Weekly during drilling operations	Internal audit	At completion of drilling operations
	Records kept of location, clean-up procedure and communication with DPIR regarding any leaks or spills	As required when applicable		
REHABILITATION				
P&A	Check for weeds and erosion and vegetation re-establishment	Once post rehabilitation Once again, 1-year post rehabilitation	Internal audit	Post rehabilitation 1-year post rehabilitation
Suspended	Check for weeds and erosion and vegetation re-establishment	Twice a year	Internal audit	Annually
Production	Check for weeds, erosion and check cleared area reduced to 50mx50m and vegetation re-establishment	Twice a year	Internal audit	Annually

10.6 Continuous Improvement and Adaptive Management

CTP is committed to continual improvement in its HS&E MS performance. These plans are developed in accordance with *HS&E MS 04 - Improvement Plans (IP)* Policy.

The content of a HS&E IP must reflect the management of key environmental risks highlighted in this EMP, be supportive of strategic improvement initiatives and objectives and targets and highlight any improvement actions necessary to address compliance deficiencies and audit findings.

Regular review of any PVGF HS&E IP's must be made indicating progress against the EMP. Updates must be posted and be reviewed at site HS&E committee meetings as appropriate.

10.7 Incident and Non-conformance Management

Central's (CTP's) incident management procedures are designed to:

- Ensure all near misses and incidents are reported in a standard format so that consistency and accuracy of the process is maintained;
- Identify the underlying and basic causes of all near misses and/or incidents;
- Implement mechanisms to prevent the recurrence of similar near misses/incidents;
- Provide information to prepare the CTP near miss/incident statistics, and
- Identify potential losses and suitable corrective actions.

It is CTP's policy to report and investigate near misses, major hazards and incidents and to implement action to mitigate any identified contributing factors.

Incident management procedures are detailed in the CTP HS&E MS.

Environmental incidents that may arise during PVGF operations include:

- Well control event;
- Well integrity failure;
- Petroleum, hypersaline produced water, grey water, chemical or sewerage spills (including uncontrolled escapes);
- Fauna injury/fatality (vehicle collisions);
- Uncontrolled fire;
- Clearing of threatened flora species;
- Clearing of threatened fauna species habitat; and
- Disturbance to heritage areas.

Work is to cease in the area of the incident. First mitigation measures will be conducted, in a safe manner, to avoid the extension of the Environmental impacts. Operations will be in standby until advice is sought from the relevant government agency or suitably qualified consultant (except in case of fire, where available firefighting equipment will be used to control the fire or evacuation plan executed).

All environmental incidents and near misses that arise due to the presence of hazards on site are reportable to CTP management for inclusion in close out reports. Environmental incidents defined under Section 14 of the *Waste Management and Pollution Control Act* will be reported as soon as possible (at most within 24 hours) to the regulator.

CTP will adhere to legislative incident reporting requirements including reporting to the DPIR forthwith or as soon as practicable of an incident involving:

- Liquid petroleum spills greater than 300 L (80 L in areas of inland waters);
- Petroleum in a gaseous form greater than 500 m^3; and

Uncontrolled escapes or ignitions of petroleum or any other flammable or combustible materials.

10.8 Emergency Preparedness

CTP's emergency planning includes:

- Emergency response plan, manual and procedures;
- Dedicated trained emergency response personnel;
- Dedicated emergency response vehicles and equipment;
- Emergency simulation training exercises (drills); and
- Preventative maintenance programs.

Types of emergency situations that may arise during PVGF Operations include:

- Spills – chemical or hazardous substance (particularly hydrocarbons and hypersaline water);
- Fire (bushfire or as a result of operations);
- Medical;
- External Communications (E.g. bomb threat).

CTP will ensure all personnel, contractors and visitors are aware of the emergency response framework and are adequately trained in emergency response procedures relevant to their role/position.

CTP's Emergency response plan, manuals and procedures are reviewed and up-dated to incorporate new information arising from incidents, near misses and emergency simulation training sessions.

In addition to this, CTP has a Site-Specific Drilling Safety Management Plan and Emergency Response plan as submitted to the DPIR.

10.9 Communication

Communication and consultation mechanisms undertaken by Central in relation to the proposed appraisal well site are summarised in section 13 and Appendix 11.

10.10 Commitments Table

Environmental commitments for each environmental aspect are detailed in Section 9 and Appendix 8.

11 REPORTING

11.1 Daily Drilling Reports

Central will supplied daily drilling reports in accordance with the Schedule of Onshore Petroleum and Exploration Requirements 2017, Section 334.

11.2 Internal and External Routine Reporting

Activity specific reporting frequency and requirements are detailed in Appendix 8. The reports and registers in Table 11-1 will be maintained and submitted to the DPIR as stipulated for compliance:

Table 11-1. Routine Reporting Frequency

Report	Internally Recorded	Submitted to the DPIR
Environmental Report	Updated monthly – collating all daily, weekly and monthly reports	Annually
Corrective Action Register	As required	Annually
Close-out Reports	As required	Annually
Incident and Contaminated Site Reports	As required	3 months after completion
External Compliance Audit	Annually	Annually

11.3 Incident Reporting

11.3.1 Recordable

External communication and internal incident management and reporting requirements are outlined in Section 11 and Appendix 8.

In accordance with legislative requirements, environmental incidents at PVGF may be reportable to external stakeholders (government, the CLC, non-government organisations, etc.).

All required incident reports should be made formally in writing to external stakeholders with copies sent to applicable CTP managers, with incident details registered into the database.

11.3.2 Palm Valley Gas Field Incidents

Incidents associated with the PVGF are reported in accordance with the requirements of the *Schedule of Onshore Petroleum Exploration and Production Requirements 2003.*

In relation to the environment, the following incident reporting clause is a key requirement:

289 Reporting Escape or Ignition of Petroleum and Other Material

(1) A report shall forthwith be made to an Inspector upon the occurrence of -

(a) a significant spillage of hydrocarbons which in areas of inland waters is in excess of 80 litres, in other areas is in excess of 300 litres and if in gaseous form is in excess of 500 m³; or

(b) Any uncontrolled escape or ignition of petroleum or any other flammable or combustible material causing a potentially hazardous situation.

(2) In the event of any occurrence referred to in Sub-Clause (1) a report in writing shall be submitted to the Director as soon as practicable specifying -

(a) The date, time and place of the occurrence;

(b) The estimated quantity of liquid that escaped or burned;

(c) Particulars of any damage caused;

(d) The events as far as they are known or suspected to have caused or contributed to the escape or ignition;

(e) Particulars of methods used to control the escape or ignition;

(f) Particulars of methods used or proposed to be used to repair property damaged; and

(g) Measures taken, or to be taken, to prevent a possible recurrence.

Other clauses under the Schedule should be referred to for reporting requirements in relation to:

- Emergency Response Plans (Part 2, Division 1 Section 203),
- Radiation monitoring (Part 2, Division 1 Section 213), or
- Serious property damage as a result of a potentially hazardous event (Part 2, Division 2 Section 287).

11.3.3 Reportable

Any reportable incident will be notified to the 24/7 Contact Number: Petroleum Duty Officer – Phone 1300 935 250 within 24 hours of a reportable incident as stipulated by the *Schedule of Onshore Petroleum Exploration and Production Requirements 2017* (the Schedule).

11.4 Emissions and Discharge Reporting

Greenhouse gas emission reporting under the *National Greenhouse and Energy Reporting Act 2007.* Any unauthorised discharges or emissions would constitute a recordable or reportable incident as per Section 11.3 of this EMP.

12 REHABILITATION MANAGEMENT PLAN

12.1 Scope

Limited to disturbances caused by the proposed appraisal well site operations.

12.2 Objectives

To ensure that all disturbed areas no longer required for safe operation of the proposed well site is returned to, as close as possible, the pre-exiting environmental condition.

12.3 Environmental Actions and Monitoring

Environmental audits required at the following frequency:

During operations

- Topsoil stockpiles stored around the edge of the well site lease in low profile mounds (<2m), on the upslope side if terrain is sloped
- Vegetation stockpiles stored separately in low profile mounds (<2m)
- Erosion and sediment control devices installed in accordance with DLRM and IECA best practice principles and guidelines
- All waste stored in accordance with Appendix 10
- Weed management measure in place in accordance with Appendix 13

Directly after cessation of drilling operation and rehabilitation

- Any imported material is removed (if no longer required)
- Hardstands deep ripped (if no longer required)
- Topsoil evenly respread over any cleared area no longer required for safe operation
- Vegetation stockpiles respread
- Surface lightly scarified
- No new weeds or invasive species
- Temporary erosion and sediment devices installed where required in accordance with IECA and DLRM best practice principles and guidelines to ensure soil stability
- No wastes or infrastructure remaining
- Mud sump, flare pit and water storage filled in if no longer required
- If required, well head removed and well P&A in accordance with industry best practice

Following first wet season

- No erosion or sedimentation occurring
- No new weeds or invasive species
- Establishment of vegetation

One year after rehabilitation

- No erosion or sedimentation occurring
- No new weeds or invasive species
- Establishment of vegetation

12.4 Reporting

Results of audits specified in Table 10-1 in relation to rehabilitation will be supplied to the DPIR with information on any corrective actions taken if required.

13 STAKEHOLDER CONSULTATION

13.1 NT Government Approval

Central has sought all required NT government approvals and will supply copies of all relevant approvals to the DPIR before any on ground work commences.

13.2 Approvals Process

Drilling activities at the proposed well site PV-13 in the PVGF area are undergoing approvals process as required under the Schedule. As such additional project-specific information has been provided to the DPIR and approvals are being sought.

13.3 Commonwealth Approval

It has been determined that the drilling activities at the proposed well site PV-13 is unlikely to cause a significant impact on any listed threatened species or ecological communities and therefore the *EPBC Act* will not be triggered. No other matters of national environmental significance as defined under the *EPBC Act* were identified within a 20km buffer of the proposed well site PV-13 area and therefore the *EPBC Act* will not be triggered.

13.4 Traditional Owner Approvals

Approval from TO's has been sought and received by Central for the drilling activities at the proposed well site PV-13 as per the requirement detailed under Clause 5.2 and Clause 5.3 of the Mereenie Agreement (2003). All communications with TO's in relation to the proposed developments can be found in the communication log in Appendix 6.

13.5 Stakeholder Management

Central is actively engaged with all stakeholders for the OL3 area under the conditions as outlined in the Appendix 11.

13.6 Stakeholder Approvals

Central has sought and gained approval from the CLC and Haasts Bluff Aboriginal Trust. Communication with stakeholders can be found in the communication log in Appendix 6.

13.7 Communication Log

A communication log similar to the one in Appendix 6 will be maintained detailing all stakeholder consultations for the proposed well site.

13.8 Written Responses from Stakeholders

All written responses from stakeholders will be maintained in the communication log.

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15 APPENDICES

15.1 Appendix 1. Disposal of drilling muds

Low Ecological Services P/L
Grouped with WA Low Ecological Services
ABN 55 064 311 502
PO Box 3130, Alice Springs, NT 0871, Australia
25 Isotoma Rd, Connellan, NT 0873
Phone: (08) 89 555 222
Email: LowEcol@LowEcol.com.au Web: www.LowEcol.com.au

Central Petroleum LTD.,
Level 7/369 Ann Street, Brisbane, QLD 4000
PO Box 292 Brisbane, Qld 4001

Attention; James van Rooyen,

Re: disposal of drilling muds and water in drilling sump – PV13

Early gas wells at Palm Valley Gas Field used unlined sumps while some wells drilled after PV8 in the early 1990s, were drilled using lined sumps to contain the water in the mud. These wells were lined due to their proximity to the National Park.

PV13 will use steel tanks to contain and recycle water and additives (drilling mud) and separate from the cuttings and cuttings will be put into the sump. At the conclusion of drilling, the drilling muds will be dumped into the tailings sump and allowed to dry before being buried. The Hermannsburg Sandstone substrate will absorb some of the water and contained salts. Assessment of vegetation recovery at the PV wells over the lined and unlined sump areas indicates slow revegetation is occurring on all well sites and the salts from the drilling muds are not presenting re-growth issues.

During the drilling of PV13, drilling with muds may be done for about half of the drilling operation to assist with removal of cuttings from the lower half of the vertical well bore. The operation using mud will pass the recovered fluid through tanks and shale shakers in order to separate cuttings and fluid so the fluid can be recirculated. Cuttings will be discharged to the sump.

The following calculated amount of additives used in the muds has been determined by RMN Drilling Fluids and AMC Drilling Fluids using a realistic assessment based on known geological structures through which drilling will take place.

At the conclusion of the drilling operation, all of the remnant mud and cuttings will be disposed of in the mud sump.

Quantity of additives to be used in the mud is shown in the table below.

The total of additives, in a rough estimate, would add 1.2 cm of other material to the calculated 1.6 cm of KCl (4800kg) which will be used if the additives were to be allowed to form a distinct layer in the 2500 cm (2.5m) deep sump. If 1/2 of the 1000 bbls of cuttings raised by the mud (say 79,500L or 79.5 m^3) for the total drill hole, mixing of cuttings and muds will result is about 2m of fill in the 290 m^2 sump bulldozed as a basin into the Hermannsburg Sandstone. This would allow the 2.5m of sandstone subsoil removed from the sump to be spread over the top (with 10cm of top soil, which had been bulldozed off the surface, to be placed on top), after the sump has been allowed dry, in a mound over a meter higher than surrounding ground level. This would reduce potential for water to run into the buried sump thus slowing the rate of leaching of leachable salts into the sandstone substrate or overflowing (and fertilising) the surrounding area. The bentonite and polypropylene fibres will slow the natural permeability of the sandstone to allow a slower leaching and dispersion of the low level of salts. There is no water table accessible under the complex geology and a consequent very low risk of contamination of the already slightly saline adjacent soils or the fresh water in the Mereenie aquifer over 730m below the sump.

The amount of mud additives expected to be used is shown in table 1 along with:

- The toxicity
- The description/composition of the chemical
- Effect on the environment short term (while drying) and long term (when disposed and buried in sandstone pit 2.5m below ground level) is not expected to be different. To avoid large animal (horse, camel) use of the moist soil in the pit, the pit should be securely fenced.
- Other comments. e.g. estimate chemical residual before dumping into the sump, estimate time of biodegradation or oxidation, use of biodegradation enhancers, what could limit the degradation, worse contamination scenario, rehabilitation)

Chemical composition and break down of materials left to dry in the sump pit during spreading and drying is shown in Table 1 of impacts below. In most cases the materials biodegrade to inert material and only the salts (mainly KCl which is a fertiliser) and polypropylene fibres will remain as potentially low impact but will be unavailable buried under 2m of clean spoil.

Table. Additives in drilling muds showing concentration and quantity in realistic final volume of fluids, biodegrability, possible toxicity, effects on environment (Calculations from RMN Drilling Fluids and AMC Drilling Fluids). Mud volume at conclusion will be 958bbls (152,322L)

Product	Final Concentration	Biodegradability in accordance with OECD test 301 TG D	Total Weight of Additives in Final Volume	Toxicity	Description of the chemicals/additives	Effect on the environment	Comments
AMC Biocide G	0.24 ppb	Readily biodegradable, > 60% ThOD removal within 28 days	104 kg	Fish (96 hours) LC50: >250mg/L Crustacea (48 hours) EC50: >40mg/L	Tetrakis (hydroxymethyl) phosphonium sulfate	Low risk	Nil
AMC Pac LV	1.77 ppb	Inherently biodegradable, 20 - 60% ThOD removal within 28 days	769 kg	Oral LD50: 27000mg / kg (rat) Dermal LD50: >2000mg / kg (rabbit) >5800mg / m^3 / 4H (rat)	Cellulose	Low risk	Nil
AMC Xtra-Sweep	0.02 ppb	Not biodegradable	9 kg	No Data available	Polypropylene	Low risk	See note 4 below
Aus-Ben A	1.5 ppb	Inorganic, not biodegradable	654 kg	Rat (oral) LD50: 5,000mg / kg Fish (96hours) LC50: 10,000mg / L	Bentonite	Low risk	See note 3 below
AMC Shalehib Ultra	2.0 ppb	Inherently biodegradable, 20 - 60% ThOD removal within 28 days	759 kg	Daphnia magna LC50: >25,000mg/L	Polyamine / potassium salt of organic acid	Low risk	See note 5 below
Caustic Soda	Negligible ppb	Inorganic, not biodegradable	0.04 kg	Fish (96 hours) LC50: 125mg / L	Sodium Hydroxide	Low risk	See note 1 below

Potassium Chloride	11.0 ppb	Inorganic, not biodegradable	4797 kg	Rat (oral) LD50: 2,600mg / kg Fish (96 hours) LC50: 880mg / L Crustacea (48 hours) EC50: >140mg / L Algae (96 hours) EC50: >1,200mg / L	Potassium Chloride	Low risk	Will form a layer in the bottom of the sump about 16mm thick if unmixed with other materials. If 1/2 of cuttings will be removed with mud, mixing of cuttings and muds will result is about 2m of fill in the sump. See note 6 below
Sodium Sulphite	0.06 ppb	Inorganic, not biodegradable	26 kg	Rat (oral) LD50: >2,100mg / kg	Sodium Sulphite	Low risk	See note 2 below
Xan-Bore	2.01 ppb	Readily biodegradable> 60% ThOD removal within 28 days	873 kg	Rat (oral) LD50: >5,000mg / kg	Xanthan Gum	Low risk	Nil
Residrill	5 ppb	Inherently biodegradable, 20 - 60% ThOD removal within 28 days	2173 kg	No specific data is available on the ecological effects of AMC RESI DRILL, however given it is a natural, cellulose based product it is not expected to pose Eco toxicological issues.	Cellulose	Low risk	Nil

Note 1
Assuming final pH of 9.0, the concentration of Hydroxyl Ion (OH^-) is 0.1 mg/l.
That is equivalent to 0.036 kg of NaOH in the final system.
(Atomic Weights:

Sodium	22.997
Oxygen	16.0
Hydrogen	1.008)

Note 2
Will assume we have 100 mg/l sulphites left in the mud.
That is equivalent to:
25,043 mg/bbl, or
25 grams/bbl, or
23,950 grams/958 bbls?
~24 kg in the entire system

Therefore, there would be a total 24 kg of Sodium Sulphite remaining in the system.

However, note that the by-products of the sulphite reaction with oxygen would likely still remain as Sulphate in the system, which we do not measure.
(Atomic Weights:

Sodium	22.997
Oxygen	16.0
Sulphur	32.06)

Note 3
Bentonite will help form a filter cake and Resdrill's chemistry also binds up clays, so I am making an estimation that only 50% will remain in the mud system before dumping.

Note 4
It is more likely the product (AMC Xtra-Sweep) will be used for hole cleaning purposes when and if losses occur downhole, as it becomes a highly effective LCM, and as such, I am estimating that only a third of the product will return to surface. Note that this product is cleared from the mud with the shale shakers, so unless cuttings are skipped way, this portion will still end up in the sump.

Note 5
AMC Shalehib Ultra was designed especially as an inhibitor for non-chloride muds. It will be used at ~7.5 ppb (2% by volume) but by the time is dumped will assume depletion to 2 ppb, perhaps more.

Note 6

The World Health Organization (W
HO) identifies KCl as non-toxic in common environmental background concentrations. It is an important soil fertiliser for commercial plant growth and average soils from sedimentary rocks contain about 25g/kg (0.25%). Although Potassium Chloride (KCl) is toxic at high concentrations it is non bio-accumulating. Dilution of the muds by mixing with the cuttings will reduce risk and covering of the cuttings and salts after drying will allow slow leaching to the surrounding environment; minimising the potential impacts.

Using the calculated amount of KCL that would be used under realistic operations would result in 15.6mm thick of material in the bottom of the 29m x 10m x 2.5m sump if unmixed with other materials. The total of other additives, in rough estimate, would add another 13mm of material. If 1/2 of the 1000 bbls, say 79500 L or 79.5 m^3, of cuttings will be removed with mud, mixing of cuttings and muds will result is about 2m of fill in the 2.5 m deep sump when dried. This would allow the 2.5m of subsoil removed from the sump to be spread over the top in a mound well over a meter above ground surface level and 1.5m over the sump muds and cuttings, which would reduce potential for water to run into the buried sump thus slowing the rate of leaching of leachable salts into the substrate. The sump will be constructed in the Hermannsburg Sandstone, essentially forming a basin in the sandstone. The bentonite and polypropylene fibres will effectively clog the pores in the sandstone, slowing the permeability of the sandstone to allow a slow leaching and dispersion of the low level of salts. There is no water table to become contaminated and the slow leaching to surface run-off will result in a very low risk of contamination of the naturally saline environment.

Yours sincerely,

Bill Low,
Senior consultant and Director
June 26, 2018

15.2 Appendix 2. EPBC Protected Matters Search Tool (PMST) Report produced for the proposed well site with a 20km buffer.

Australian Government
Department of the Environment and Energy

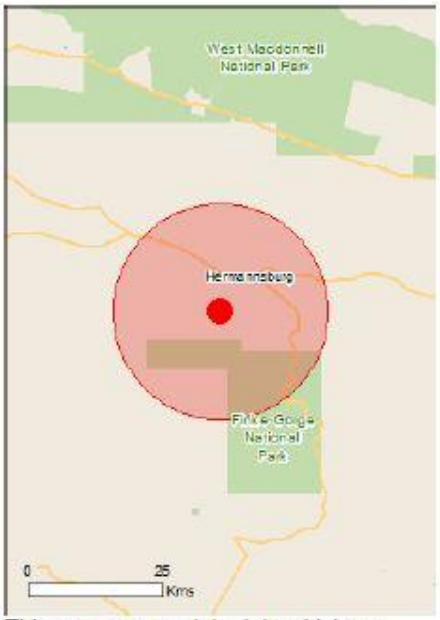
EPBC Act Protected Matters Report

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

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

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

Report created: 07/12/17 14:56:21



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Coordinates
Buffer: 20.0Km

Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	1
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	15
Listed Migratory Species:	10

Other Matters Protected by the EPBC Act

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

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

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

Extra Information

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

State and Territory Reserves:	1
Regional Forest Agreements:	None
Invasive Species:	13
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

National Heritage Properties		[Resource Information]
Name	State	Status
Indigenous		
Hermannsburg Historic Precinct	NT	Listed place

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat known to occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Polytelis alexandrae Princess Parrot, Alexandra's Parrot [758]	Vulnerable	Species or species habitat known to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Insects		
Croitana aestiva Desert Sand-skipper, Aestiva Skipper [26238]	Endangered	Species or species habitat likely to occur within area
Mammals		
Dasycercus cristicauda Crest-tailed Mulgara [328]	Vulnerable	Species or species habitat likely to occur within area
Macrotis lagotis Greater Bilby [282]	Vulnerable	Species or species habitat likely to occur within area
Petrogale lateralis MacDonnell Ranges race Warru, Black-footed Rock-wallaby (MacDonnell Ranges race) [66649]	Vulnerable	Species or species habitat known to occur within area
Zyzomys pedunculatus Central Rock-rat, Antina [68]	Endangered	Species or species habitat may occur within area
Plants		
Livistona mariae subsp. mariae Central Australian Cabbage Palm, Red Cabbage Palm [64929]	Vulnerable	Species or species habitat known to occur within area

Name	Status	Type of Presence
Macrozamia macdonnellii		
MacDonnell Ranges Cycad [11843]	Vulnerable	Species or species habitat known to occur within area
Minuria tridens		
Minnie Daisy [13753]	Vulnerable	Species or species habitat known to occur within area
Thryptomene wittweri		
Mountain Thryptomene [16645]	Vulnerable	Species or species habitat likely to occur within area
Reptiles		
Liopholis slateri slateri		
Slater's Skink, Floodplain Skink [83163]	Endangered	Species or species habitat known to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Motacilla cinerea		
Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius veredus		
Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum		
Oriental Pratincole [840]		Species or species habitat may occur within area
Pandion haliaetus		
Osprey [952]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Finke Gorge	NT

Invasive Species	[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Camelus dromedarius Dromedary, Camel [7]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		

Name	Status	Type of Presence
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Prosopis spp. Mesquite, Algaroba [68407]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area

Caveat

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

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

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

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

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

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

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

- migratory and
- marine

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

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

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

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

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

Coordinates

-23.99694 132.72917

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.

15.3 Appendix 3. Assessment of Likelihood of Occurrence of TPWC/EPBC listed fauna species identified by the NT Fauna Atlas and/or EPBC PMST report within 20km of proposed well site.

Mammal species of conservation significance

The likelihood of occurrence of the 20 EPBC or TPWC listed threatened mammals identified in the desktop assessment, is presented below. Likelihood of occurrence is determined based on habitat characteristics preferred by each species, existing habitat within the proposed well site area and proximity to nearest records.

Crest-tailed mulgara (*Dasycercus cristicauda*)

The crest-tailed mulgara occurs in sand dune habitats, and is predominantly found on the slopes and crests of dunes with *Zygochloa paradoxa* and *Triodia spp.* vegetation.

As the proposed well site is situation on a rocky plateau in the Kirchauff Ranges, suitable habitat for the species is not present within the project area. The species has a low likelihood of occurrence.

Greater Bilby (*Macrotis lagotis*)

The greater bilby occurs in a wide variety of habitats that can be classified into three major groups; sparse grassland/forbland on uplands and hills with a low fire frequency, mulga scrub/woodlands on ridges and rises with an infrequent (20-50 year) fire interval and hummock grassland mixed shrub or woodland steppe on plains and alluvial areas with a high (4-10 year) fire frequency (Southgate, 1990).

None of these habitat types occur within the proposed wel site and there is therefore a low likelihood of the species occurring on site.

Black-footed rock-wallaby (*Petrogale lateralis MacDonnell Ranges race*)

The distribution of the black-footed rock-wallaby spans from the Davenport and Murchison Ranges in the north, east to the Jervois Range, west to the WA border and south to the SA border (Pavey, 2006b). The species is also present in the Gibson Desert of WA and in the Anangu Pitjatjantjara land of northern SA (Pavey, 2006b). Habitat preferences of the black-footed rock-wallaby appears to be steep slopes, cuestas, deep gorges and boulder scree slopes, which are common in quartzite ranges where the majority of the species records are from (Gibson, 2000).

There are nearly 300 records of the species within 20km of the proposed well site and the species is known to occur within PVGF. The 2012 survey of site PV-12 conducted by Low & Carpenter found signs of black-footed rock wallaby (scats) adjacent to the site. There is therefore a high likelihood of the species occurring within the proposed well site.

Common brushtail possum (*Trichosurus vulpecula vulpecula*)

The common brushtail possum (subspecies *T.v.vulpecula*) occurs in isolated populations in southern NT, with the West MacDonnell National Park a known stronghold of the species. Prior to European settlement the species spanned extensively across the Northern Territory, with the most extreme phase of decline recorded in the 1940s and local extinctions continuing through until the early 2000s (Pavey & Ward, 2012). The species predominantly occupies riverine habitat that is close to rocky outcrops and most gullies within the ranges or rocky slopes (Pavey & Ward, 2012). The presence of caves, rock holes and tree hollows for shelter are characteristic of habitat areas.

The proposed well site is located at an elevated location in the Krichauff Ranges. Suitable habitat for the common brushtail possum occurs at creek level and in the surrounding foothills in the gorges and crevices of the ranges surrounding the proposed well site. There is potential for run-off from the site to affect the species habitat however it is unlikely the species will occur directly within the proposed appraisal well site. Potential impacts on species habitat and proposed mitigation measures are presented in Section 8 and Section 10 of this report.

Central Rock-rat (*Zyzomus pedunculatus)*

The central rock-rat is endemic to the Southern NT. No records of the species were obtained between 1970 and 1995 however the species was rediscovered in the MacDonnell Ranges in 1996 where it was recorded at 14 sites in the MacDonnell Ranges. Habitats within these areas typically include tussock and hummock grasslands and low open woodland; on ridge tops, cliffs, scree slopes, hills and valley floors. All sites where rock-rate have been located in 2010-2011 have been on high-altitude (>1200m Above Sea Level) rugged quartzite peaks.

Whilst a suitable habitat for the central rock-rat exists within the proposed well site area, the site is outside the known current range of the species, thought to be restricted solely to the MacDonnell Ranges. It is therefore considered a very low likelihood that the species will reside in the proposed well site area.

Bird species of conservation significance

Curlew sandpiper (*Calidris ferruginea*)

The curlew sandpiper inhabits intertidal mudflats in sheltered coastal areas such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast and ponds in salt works and sewage farms. Inland sightings have been reported from around ephemeral lakes, dams, waterholes and bore drains, usually with bare areas of mud or sand (Ward, 2012).

No suitable habitat for this species occurs within the proposd well site area therefore there is a low likelihood of occurrence.

Red Goshawk (*Erythrotriorchis radiatus*)

The red goshawk is a large reddish-brown hawk with conspicuous dark streaks from chin to belly and barring on the underwing and tail (Woinarski, 2006). It is listed as vulnerable under the TPWC Act and EPBC Act. The red goshawk occurs across much of northern Australia where it generally occupies tall open eucalypt forest and riparian areas characteristic of higher rainfall areas (Woinarski, 2006).

The proposed well site is located within a sparsely vegetated landform with no large trees. Given the lack of suitable habitat within the proposed well site area, the likelihood of the species occurring is considered low.

Night parrot (*Pezoporus occidentalis*)

Night parrots are restricted to arid and semi-arid Australia. The distribution of the night parrot has not been well documented but late 19th and early 20th century records are known from northern WA, SA, New South Wales and western QLD (Pavey, 2006b). Records of the night parrot are primarily from spinifex (*Triodia* sp.) hummock grasslands in stony or sandy areas and chenopod shrublands on floodplains, salt lakes and claypans, likely being more common in the former (Pavey, 2006b; Pyke & Ehrlich, 2014).

No suitable habitat for this species occurs within the proposed well site area therefore there is a low likelihood of occurrence.

Princess parrot (*Polytelis alexandrae*)

The princess parrot has a patchy and irregular distribution in the arid zone of WA, NT and SA (Pavey, 2006c; Pavey, et al., 2014). Within the NT, the species has been recorded from the southern Tanami in the north, south to Yulara and Angas Downs and east to Alice Springs (Pavey, 2006c). The exact distribution within the NT range is unclear as records are irregular and patchy, and there may be long intervals (up to 20 years) between them (Pavey, 2006c). The princess parrot has been recorded from sandplain environments with vegetation characterised by *Eremophila, Grevillea* and *Hakea* shrubs with scattered trees and less frequently in riverine forest, woodland and shrubland habitats (Pavey, 2006c).

No suitable habitat for this species occurs within the proposed well site area therefore there is a low likelihood of occurrence.

Australian Painted Snipe (*Rostratula australis*)

The Australian painted snipe is a wading bird that is found throughout Australia, though mostly recorded in south-east Australia (Taylor, et al., 2013). In the NT the species have been recorded in the Barkly Tablelands, but may also occur on any shallow ephemeral wetlands in central or southern NT (Taylor, et al., 2013). The species inhabits shallow, vegetated, freshwater swamps, claypans or inundated grassland (Taylor, et al., 2013). There are no sites where they are known to be resident or even regular in occurrence, suggesting the species may be nomadic.

No suitable habitat for this species occurs within the proposed well site area therefore there is a low likelihood of occurrence.

Reptile species of conservation significance

Slater's skink (*Liopholis slateri slateri*)

Slater's skink includes two subspecies, L. slateri in southern NT and L. slateri virgata in northern SA (McDonald, 2012a). The southern subspecies has been recorded from the Finke and MacDonnell Ranges bioregions where it occurs on plains in the valleys of major drainages (Pavey, 2004). At most sites, Slater's skink inhabits shrubland and open shrubland on alluvial soils close to drainage lines (McDonald, 2012a). The species has also been recorded in an isolated dune supporting shrubland, low rolling calcareous rises with 60% spinifex cover, and on an elevated, narrow, rocky creek-line (Pavey, 2004).

No suitable habitat for this species occurs within the proposed well site area therefore there is a low likelihood of occurrence**.**

Invertebrate species of conservation significance

Desert Sand Skipper (*Croitana aestiva*)

The desert sand-skipper is a butterfly endemic to southern NT, known only from a 1400 km_2 area in the West MacDonnell Ranges as far west as Mt Liebig, 260 km west of Alice Springs (Palmer, et al., 2012). The distribution of butterflies is determined to a large extent by the distribution of the larval food plant; grass *Neurachne tenuifolia* which is restricted to the West MacDonnell Ranges and continuously through the Chewings and Heavitree Ranges.

There are no records of the desert sand-skipper within 20km of the proposed well site area. A search of the NT Flora Atlas also revealed no records of the grass *Neurachne tenuifolia* within 20km of proposed well site. As the proposed well site is outside the MacDonnell, Chewings and Heavitree

Ranges and there are no records of the larval food plant, there is considered a low likelihood the species will occur in the proposed well site area.

Land snail species including *Basedowena squamulosa, Bothriembryon spenceri, Divellomelon hillieri, Granulomelon arcigerens, Semotrachia elleryi, Semotrachia esau* and *Semotrachia euzyga*

Three of the land snail species (*Granulomelon arcigerens, Semotrachia elleryi* and *Semotrachia euzyga*) are considered highly restricted in range and known only from areas within the Finke River Gorge, West MacDonnell National Park, Todd River and nearby Choritza Hill and Mt Gillen areas. As the proposed well site is outside these areas, there is a low likelihood that these species will occur at the proposed well site.

Four of the land snail species (*Basedowena squamulose, Bothriembryon spenceri, Divellomelon hillieri* and *Semotrachia esau*) are considered restricted in range to the Krichauff Ranges with the range of some species extending to the nearby Chewings and James Ranges. Within these locations, species are typically associated with leaf litter under fig trees however may be located in other vegetated cracks and sheltered crevices in rocky cliffs and slopes. There is a low/moderate likelihood that these species could occur in the proposed well site area.

15.4 Appendix 4. Flora recorded during 2015 survey of sites proposed PV-12, PV-7, adjacent creek line and an undisturbed control site.

Family	Scientific Name	Common Name	Status (TPWC)	Site
Amaranthaceae	*Ptilotus scwartzii*	Horse mulla mulla	LC	PV12
Asteraceae	*Olearia ferresii*	Daisy bush	LC	PV7, Creek
	Ozothamnus kempei	Daisy	LC	Creek
	Streptoglossa sp.	Daisy	-	PV7
Boraginaceae	*Halgania cyanea*	Rough halgania	LC	PV12
Capparaceae	*Capparis spinosa*	Native passion fruit	LC	PV7
Cupressaceae	*Callitris glaucophylla*	Native pine	LC	Creek
Fabaceae	*Acacia anerua var Holey Trunk*	Holey trunk mulga	LC	PV7
	Acacia aneura	Mulga	LC	Control
	Acacia basedowii	Basedow's wattle	LC	PV12, PV7
	Acacia kempeana	Witchetty bush	LC	PV12, Control, PV7, Creek
	Acacia macdonnelliensis	Hill mulga	LC	Control, PV7, Creek
	Acacia melleodora	Waxy wattle	LC	PV12, Creek
	Acacia minyura	Desert mulga	LC	PV12
	Gastrolobium brevipes	Hill wallflower poison bush	LC	PV12
	Indigofera georgei	Georges indigo	LC	Creek
	Petalostylis cassioides	Butterfly bush	LC	Control
	Senna art. Ssp. Artemisioides	Silver cassia	LC	PV12, Control, PV7, Creek
Goodeniaceae	*Goodenia sp*		-	Creek
	Scaevola spinescens	Spiny fan flower	LC	PV12, Control, PV7
Malvaceae	*Commersonia magniflora (previously Rulingia)*	Pink fire bush	LC	PV7
Myrtaceae	*Corymbia eremaea*	Hills bloodwood	LC	PV12, Control
	Eucalyptus gillenii	MacDonnell Range red gum	LC	Creek
	Eucalyptus lucens	Shiny-leaved mallee	NT	Control
	Eucalyptus sessilis	Finke River mallee	LC	PV12, PV7, Creek

Family	Scientific Name	Common Name	Status (TPWC)	Site
	Eucalyptus trivalvis	Victoria Spring mallee	LC	PV12, PV7, Creek
Poaceae	*Aristida holathera*	Erect kerosene grass	LC	Creek
	Aristida inaequiglumis	Unequal three-awn grass	LC	PV7
	Cenchrus ciliaris	Buffel grass	Int	PV7, Creek
	Cymbopogon obtectus	Lemon scented grass	LC	PV7, Creek
	Digitaria brownii	Cotton panic grass	LC	Creek
	Eragrostis eriopoda	Three-awn wanderrie	LC	PV12, Control
	Eriachne mucronata	Mountain wanderrie	LC	PV12, Control, PV7, Creek
	Triodia brizoides	Hillside spinifex	LC	PV12, Control, PV7, Creek
	Triodia melvillei	Soft Spinifex	LC	PV12, Control, PV7, Creek
Proteaceae	*Grevillea wickhamii*	Holly-leaf grevillea	LC	PV12, Creek
	Hakea divaricata	Fork-leaved corkwood	LC	PV12
	Hakea leucoptera	Needlewood	LC	PV7
Rhamnaceae	*Stenanthemum centrale*		NT	PV12, Control, Creek
Rubiaceae	*Psydrax latifolia*	Native currant	LC	Control, Creek
Santalaceae	*Santalum lanceolatum*	Plum bush	LC	Creek
Sapindaceae	*Dodoneae sp*	Sticky hopbush	LC	Control
Scrophulariaceae	*Eremophila goodwinii*	Purple fuchsia bush	LC	Control, PV7, Creek
	Eremophila latrobei	Harlequin fuchsia	LC	Control, Creek
Solanaceae	*Solanum quadriloculatum*	Bush tomato	LC	PV7, Creek

*TPWC Status: LC – Least Concern, NT – Near Threatened, Int - Introduced

15.5 Appendix 5. Fauna recorded during 2015 flora and fauna survey of sites proposed PV-12, PV-7, adjacent creek line and a control site.

Scientific name	Common name	Location	Status (TPWC)*
Mammals			
Canis lupus	Dingo	PV-12	LC
Macropus robustus	Euro	PV-12	LC
Oryctolagus cuniculus	Rabbit	PV-12	Int
Pseudomys hermannsburgensis	Sandy Inland Mouse	Creek	LC
Reptiles			
Ctenophorus caudicinctus	Ring-tailed Dragon	PV-12	LC
Ctenotus pantherinus	Leopard Skink	PV-12	LC
Varanus sp.	Goanna	PV-12, PV7	-
Birds			
Acanthagenys rufogularis	Spiny-cheeked honeyeater	PV-12	LC
Acanthiza species	Thornbill	PV-12, Control, PV-7	-
Corvus species	Raven	PV-12, Creek	-
Dicaeum hirundinaceum	Mistletoe bird	PV-7	LC
Lichenostomus keartlandi	Grey-headed honeyeater	Creek	LC
Lichenostomus virescens	Singing honeyeater	Creel	LC
Malurus lamberti	Variegated fairy wren	Creek	LC
Malurus species	Fairy wren	Control	-
Oreoica gutturalis	Crested bellbird	PV-12	LC

* TPWC Status: LC – Least Concern, Int - Introduced

15.6 Appendix 6. Communications Log for all communication with relevant Traditional Owners regarding proposed well site

COMMUNICATION LOG (Palm Valley)					
Date	**Topic**	**Type of engagement (e.g. email)**	**CP contact**	**Stakeholder**	**Outcomes**
20/06/2017	Fire on the rangers behind PV Plant	Phone call	Deidre White (on behalf of Paul Mc Clelland)	Tjuwampa Ranger	Fire on the other range visible from PV plant. Rangers notified of Helicoptor control burn. (No issue)
May 2017	Hermannsburg sports sponsorship	Phone call/email/face to face	David Liddle	Ngurratjuta/Conrad Ratara	Sponsorship didn't go ahead.
Apr-17	Hermannsburg/Ntaria school uniforms	Phone/email/on-site visit	David Liddle	Ntaria School	Gave donated sports shirts from St Hilda's College in Brisbane to Ntaria School. Discussed future exhange between St Hildas and Ntaria School.
20/10/2017	Proposed 1 well program. PV 13	notifcation (via Email)	James van Rooyen	CLC / Traditional Owners	Proposedd work scope, well location and maps sent to CLC / tradtional ownders as preparation for the LCM submitted to the CLC.
23/10/2017	Central Petroleum, CLC and Tradtional owners stakeholder meeting (Liaison Committee meeting - LCM)	Site visit held at Palm Valley	Mike Herrington, Rolf Schulte	CLC, Conrad Ratara (Recognised T/O Elder) and representatives from Hernammsberg T/O stakeholders	Formal yearly meeting held betweent he traditional owners, the CLC and Central Petroleum. The past years operations were discussed and the future years operations planned. Maps and details of the new well PV 13 were reviwed and discussed with them at this point. T/O's took the maps and walked the proposed new well location. Initial verbal approvals granted.
23/10/2017	Central Petroleum, CLC and Tradtional owners stakeholder meeting (Liaison Committee meeting)	Site visit held at Palm Valley	Mike Herrington, Rolf Schulte	CLC, Conrad Ratara (Recognised T/O Elder) and representatives from Hernammsberg T/O stakeholders	Formal yearly meeting held betweent he traditional owners, the CLC and Central Petroleum. The past years operations were discussed and the future years operations planned. Maps and details of the new well PV 13 were reviwed and discussed with them at this point. T/O's took the maps and walked the proposed new well location. Initial verbal approvals granted.
24/10/2017	Proposed 1 well program. PV 13	Formal Sacred Site Application (via Email)	James van Rooyen	CLC / Traditional Owners	Proposed work scope, well locations and formal Sacred Site Clearance applied for throught the CLC for the PV 13 well submitted to the CLC.
7/12/2017	Proposed 1 well program. PV 13	Formal Sacred Site Approval letter	James van Rooyen	CLC / Traditional Owners	Proposed work scope, well locations and formal Sacred Site Clearance letter of approval granted for the PV 13 site.

15.7 Appendix 7. Temporary Drilling Camp Sewage treatment discharge specifications.

The unit supplied complies with Australian Standard number AS/NZS 1546.1:2008 as specified below

Suncoast Waste Water Management Pty Ltd
Head Office
59 Industrial Ave
KUNDA PARK. Qld 4556
ABN: 62 063 770 534
Ph: 07 5450 4000
Fax: 07 5450 4677
Email: info@ozzikleen.com

Manufacturers of: OZZI KLEEN Waste Water Systems

OZZI KLEEN EFFLUENT STANDARDS

Typical Raw Sewage Standard	
Parameter	**Sewage Characteristics**
Wastewater hydraulic flow convention	EP (equivalent persons) rated at 200 L/person/day)
BODs	350 mg/litre or 70 g/day/person
Suspended Solids	350 mg/litre or 70 g/day/person
Total Nitrogen	75 mg/litre or 15 g/day/person
Total Phosphorous	12.5 mg/litre or 2.5 g/day/person
Total grease and oils	75 mg/litre For restaurant applications, a grease trap must be fitted upstream of the treatment plant to remove grease and oils.
pH	6 ≤ pH ≤ 8.5
Wastewater temperature range	10°C to 40°C

Typical Effluent Standards for Sewage Treatment Plants			
Parameter	**Primary Effluent* Characteristics [mg/litre]**	**Secondary Effluent^ Characteristics [mg/litre]**	**Advanced Secondary# Effluent Characteristics [mg/litre]**
BODs	120 – 140	≤ 20	≤ 10
Suspended Solids	65 – 180	≤ 30	≤ 10
Total Nitrogen	36 – 45	≤ 30	≤ 10
Total Phosphorous	6 – 10	≤ 10	≤ 5
Thermotolerant Coliforms	N/A	≤ 10 colonies per 100 ml (median value)	≤ 10 colonies per 100 ml (median value)
Residual Chlorine	N/A	0.5 ≤ Chlorine ≤ 2.0	0.5 ≤ Chlorine ≤ 2.0

* **Primary effluent** is typical of effluent from a septic tank anaerobic system.
^ **Secondary effluent** is typical of effluent from an aerobic wastewater treatment system.
# **Advanced secondary effluent** is typical of effluent from an aerobic wastewater treatment system with biological nutrient removal.

www.ozzikleen.com *Efficiency, Reliability, Simplicity*

STANDARDSMARK LICENCE

SAI Global hereby grants:

Neatport Pty Ltd

ABN 62 063 770 534

Trading As

Suncoast Waste Water Management

59 Industrial Avenue, Kunda Park, QLD 4556, Australia

StandardsMark Licence

Manufactured to:

AS/NZS 1546.1:2008 - On-site domestic wastewater treatment units - Septic tanks

"the StandardsMark Licensee" the right to use the STANDARDSMARK as shown below only in respect of the goods described and detailed in the Schedule which are produced by the Licensee or on behalf of the Licensee* and which comply with the appropriate Standard referred to above as from time to time amended. The Licence is granted subject to the rules governing the use of the STANDARDSMARK and the Terms and Conditions for certification and licence. The Licensee covenants to comply with all the Rules and Terms and Conditions.

Certificate No:SMKB20032

Issued: 19 September 2017 **Originally Certified: 24 September 2003**

Expires: 23 September 2018 **Current Certification: 19 September 2017**

Nicole Grantham
General Manager SAI Global Certification Services

Certified Product™ Australian Standard

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*** For details of manufacture, refer to the licensee**

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SCHEDULE TO
STANDARDSMARK LICENCE

SAI Global hereby grants:

Neatport Pty Ltd

59 Industrial Avenue, Kunda Park, QLD 4556, Australia

StandardsMark Licence

Manufactured to:

AS/NZS 1546.1:2008 - On-site domestic wastewater treatment units - Septic tanks

Model identification of the goods on which the STANDARDSMARK may be used:

Tank Type	Description	Size	Additional Product Information	Date Endorsed
Collection Well Model – PT4000 - Single Turret	Vertical Axis Type – Cylindrical Tank Roto moulded Polyethylene Certification applies only to the construction of the Collection Well and Access Covers. It does not include the internal fittings.	4000L (nominal; 4150L (actual)	Tank Burial Depth 0 mm; Drawing - Collection Well PT4000 dated08/08/2008. New Rev. Collection Well Single Turret PT4000 dated 23/11/2015.	18 Sep 2017
Collection Well Model – PT4000 - Twin Turret	Vertical Axis Type – Cylindrical Tank Roto moulded polyethylene	4000L (nominal; 4150L (actual)	Tank Burial Depth 0 mm; Drawing - Collection Well PT4000 dated 08/08/2008. New Rev. Collection Well Twin Turret PT4000 dated 23/11/2015.	18 Sep 2017
Collection Well Model – RW5300	Vertical Axis Type – Cylindrical Tank Roto moulded Polyethylene Certification applies only to the construction of the Collection Well and Access Covers. It does not include the internal fittings.	5300L (nominal; 5300L (actual)	Tank Burial Depth 0 mm; Drawing - Collection Well RW5300 dated08/08/2008.	18 Sep 2017
Collection Well Model PT1000 - Flat Base	Vertical Axis Type – Cylindrical Tank Roto moulded polyethylene	1000L (nominal); 1208L (actual)	Tank Burial Depth 0 mm; Drawing - Collection Well Flat Base PT1000 dated23/11/2015. Same tank body mould as PS1000 with flat base.	18 Sep 2017

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This schedule supersedes all previously issued schedules

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Tank Type	Description	Size	Additional Product Information	Date Endorsed
Collection Well Model PT1000 - Hopper Bottom	Vertical Axis Type – Cylindrical Tank Roto moulded polyethylene	1000L (nominal); 1225L (actual)	Tank Burial Depth 0 mm; Drawing - Collection Well Hopper Bottom PT1000 dated23/11/2015. Same tank body mould as PS1000 with hopper bottom.	18 Sep 2017
Collection Well Model PT5300 - Flat Base	Vertical Axis Type – Cylindrical Tank Roto moulded polyethylene	5300L (nominal; 5350L (actual)	Tank Burial Depth 0 mm; Drawing - Collection Well Flat Base PT5300 dated 23/11/2015. Same tank body mould as RW5300 with flat base.	18 Sep 2017
Collection Well Model PT5300 - Hopper Base	Vertical Axis Type – Cylindrical Tank Roto moulded polyethylene	5300L (nominal; 5250L (actual)	Tank Burial Depth 0 mm; Drawing - Collection Well Hopper Base PT5300 dated 23/11/2015. Same tank body mould as RW5300 with hopper base.	18 Sep 2017
Pump Chamber (Holding Tank) Model – PS1000	Vertical Axis Type – Cylindrical Tank Roto moulded Polyethylene Certification applies only to the construction of the Pump Well and Access Covers. It does not include the internal fittings.	1000L (nominal); 1225L (actual)	Tank Burial Depth 0 mm; Drawing - Collection Well PS1000 dated13/12/2013.	18 Sep 2017
Pump Chamber (Holding Tank) Model – PS1500	Vertical Axis Type – Cylindrical Tank, Roto Moulded Polyethylene Certification applies only to the construction of the Holding Tank and Access Covers. It does not include the internal fittings	1500L (nominal); 1640L (actual)	Tank Burial Depth 0 mm; Drawing - Collection Well PS1500 dated13/12/2013.	18 Sep 2017
Pump Chamber (Holding Tank) Model PT1500 - Flat Base	Vertical Axis Type – Cylindrical Tank Roto moulded polyethylene	1500L (nominal); 1735L (actual)	Tank Burial Depth 0 mm; Drawing - Collection Well Flat Base PT1500 dated 23/11/2015. Same tank body mould as PS1500 with flat base.	18 Sep 2017

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Tank Type	Description	Size	Additional Product Information	Date Endorsed
Pump Chamber (Holding Tank) Model PT1500 - Hopper Bottom	Vertical Axis Type – Cylindrical Tank Roto moulded polyethylene	1500L (nominal); 1640L (actual	Tank Burial Depth 0 mm; Drawing - Collection Well Hopper Bottom PT1500 dated 23/11/2015. Same tank body mould as PS1500 with hopper bottom.	18 Sep 2017
Pump Well Model – PT350	Vertical Axis Type – Cylindrical Tank Roto moulded Polyethylene Certification applies only to the construction of the Pump Well and Access Covers. It does not include the internal fittings.	350L (nominal; 350L (actual)	Tank Burial Depth 0 mm; Drawing - Collection Well PT350 dated08/08/2008. New Rev. 23/11/2015.	18 Sep 2017
Pump Well Model - PT500 - Flat Base Model.	Vertical Axis Type – Cylindrical Tank Roto moulded polyethylene	500L (nominal) 663L (actual)	Tank Burial Depth 0 mm; Drawing - Collection Well PT500 dated15/04/2016.	18 Sep 2017
Pump Well Model – PT850	Vertical Axis Type – Cylindrical Tank Roto moulded Polyethylene Certification applies only to the construction of the Pump Well and Access Covers. It does not include the internal fittings.	850L (nominal); 850L (actual)	Tank Burial Depth 0 mm; Drawing - Collection Well PT850 dated16/04/2009. New Rev. 23/11/2015.	18 Sep 2017
Septic Tank - ST10	Vertical Axis Type – Cylindrical Tank Roto moulded polyethylene. Certification applies to the construction of the Septic Tank and Access Covers. It does not include the fittings.	4506 L	Tank Burial Depth 0 mm	5 May 2016
Septic Tank - ST10A	Vertical Axis Type – Cylindrical Tank Roto moulded polyethylene. Certification applies to the construction of the Septic Tank, Baffle and Access Covers. It does not include the fittings.	3876 L Primary; 630 L Secondary	Tank Burial Depth 0 mm	5 May 2016

End of Record

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15.8 Appendix 8. Measurement Criteria

The following tables outlines mitigation, preventative measures and their implementation to reduce the different risks to ALARP in order to meet CTP's management objective and successfully deliver detailed environmental outcomes.

Biodiversity – Flora and fauna

Table 1. Mitigation Measures and Implementation Strategy to meet CTP's Required Environmental Objective and Outcomes for the Biodiversity Management in the OL3 Area

Mitigation Measure / Performance Standard	Measurement Criteria	Implementation Strategy / Procedure	Responsibility	Internal Recording	Internal/External Audits
Zero off road driving	Routine inspection of the OL3 area and well pads to include visual assessment of any off-road driving. Any off-road driving to be reported to the supervisor and investigated.	Journey management Plan (v5)	Superintendent	Records of attendance by all employees	Annual External
No speeding	Zone designated speed limits unless authorised (e.g. emergency)	Journey management Plan (v5)	Superintendent	Records of any off-road driving and corrective action taken	Annual External
No driving at night time unless authorised (e.g. emergency)	All vehicles to remain parked between sunset to sunrise	Health, Safety, Security and Environment Handbook	Superintendent	Records of any no conformance and corrective actions taken	Annual External
No driving under the influence of alcohol, BAC = 0	Random BAC testing to cover all drivers, frequency of at least 4 times per year	Drug and Alcohol Policy	Superintendent	Records of testing results	Annual Internal
Zero fauna fatalities	Fauna fatalities register to be filled in for each incident or near miss and appropriate action taken to reduce potential for further incidents, e.g. speed zone	Health, Safety, Security and Environment Handbook	Superintendent	Fauna fatalities register	Annual External
No fauna access to waste	All waste receptacles to have secure lids to prohibit fauna access or interference	Waste Management Plan	Superintendent	Monthly records of checks	6 Months Internal; Annual External

Mitigation Measure / Performance Standard	Measurement Criteria	Implementation Strategy / Procedure	Responsibility	Internal Recording	Internal/External Audits
No weeds in areas where fill has been used	All fill sourced from approved borrow pits on site; weed free. Routine site inspection to look for emergence of weeds and remove or spray accordingly.	Weed Management Plan	Superintendent	Any fill brought to site to have a weed free certificate	Annual External
No new infestations of weeds	Disturbed areas checked for emergence of weeds, and removed or dealt with in accordance with DENR and WoNS guidelines	Weed Management Plan	Superintendent	Records of six-month checks	Annual External
No spills or leak of hazardous material into surrounding environment	All hazardous waste stored in designated bunded area, with appropriate spill kit and MSDS. Any spill recorded in RCCA for remediation action implementation	Chemical – Hazardous Materials Management Procedure	Superintendent	Map showing location of hazardous waste storage	Annual External
No unauthorised land clearing	Clearance from DPIR, CLC and/or AAPA before any new clearing works undertaken.	Land Disturbance Policy	Superintendent	Records of clearance for any land clearing works	Annual External
No unauthorised third-party access	Travel management plan filled in and submitted to site supervisor before arrival. Visitor to report to camp on arrival. Records of all visitors and staff inducted and compliant with site policies.	Health, Safety, Security and Environment Handbook / Journey management Plan (v5)	Superintendent	Records of all travel management plans. Sign in sheets maintained. Records of inductions show 100% attendance	Annual Internal
All spills or leaks of hazardous material to be remediated	Adequate remediation of spills or leaks in conformance to NEPM 2013 guidelines. RCCA maintained and updated	Chemical – Hazardous Materials Management Procedure	Superintendent	Records showing location; type of spill; cause; amount and remediation effort	Annual External
Scheduled vehicle maintenance and safety checks	As a minimum, all vehicles serviced to vehicle manufacturer specifications and frequency requirements; and Northern Territory Motor Vehicle registry standards. Weekly safety checks	Journey management Plan (v5)	Superintendent	Vehicle log books maintained	Annual Internal

Mitigation Measure / Performance Standard	Measurement Criteria	Implementation Strategy / Procedure	Responsibility	Internal Recording	Internal/External Audits
No feeding of local fauna	Records of all staff inducted and compliant with site policies. Routine observations to record if increased presence of fauna occurring and corrective actions and staff briefing taken.	Health and Safety policy	Superintendent	Records of all staff inductions	Annual Internal
All areas no longer required for safe operation rehabilitated	Commence to rehabilitate disturbed areas within 12 months of decommission. As a minimum rehabilitated surface to: • Be deep ripped if heavily compacted or surface scarified if not; • Surface left rough to encourage water pooling and seed collection; • Run rips or any furrows along the contour; • Whoa-boys or diversion bunds installed in accordance with DENR or IECA guidelines on slopes greater than 3%; and • Final surface profile to match surrounding topography.	Rehabilitation Plan	Superintendent	Records of all areas rehabilitated and works carried out	Annual External

Land and Soil – Erosion and sedimentation

Table 2 Mitigation Measures and Implementation Strategy to meet CTP's Required Environmental Objective and Outcomes for the Land and Soil Management in the OL3 Area

Mitigation Measure / Performance Standard	Measurement Criteria	Implementation Strategy / Procedure	Responsibility	Internal Recording	Internal/External Audits
No unauthorised clearing	Clearance from DPIR, CLC and/or AAPA before any new clearing works undertaken.	Land Disturbance Policy	Superintendent	Records showing third party approval to clear	Annual External
Location of top soil mounds clearly marked and less than 1.5m high	Top soil stored in low profile mounds (<1.5m) and irrigated if stored for more than six months	Land Disturbance Policy	Superintendent	Records to indicate location of top soil mounds and planned long term management	Annual External
Zero off road driving	Routine inspection of the OL3 area and well pads to include visual assessment of any off-road driving. Any off-road driving to be reported to the supervisor and investigated.	Journey management Plan (v5)	Superintendent	Records of any incidents and details of corrective actions taken	Annual External
No unauthorised third-party access.	Travel management plan filled in and submitted to site supervisor before arrival. Visitor to report to camp on arrival. Records of all visitors and staff inducted and compliant into site policies.	Health, Safety, Security and Environment Handbook	Superintendent	Records of all travel management plans. Sign in sheets maintained. Records of inductions show 100% attendance	Annual Internal

Mitigation Measure / Performance Standard	Measurement Criteria	Implementation Strategy / Procedure	Responsibility	Internal Recording	Internal/External Audits
All areas no longer required for safe operation rehabilitated	Commence to rehabilitate disturbed areas within 12 months of decommission. As a minimum rehabilitated surface to: • Be deep ripped if heavily compacted or surface scarified if not; • Surface left rough to encourage water pooling and seed collection; • Run rips or any furrows along the contour; • Whoa-boys or diversion bunds installed in accordance with DENR or IECA guidelines on slopes greater than 3%; and • Final surface profile to match surrounding topography.	Land Disturbance Policy	Superintendent	Records of location of rehabilitation works, work undertaken and timing.	Annual External
All erosion and sedimentation control devices compliant with DENR and IECA best practise guidelines	Install erosion and sediment control devices in accordance with DENR and IECA guidelines to: • Slow surface water on slopes greater than 3%; • Divert water into the surrounding environment to encourage natural sheet flow; • Sediment catch drains installed (to stop sediment flowing into water courses); • Reference the DENR or IECA guidelines for a full list or control devices and how to install.	Land Disturbance Policy	Superintendent	Records of works undertaken with reference to relevant guidelines. Checks undertaken to ensure integrity after significant rainfall events	Annual External

Mitigation Measure / Performance Standard	Measurement Criteria	Implementation Strategy / Procedure	Responsibility	Internal Recording	Internal/External Audits
No windrows or concentration points.	Inspection of all access tracks, roads and cleared areas within the OL3 area to ensure no windrows or concentration points. All erosion gully heads removed and flattened to encourage laminar flow and reduce further development of erosion.	Land Disturbance Policy	Superintendent	Photo records to indicate no concentration points and gully heads.	Annual External
Landform consistent with surrounding environment, no blocking of drainage channels or water courses.	Restore drainage channels and water course to original alignment and elevation after construction where applicable.	Land Disturbance Policy	Superintendent	Photo records of drainage channel condition before and after disturbance works	Annual External
Ensure no new erosion or sedimentation occurs on rehabilitated surfaces after first significant rainfall	After significant rainfall inspect rehabilitated surfaces to ensure that there is: • No erosion; • No sedimentation; • No blocking of drainage lines; and • An indication of vegetation growth.	Environmental Monitoring Handbook	Superintendent	Records of checks and any works conducted after significant rainfall.	Annual External
All staff inducted to this EMP	Inductions to show 100% attendance and compliance with this EMP	Health, Safety, Security and Environment Handbook	Superintendent	Records show attendance by all staff	Annual Internal

Water – Hydrology and hydrogeology

There is no groundwater monitoring undertaken as there is an impermeable layer between the fresh water sandstone aquifer and the target gas containing formation with hypersaline produced water. The aquifers are largely fractured rocks, with good yield difficult to produce from a groundwater well and interconnection between surface locations highly variable. Surface water monitoring is also not undertaken due to the ephemeral nature of the surrounding water course and distance to any major tributary of the Finke River system. If a spill or incident occurred that may have the potential to impact of hydrology in the area, an opportunistic water sample program would be developed.

Table 3. Mitigation Measures and Implementation Strategy to meet CTP's Required Environmental Objective and Outcomes for Water Management in the OL3 Area

Mitigation Measure / Performance Standard	Measurement Criteria	Implementation Strategy / Procedure	Responsibility	Internal Recording	Internal/External Audits
No clearing works or disturbance to affect long term stability of existing drainage channels or water courses	Clearance approved from DPIR before any clearing works are undertaken.	Land Disturbance Policy	Superintendent	Photo records of before and after disturbance. Any consultation with third party consultants.	Annual External
No long-term impact to groundwater resources in the area.	Regular testing of groundwater quality, extraction volumes and static water level recorded. Results of testing analysed to show no impact.	Water Management Plan	Superintendent	Annual recording of SWL in any bores used for extraction and a nearby monitoring bore. Record of groundwater quality sample analysis and quarterly extraction rates.	Bi-annual external audit on groundwater extraction, water quality samples and extraction rate.
No uncontrolled or unregulated release of wastes.	Waste discharge license from NT EPA and approval by affected stakeholders before any release of wastes into surrounding environment that will impact areas off the OL3 area.	Waste Management Plan	Superintendent	As per NTEPA licensing requirements. Document location and type of any uncontrolled release and actions taken.	Annual Internal
No waste or hazardous material stored with potential for impact on water courses.	All hazardous waste stored in designated bunded areas, with appropriate spill kit and SDS. As a minimum no hazardous waste to be stored within riparian buffer zones as stipulated by DLRM.	Chemical – Hazardous Materials Management Procedure	Superintendent	Record location of hazardous waste storage.	Six months Internal; Annual External

Mitigation Measure / Performance Standard	Measurement Criteria	Implementation Strategy / Procedure	Responsibility	Internal Recording	Internal/External Audits
No unregulated disposal of grey water	All grey water treated in existing sewerage systems	Waste Management Plan	Superintendent	Record any breaches as observed.	Annual External
All staff inducted to this EMP	Inductions to show 100% attendance and compliance with this EMP	Health, Safety, Security and Environment Handbook	Superintendent	Records show attendance by all staff	Annual Internal

Waste – Operational and produced.

Table 4. Mitigation Measures and Implementation Strategy to meet CTP's Required Environmental Objective and Outcomes for Waste Management in the OL3 Area

Mitigation Measure / Performance Standard	Measurement Criteria	Implementation Strategy / Procedure	Responsibility	Internal Recording	Internal/External Audits
No fauna access to waste	All waste receptacles fitted with fauna proof and secure lids	Waste Management Plan	Superintendent	Record all waste receptacle lids fitted; photos.	Annual External
All waste separated and stored appropriately in accordance with this EMP.	Routine inspections of waste storage area to ensure all wastes are in the appropriate place. All waste removed by an approved NT EPA contractor. Where waste is required to be transported across state or territory borders the NEPM 2013 guidelines for waste transport will be adhered to.	Waste Management Plan	Superintendent	Photo and document showing waste separation requirements and locations	Annual External
All waste not requiring routine removal to be stored in waste management area for either re-use or ultimate disposal offsite.	Excess material stored in designated waste management facility area.	Waste Management Plan	Superintendent	Record of all waste in waste management area	Annual External
Final waste disposal off-site	Waste removed by appropriately licensed and NT EPA approved contractor (where required)	Waste Management Plan	Superintendent	Record all waste removed, date and by whom	Annual Internal
All waste removed from site recorded	Quantity and type of waste removed from site recorded. Waste streams monitored to ensure all waste is appropriately removed.	Waste Management Plan	Superintendent	Record quantities of waste removed	Annual Internal
Only approved waste burnt in designated burn pit.	Appropriate waste burned in designated burn pit under suitable climatic conditions – low wind.	Waste Management Plan	Superintendent	Records of conditions when burning carried out and what is burnt.	Annual External

Mitigation Measure / Performance Standard	Measurement Criteria	Implementation Strategy / Procedure	Responsibility	Internal Recording	Internal/External Audits
Minimise increase in predator species and introduced fauna.	Fauna monitored around waste storage sites to show no sign of increased numbers.	Waste Management Plan	Superintendent	Records of any increased fauna activity around waste sites	Annual External
No increase in invasive flora, NT declared weeds or WoNS in waste disposal area	Regular site of inspection for emergence of weeds or invasive species. Any weed species identified to be removed following specific management plans i.e. mechanically or chemically.	Weed Management Plan	Superintendent	Records of any weed or invasive flora species identified in wastes storage areas	Annual External
No unregulated disposal of NT EPA listed waste	All listed waste disposed of in accordance with the NT EPA listed waste register. Where waste is required to be transported across state or territory borders the NEPM 2013 guidelines for waste transport will be adhered to.	Waste Management Plan	Superintendent	Records of any disposal of listed waste and volumes	Annual External
All hazardous waste material to be separated in the appropriate area for disposal according to their SDS, this EMP and the hazardous goods register.	Visual inspection and results of external and internal annual audits indicate all hazardous waste stored in appropriate location.	Managing Hazardous Chemicals Workplace Risk Assessment	Superintendent	Records of all SDS and storage in accordance with recommendations	Annual External

Mitigation Measure / Performance Standard	Measurement Criteria	Implementation Strategy / Procedure	Responsibility	Internal Recording	Internal/External Audits
All waste to be stored in appropriately bunded area.	Visual inspection of storage locations and records indicate compliance. Bunding for tank storage of waste in a storage facility should be 120% of total volume of largest tank for non-flammable and 133% for any flammable material; away from drainage lines. Bunding for storage of wastes material contained in drums needs to be at least 25% of the total volume of stored material per Australian Standards.	Waste Management Plan	Superintendent	Records and photos of all waste storage locations.	Annual External
The waste reduction hierarchy followed: • Reduce; • Reuse; • Recycle; and • Dispose	Records clearly show efforts made to reduce material imported to site and measures to re-use where possible or separation for recycling.	Waste Management Plan	Superintendent	Records of efforts to reuse, recycle and order only that which is required.	Annual Internal
No waste found outside of designated areas.	All waste generated to be placed in on-site waste receptacles.	Waste management Plan	Superintendent	Records of six monthly site check to ensure all waste in appropriate areas.	Annual External
No accumulation of waste in vehicles.	Vehicles cleaned before crew change; removing waste materials.	Traffic Management Plan	Superintendent	Records of any vehicle that is left in unkempt state.	Annual Internal
No contamination to soil from liquid waste containers.	Record shows active inspection of liquid waste containers and no leaks. External and internal annual audits show no sign of soil contamination.	Waste management Plan	Superintendent	Quarterly check of all liquid waste containers stored on site.	Annual External
Clean-up/spill kits in all relevant areas.	Visual inspection to indicate compliance.	Waste management Plan	Superintendent	Monthly record of check of all spill kits to ensure adequately stocked.	Annual External

Mitigation Measure / Performance Standard	Measurement Criteria	Implementation Strategy / Procedure	Responsibility	Internal Recording	Internal/External Audits
All clean up material appropriately disposed for off-site disposal.	Records show location and removal of any clean-up materials in incident log report. Used clean-up materials appropriately contained for off-site disposal.	Waste management Plan; and Incident Investigation Procedure.	Superintendent	Records showing location and date when clean-up material was removed from site.	Annual Internal
All spills and/or leaks are remediated as soon as possible.	Records show clean-up procedures. Routine visual inspection of waste storage area to ensure no leaks or spills. If any spill or leak identified then appropriate action taken to rectify the problem as soon as possible. Records kept of remediation steps taken.	Waste Management Plan; and Incident Investigation Procedure.	Superintendent	Records of any spills and remediation works carried out	Annual Internal
All spills and leaks reported to the regulator as required.	Records show communication with DPIR if spill occurs and details of initial investigation and future investigations. A contaminated site investigation carried out with GPS reference point and soil sample locations for reportable incidents: • 300 L (80L inland waters) liquid hydrocarbon spill; or • 500 m^3 in gaseous form. All items on the RCCA closed.	Waste Management Plan; and Incident Investigation Procedure	Superintendent	Records of spill location, type and amount. Records of correspondence with the DPIR and timing. All remediation works carried out	Annual External

Mitigation Measure / Performance Standard	Measurement Criteria	Implementation Strategy / Procedure	Responsibility	Internal Recording	Internal/External Audits
No unregulated disposal of wastes.	NT EPA waste discharge license before any waste disposed outside of or likely to impact receptor outside the OL3 area. Evidence of waste discharge license and conditions of approval if area outside of OL3 impacted.	Waste Management Plan	Superintendent	Copy of any NT EPA discharge license as required	Annual External
All staff inducted to this EMP Visitors and contractors inducted depending on the nature of their work	Inductions to show 100% attendance	Health, Safety, Security and Environment Handbook	Superintendent	Records show attendance by all staff	Annual Internal

Air and Noise – Emissions, Vibration and Lighting

Table 5. Mitigation Measures and Implementation Strategy to meet CTP's Required Environmental Objective and Outcomes for Air and Noise Management in the OL3 Area

Mitigation Measure / Performance Standard	Measurement Criteria	Implementation Strategy / Procedure	Responsibility	Internal Recording	Internal/External Audits
No open flames or fires outside of designated areas	Burning of approved waste and gas flaring in designated area only. Routine site inspection to record any fires outside of designated area. If any fires or burning occur outside of the designated area, then staff made aware of the incident and corrective actions taken.	PVGF Operations Manual	Superintendent	Records show any incident of burning outside designated areas	Annual External
No smoking outside of restricted areas.	Smoking to only occur within designated smoking areas facilitated with appropriate waste receptacles and signage. If incident observed, then corrective actions to be taken and recorded.	PVGF Operations Manual	Superintendent	Records show any incidence of smoking outside designated area and action taken	Annual External
Minimise greenhouse gas/fugitive emissions.	Annual NGERS measurement criteria and reporting to include: • Gas to flare; • Emissions from plant and vehicles; and • Any fugitive emissions. Records show routine inspection of all joints to ensure no leaks	PVGF Operations Manual Environmental Monitoring Handbook	Superintendent	Daily monitoring and annual emissions report	Annual Internal

Mitigation Measure / Performance Standard	Measurement Criteria	Implementation Strategy / Procedure	Responsibility	Internal Recording	Internal/External Audits
Noise complaints minimised	Active stakeholder engagement and complaints management through CLC. Noise complaints register maintained at camp. Consult with surrounding stakeholders when major operation will occur likely to impact air and noise quality. Consultation log shows active consultation with surrounding stakeholders on any potential noise increase and results of these consultations.	Community Landholder Consultation; and PVGF Operations Manual	Superintendent	N/A due to remote location	-
No decrease in air quality due to increased inefficient vehicle emissions.	As a minimum standard, all vehicles serviced to vehicle manufacturer specifications and frequency. Ensure all vehicles compliant with Northern Territory Motor Vehicle registry regulations and work health and safety regulations. Consult with surrounding stakeholders when major operation will occur likely to impact air and noise quality. Consultation log shows active consultation with surrounding stakeholders on any potential noise increase and results of these consultations.	Journey management Plan (v5)	Superintendent	Log books maintained	Annual Internal

Mitigation Measure / Performance Standard	Measurement Criteria	Implementation Strategy / Procedure	Responsibility	Internal Recording	Internal/External Audits
No decrease in air quality due to fires in the OL3 area.	Firefighting equipment available and serviced as required per original equipment manufacturer specifications. Firefighting equipment available at each facility, in all vehicles and adjacent to flammable material stores and handling areas. Only burning or flaring of gas in designated areas. No open flames outside of these areas. Smoking in designated areas with appropriate waste disposal facilities. Existing and new fire breaks maintained to keep at least 4 m clear around all infrastructures or at low vegetation cover (<10cm)	PVGF Operations Manual	Superintendent	Records show serviced every six months. Six monthly check of fire break integrity; in August/September before fire season.	Annual External
All staff inducted to this EMP.	Inductions to show 100% attendance	Health, Safety, Security and Environment Handbook	Superintendent	Records show attendance by all staff	Annual Internal

Fire

Table 6. Mitigation Measures and Implementation Strategy to meet CTP's Required Environmental Objective and Outcomes for Fire Management in the OL3 Area

Mitigation Measure / Performance Standard	Measurement Criteria	Implementation Strategy / Procedure	Responsibility	Internal Recording	Internal/External Audits
No open flames or fires outside of designated areas.	Routine inspections to ensure that only approved waste burnt in designated burn pit under suitable climatic conditions i.e. low wind. Gas flared in flare pits with climatic conditions monitored.	PVGF Operations Manual	Superintendent	Records show any incident of burning outside designated areas.	Annual External
No smoking outside of designated area.	Designated smoking area with appropriate waste receptacles.	MPVGF Operations Manual	Superintendent	Records show any incidence of smoking outside designated area and corrective action taken.	Annual External
No petrol vehicles on site.	Only diesel vehicles used in operations. Any petrol vehicle brought to site to have specific hazardous substance management plan developed.	Journey management Plan (v5)	Superintendent	Records of all vehicles on and accessing the site	Annual External

Mitigation Measure / Performance Standard	Measurement Criteria	Implementation Strategy / Procedure	Responsibility	Internal Recording	Internal/External Audits
No combustible material stored around flare pit,	Regular inspection of the flare pit to maintain a cleared vegetation buffer of at least 4 m maintained. Combustible materials cleared from the area surrounding the flare pit (as per FESA/DPIR requirements) Regular visual inspection of flare pit integrity. Ensure flare pit is constructed to best practise principles, bunded to contain flame and integrity maintained.	PVGF Operations Manual	Superintendent	Records of any combustible material in flare pit removed	Annual External
Spread, intensity and duration of fire to be controlled appropriately.	SDS available and appropriate firefighting equipment next to all flammable material stores. Visual confirmation in external and internal audit. Staff trained in the emergency response procedures and basic firefighting skills.	Chemical - Hazardous Materials Management Procedure	Superintendent	Copies of SDS kept in office for any hazardous material used or stored on site.	Annual External
All staff trained in use of firefighting equipment	Records of all staff participating in regular fire and emergency drills. Firefighting equipment available and serviced as required per original equipment manufacturer specifications.	Emergency Response Plan	Superintendent	Records show fire drills carried out and at what frequency.	Annual Internal

Mitigation Measure / Performance Standard	Measurement Criteria	Implementation Strategy / Procedure	Responsibility	Internal Recording	Internal/External Audits
Minimise volume of gaseous wastes to be flared where possible.	Records show efforts to re-use gas where possible to limit gas flaring. Volume of gas to flare monitored and flame adjusted to maintain full combustion.	Environmental Monitoring Handbook	Superintendent	Records indicating any change in gas to flare ratios.	Annual Internal
No transport or storing of flammable material within 25m of flare pit.	Visual inspection during external and internal audits with no flammable material stored within 25m of flare pit. Ensure vegetation stockpiles are stored away from ignition sources and in low profile mounds.	Chemical - Hazardous Materials Management Procedure	Superintendent	Photo evidence and records show no flammable material stored within 25m of flare pit.	Annual External
Complete combustion of gas to flare	Visual inspection of sparkler or other means to ensure flame stays on. Regular inspection of the flare pit to determine if any contamination occurring from unburnt fuel or external incidents.	Emergency Response Plan	Superintendent	As required, if any measures fail or require maintenance.	Annual Internal
Existing fire breaks maintained.	Fire breaks maintained to a minimum of 4m around any infrastructure.	PVGF Operations Manual	Superintendent	Records every annual inspection of fire break and slashing if required	Internal and Annual External

Heritage and Culture

Table 7. Mitigation Measures and Implementation Strategy to meet CTP's Required Environmental Objective and Outcomes for Heritage and Cultural Management in the OL3 Area

Mitigation Measure / Performance Standard	Measurement Criteria	Implementation Strategy / Procedure	Responsibility	Internal Recording	Internal/External Audits
No unauthorised third-party access.	Travel management plan filled in and submitted to site supervisor before arrival. Visitor to report to camp on arrival. Records of all visitors and staff inducted and compliant with site policies.	Journey management Plan (v5)	Superintendent	Records of all visitor sign in and travel management plans	Annual Internal
No unauthorised clearing	Clearance from CLC, AAPA, and DPIR before any clearance works undertaken.	Land Disturbance Policy	Superintendent	Records of third party clearance for any new clearing works	Annual Internal
Zero illicit drugs and alcohol on site	Random checks of camp and offices	Cultural Heritage Management	Superintendent	Records of routine checks and any breach and corrective action taken.	Annual Internal
No unauthorised fire arms on site	Random checks of camp and offices. Access is restricted to licenced persons only. There is a usage log kept with the firearm. The firearm is kept secured at PVGF and is registered and licenced to Central Petroleum's NT Corporate licence. The licence is current until 2022. Users of the firearm at PVGF must have completed a government firearm course and obtain a special NT corporate licence which allows the user to access and use that firearm only. The firearm is subject to standard weapons licencing laws	Cultural Heritage Management	Superintendent	Record of usage log and staff licenses.	Annual Internal

Mitigation Measure / Performance Standard	Measurement Criteria	Implementation Strategy / Procedure	Responsibility	Internal Recording	Internal/External Audits
No impact to cultural heritage sites	CLC and/or AAPA clearance required before any work occurs next to a previously unrecorded cultural heritage site.	Cultural Heritage Management	Superintendent	Records of any previously unidentified cultural or heritage site discovered.	Annual Internal
Access by TOs at any time	All staff to allow access to the site by TOs at any time. TOs to notify the supervisor on shift that they will be accessing the site. Access is not to interfere with operation of the site.	Cultural Heritage Management	Superintendent	Records of TO access, numbers and reason	Annual Internal
All staff inducted to this EMP.	Inductions to show 100% attendance and compliance with this EMP.	Health, Safety, Security and Environment Handbook	Superintendent	Records of all inductions	Annual External

Incidents

Table 8. Mitigation Measures and Implementation Strategy to meet CTP's Required Environmental Objectives and Outcomes in Response to Well Control Event and Well Integrity Failures.

Mitigation Measure / Performance Standard	Measurement Criteria	Implementation Strategy / Procedure	Responsible	Reporting	Auditing
Routine testing and well head integrity monitoring	Records show routine testing and results of testing. Any incident to have an incident action item created for close out.	Morning Well Inspection Incident Investigation Procedure	Super Intendent	Daily full operations; Monthly during remote operations	Annual
Well pressure constantly monitored for any drop indicating well failure	Records show daily monitoring of well pressure.	PVGF Daily Data Sheet	Super Intendent	Daily full operations; Fortnightly during remote operations	Annual
Well design developed using industry best practise	Records of well design to meet industry best practise standards	Palm Valley Operations Manual	Super Intendent	As required	Annual
Methods for operation continually updated to meet industry best practise standards	Evidence of adaptive management principles employed	Palm Valley Operations Manual	Super Intendent	As required	Annual
Casing used to seal off different geological and hydrogeological strata	Records of well design to meet industry best practise standards	Palm Valley Operations Manual	Super Intendent	As required	Annual
Well-sealed with cement plugs as soon as determined a casing failure exists	Records of well design to meet industry best practise standards	Palm Valley Operations Manual	Super Intendent	As required	Annual
Routine maintenance of flow lines and joints or high stress points	Records show results of routine maintenance carried out on flow lines and any incidents	Morning Well Inspection Incident Investigation Procedure	Super Intendent	Monthly	Annual
Spill Response Plan and emergency response plan in place	Visual inspection of emergency and spill response plans at PVGF	Emergency Response Plan	Super Intendent	Annually	Annual

Mitigation Measure / Performance Standard	Measurement Criteria	Implementation Strategy / Procedure	Responsible	Reporting	Auditing
All staff trained and inducted into emergency drills and Spill Response Plan	Records show 100% staff satisfactory completion of induction and training in emergency and Spill Response Plan.	Emergency Response Plan	Super Intendent	Drills: As required, minimum twice a year As required for new staff, visitors and contractors. Annual refreshers for current personnel	Annual
Security bond held by the DPIR	Notification of lodgement of security bond with the DPIR	Palm Valley Operations Manual	Super Intendent	As required	Annual
Security at fence maintained	Visual inspection of security fence during routine inspections	Palm Valley Operations Manual	Super Intendent	Monthly	6 monthly
All visitors must be accompanied by CTP staff whilst on site	Records show all visitors to site accompanied by CTP representative.	Palm Valley Operations Manual	Super Intendent	As required	Annual
All contractors inducted into this EMP and CTP policy's	Records show 100% satisfactory completion of inductions by all contractors on site	This EMP	Super Intendent	As required	Annual
Community consultation with affected stakeholders currently accessing the property on third party business separate from CTP	Consultation log shows community consultation and any issues or resolutions from the process.	Community Landholder Consultation	Super Intendent	Annual	Annual
Due to remote location, traffic volume is minimal	Stakeholder consultations to determine if increase in traffic numbers accessing the site is likely to occur. Results in consultation log.	Traffic Management Plan Community Landholder Consultation	Super Intendent	As required Annually during stakeholder engagement	6 monthly

15.9 Appendix 9. Rehabilitation Management Plan

Scope

The rehabilitation management plan applies to the whole of the OL3 area, including:

- Decommissioning and removal of infrastructure;
- Well plug and abandonment;
- All cleared surfaces and disturbed sites;
- Residual contamination;
- Removal of access roads;
- Revegetation; and
- Soil stability.

Objectives

- Remove all infrastructure and decommission plant
- Return all disturbed areas to a safe and stable landform as close as possible to the surrounding environment
- Ensure final landform is conducive to the re-establishment of native vegetation
- No residual contamination
- No land management issues for future land managers

Environmental Actions and Monitoring

Table 1 details the environmental actions required to meet the environmental requirements for rehabilitation and monitoring requirements in order to determine that these outcomes have been achieved.

Table 1. Rehabilitation and Closure Plan Management Environmental Actions and Monitoring Requirements

Activity	Factors Assessed/Actions	Timing
Decommissioning	Removal of all above ground infrastructure Removal of rubbish Re-spread vegetation All RCCA items closed out to satisfaction of the DPIR	Commence within 12 months of site/infrastructure closure
Future land holders/managers	Previous agreement for infrastructure or disturbed areas to be left for future land holders/managers (beneficial use)	Before rehabilitation works commence

Activity	Factors Assessed/Actions	Timing
Soil Stability	Return soil profile with top soil replaced as final layer where possible Remove any flow concentration points that may block overland sheet flow Re-instate natural drainage channels Ensure all cleared areas have a rough surface to aid in water catchment All compacted areas to be deep ripped Erosion and sedimentation devices maintained and installed as appropriate to best practise guidelines by the DENR and IECA	Commence within 12 months of site closure
Revegetation	Allow for natural passive re-seeding Assess within 12 months and apply active re-seeding if inadequate growth	To be assessed 12 months after initial seeding
Monitoring	Establish photo monitoring points before and vegetation survey before disturbance, so to bench mark against in later surveys. The following monitoring program is proposed: Immediately after rehabilitation works completed: *Check for integrity of works and ability for future rehabilitation success*; Following first wet season: *Stability of soil, landform, vegetation type and re-growth and appearance of weeds*; One year after rehabilitation*: Re-vegetation success*; Three years after: *Soil stability, landscape and vegetation re-growth and type after several wet seasons*; and Five years after: *Long term rehabilitation success measured by landform stability and vegetation re-growth.* Photo monitoring and vegetation surveys conducted at each monitoring event to compare progress	As prescribed

Rehabilitation Reporting

Submit to the DPIR an annual report with information regarding:

- Total area rehabilitated;
- Photo monitoring points GPS locations and results;
- Any areas left in an agreement with future land holders/managers;
- Monitoring of progressive rehabilitation, including flora type and density, fauna activity and soil stability;
- Any erosion and sedimentation issues;
- Any stakeholder consultations and results of discussions;
- Any issues noticed, and remedial actions taken (RCCA); and
- Monitoring of contaminated sites (RCCA).

15.10 Appendix 10. Waste Management.

Wastes - Output

There are three main waste streams associated with the field:

- Produced water;
- Produced gas; and
- Camp, office, operations and workshop miscellaneous wastes

Waste management at the PVGF aims to reduce waste production through avoidance, reuse, recycling and recovery. All personnel look for ways of reducing waste at the source whenever feasible. Good housekeeping practices assists in preventing litter and minimising leaks and spills.

The following sections deal with management of the miscellaneous waste generated from PVGF which is summarised in Table 1 below. For more detailed in regards management measures refer to Appendix 8.

Table 1. Miscellaneous Waste Stream Generated at PVGF

Waste	Examples of Main Source at PVGF	Disposal
Domestic	• Scrap metal (including clean, empty used drums) • Plastic; • Glass; • Aluminium cans; • Paper and cardboard; and • Organic wastes	Stored on site in predator proof bins and routinely removed for offsite disposal by a licensed waste removal contractor.
Listed Wastes	• Waste mineral oils unfit for their original intended use; • Soils contaminated with a listed waste; • Containers contaminated with a listed waste; • Waste mixtures or waste emulsions of oil and water or hydrocarbon and water; • Sewerage sludge and residues including nightsoil and septic tank sludge; and • Tyres	Classified and stored according to listing based on the NT EPA listed waste register. Removed from site by licensed contractor for disposal in the nearest licensed waste disposal facility.
Sewerage	Effluent from camp and offices	Treated water is discharged to grade. Concentrated effluent will be routinely removed from site as required by a licensed waste removal contractor.

Domestic Waste

General waste consists of all domestic, office waste, and other solid workshop refuse including drained oil filters.

General waste, particularly putrescible waste, is stored in predator proof receptacles with secure, fit-for-purpose lids. General waste is regularly removed off-site and disposed of at the nearest licenced

waste management facility. Similarly, any separate receptacles for recyclable materials such as those listed below are transported to the nearest licenced off-site waste management facility:

- Scrap metal (including clean, empty used drums)
- Plastic
- Glass
- Aluminium cans
- Paper and cardboard

Listed Waste

Listed Waste is specified in Schedule 2 of the Waste Management and Pollution Control (Administration) Regulations.

PVGF potentially generates only several types of waste described in the regulations. These are:

- Waste mineral oils unfit for their original intended use;
- Soils contaminated with a listed waste;
- Containers contaminated with a listed waste;
- Waste mixtures or waste emulsions of oil and water or hydrocarbon and water;
- Sewerage sludge and residues including nightsoil and septic tank sludge; and
- Tyres.

Listed waste is removed from site by a licenced waste management contractor.

Sewage System

These units work with a cyclic aeration process built into a single tank designed to accept and treat the sewage. The waste products in the sewage are completely consumed by naturally occurring bacteria in the oxygen-rich environment in the aeration tank. The system treats the organic waste to produce treated water of a high standard. The unit consists of a round polyethylene tank with an internal effluent compartment and pumping system. As the treatment plant is installed above ground, a sewage pump station would be provided to lift the sewage into the treatment plant if pumps are not connected to every line connected to the STP.

15.11 Appendix 11. Stakeholder Engagement

The following will be considered when seeking approvals for new or amended projects or activities.

NT Government Approval

This EMP has been developed to cover the principal activities and projects undertaken at the PVGF operational areas. However, there may be a requirement, on occasion, to amend activities or seek approvals for new projects or activities that may not be covered under this EMP.

In the event that:

- An amendment is required to an existing exploration or production activity, or
- A new activity or project is proposed;

The Schedule of Petroleum Onshore Requirements 2017 will be reviewed for approvals requirements.

The following Sections of the Schedule relate to approvals:

- Section 301 – Approval to Drill.
- Section 303 – Approval of Drilling Equipment.
- Section 328 – Approval to Abandon or Suspend a Well.
- Section 401 – Approval for Production Equipment and Safety Systems.
- Section 419 – Approval to Vent or Flare.
- Section 503 – Approval to carry out Geological and Geophysical Survey.

Approvals Process

Approval for a revised or new process is required when:

- It is stipulated under the Schedule, and the activity is covered by this EMP. In this event the application would simply request approval and state that the hazards will be controlled as per the approved EMP; or
- It is stipulated under the Schedule, but the approved EMP does not cover the particular hazards that could arise from the proposed activity/project. In this case there will be a need to provide additional supporting information on the management of hazards with the approval request.

To define the process for providing the DPIR additional project-specific information for new projects/programs at PVGF, an Activity Specific Environment Plan template has been developed. The template is based on *HS&E MS09.5 Environmental Impact Assessment & Approvals*, and sets out the information to address the DPIR's requirements for an *Onshore Environmental Plan*, in particular:

- Description of the Project Activity.
- Description of the Project Environment.
- Reporting (activity specific).
- Consultation.

It is noted that for a significant activity / project change, the NT Government may require assessment under the *Environmental Assessment Act 1982,* i.e. the preparation of a Public Environmental Report

or Environmental Impact Statement. This could also be initiated if the Commonwealth assessment process is triggered, as discussed below.

Commonwealth Approval

A check needs to be made in relation to any new activity / project on whether the Commonwealth Environment Protection and Biodiversity Conservation Act (EPBC Act) 1999 is triggered. The EPBC Act provides that certain actions, especially actions that may have a significant impact on defined 'matters of national environmental significance' (MNES) outlined below, are subject to an assessment process and may require approval from the Commonwealth Environment Minister.

The seven MNES defined under the EPBC Act are:

1. World Heritage properties;
2. Ramsar wetlands;
3. Nationally threatened species and ecological communities;
4. Migratory species;
5. Commonwealth marine areas;
6. Nuclear actions (including uranium mining); and
7. National and Commonwealth heritage places (as of 1 January 2004).

In addition to the above, actions that may have a significant impact on Commonwealth land (even if taken outside Commonwealth land), and actions taken on Commonwealth land that may have a significant impact on the environment generally, are also covered by the EPBC Act.

The approval process is initiated by preparing a Referral under the EPBC Act, which would be used in order to determine the level of assessment (if any further is required). If it is determined through the Referral process that an action does require the Minister's approval, i.e. is a Controlled Action under the EPBC Act, then that action must be assessed. As a bilateral agreement is in place with the NT Government, the NT can assess the action under the terms of the agreement. However, in the assessment process, the Commonwealth will also consider whether any conditions (additional to any Territory conditions) should be required to meet any specific Commonwealth requirements, e.g. to protect any listed Commonwealth flora or fauna species.

As part of the Referral process, an EPBC Act Protected Matters Search Report (PMSR) needs to be prepared for the area of interest, supported by any survey or other work as considered necessary to enable assessment of whether any MNES have been triggered.

Traditional Owner Approvals

Approval from the TOs is required for any activities at the PVGF operations involving ground disturbance, including:

- Survey work;
- Drilling;
- Construction of petroleum gathering and processing facilities;
- Access roads;
- Pipelines; and
- Camp and ancillary facilities.

This requirement is detailed under Clause 5.2 and Clause 5.3 of the Palm Valley Agreement (2003), which is a legal agreement between CTP and its Joint Venture partners and the CLC (the body corporate representing the TOs).

As part of this approval process, inspection by TOs and/or a professional Archaeologist may be required to finalise locations for proposed activities involving ground disturbance (Signed section of the agreement found below). Once locations are finalised, and prior to any site activity, further field inspection reports are undertaken for each location, in accordance with the CTP HS&E MS.

Stakeholder Management

CTP is committed to upholding its reputation. CTP seeks to establish and maintain enduring and mutually beneficial relationships with the communities of which it is a part; ensuring that our activities generate positive economic and social benefits for and in partnership with these communities.

In the case of new projects and activities, CTP will prepare Stakeholder Management Plans (SMP) to achieve the above objectives. The SMP is used by the project team to develop effective engagement and management of stakeholders.

The principal objectives of SMP are:

- Identification of relevant stakeholders
- Initiation and maintenance of communications
- Identification of stakeholder engagement tools
- Establishment of an open and transparent process for input
- Provision of a means for recording all initiatives in which communication and/or consultation is undertaken, issues raised and responses recorded
- Establishment of a sense of ownership in the project by stakeholders.

Stakeholder identification regarding PVGF was conducted early and the relevant stakeholders are as follows

- Community
- Landholders (in this case indigenous through the CLC)
- Indigenous
- Government
- Other key non-commercial external stakeholders (e.g. NGOs and industry bodies)
- Industrial Relations stakeholders
- Other commercial external stakeholders
- Internal stakeholders

Stakeholder engagement during this project involved a number of engagements:

- Public release of key documents;
- Stakeholder needs survey;
- Project newsletters;
- Public displays;
- Staffed Environmental Impact Statement displays;
- Regular updates to central website;
- Fact sheets;

- Project sustainability reports;
- Native Title Representative Body meetings and briefings;
- Advertising and/or articles in relevant print media;
- Media briefings, releases, and monitoring;
- Responding to media enquiries;
- Community workshops;
- Public information sessions and meetings;
- Project Information Line and email;
- Written enquiry forms;
- Face to face meetings with stakeholders and stakeholder groups; and
- Other direct and indirect engagement mechanisms

Stakeholder Approvals

In the case of PVGF, the stakeholders needing to formally approve of PVGF operations are as follows:

Petroleum Operations Regulator

- Department of Primary Industry and Resources

Land authority stakeholders

- Central Land Council

Signed and dated historic approvals along with the most recent complete approved stakeholder certificate are below.

Summary of Matters Discussed

A summary of any matter discussed with stakeholders is recorded in the CTP PVGF Communications Log. The most up to date copy is provided in Appendix 6 Communication Log. This log is continually updated following any stakeholder consultation and will be submitted to the regulator in the annual environmental report.

Assessment of Merit of Stakeholder Objection or Claim

At present there has been no stakeholder objection, claim or dispute that has required resolution. If there are any disputes CTP will follow the conflict resolution procedure Consultation and Communication (MSTD07-01 (v1). This assessment of the objection or claim will be recorded in the Communication Log for future reference and submission to the regulator in the annual environmental report.

Statement of Intent Holders Response

CTP will issue a statement of response to any stakeholder objection or claim to resolve the conflict or dispute in line with the Consultation and Communication (MSTD07-01 (v1) procedure. This will be recorded in the Communication Log and a copy of the statement of response will be kept on file for inclusion in the annual environmental report and available for view in audits.

Details of Changes Due to Engagement

Any changes in operations, policy or procedures as a result of stakeholder consultation or other will be recorded in writing and approved by CTP management before any action is taken. CTP management will review any proposed changes and assess the merits of perusing these changes, before submitting details of the proposed changes to the regulator for approval before any action is undertaken if it is deemed necessary. Any changes that derive from stakeholder consultation or other will be included in the annual environmental report.

Ongoing Consultation

CTP maintains a record of all ongoing interactions and communications with stakeholders and affected parties to the PVGF. This information is maintained in a Communication Log. A copy of this will be submitted to the DPIR annually. The communication log to date is in Appendix 6.

It details:

- Date;
- Topic discussed;
- Type of engagement;
- CTP contact;
- Primary stakeholder; and
- Outcomes – Any issued resolved or identified.

Signed CLC Palm Valley Agreements

SIGNED for and on behalf of)
MAGELLAN PETROLEUM (N.T.) PTY LTD)
)
By THOMAS GWYNN DAVIES)
its duly authorised Attorney under Power of
Attorney dated 16 APRIL 2006
who hereby states that he has no notice of
revocation of the said Power of Attorney at
the time of execution of this instrument, in
the presence of:

Witness

M. V. COWIE
Name

SIGNED for and on behalf of)
SANTOS LTD)
FARMOUT DRILLERS PTY LTD)
CANSO RESOURCES PTY LTD)
SANTOS EXPLORATION PTY LTD)
)
By JOHN RUPERT BRUCE)
its duly authorised Attorney under Power of)
Attorney dated 24 APRIL 2004)
who hereby states that he has no notice of)
revocation of the said Power of Attorney at)
the time of execution of this instrument, in)
the presence of:)

Witness

M. V. COWIE
Name

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THE COMMON SEAL of the Central Land Council was hereunto affixed according to law and in the presence of:

William BROWN
Chairman

Deputy Chairman
Executive Member

CONRAD. RATARA
Name

CONRAD. RATARA
Signature

MURRAY. RAGGETT
Name

MURRAY. RAGGETT
Signature

Edward Rontji
Name

Edward Rontji
Signature

Anita Ratara
Name

Anita Ratara
Signature

Doris In Kamala
Name

Doris In Kamala
Signature

Roberta Ramkaraka
Name

Roberta Ramkaraka
Signature

DESMOND EBATARINGA
Name

DESMOND. EBATARINGA
Signature

Cleophas Lofty Kakakaringe
Name

Cleophas Lofty Kakakaringe
Signature

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THE COMMON SEAL of the Central Land Council was hereunto affixed according to law and in the presence of:

William BROWN
Chairman

Deputy Chairman
Executive Member

15.12 Appendix 12. Chemicals and Hazardous Materials

All chemicals and hazardous substances are managed in accordance with CTP's Chemical and Hazardous Materials Management Procedure (Document MSTD11-PC002). A Hazardous Chemical Goods Register (HCGR) is kept for all sites and facilities operated by CTP. It details:

- Product Name;
- Substance Name;
- Storage Locations;
- Current MSDS;
- Hazardous Goods (Yes/No);
- Dangerous Goods (Yes/No);
- Class & Packing Group;
- Quantity;
- Risk Assessment;
- Comments (Use, if still holding etc.)

A copy of the current (Oct 2016) HCGR for PVGF contains 54 different products that are stored and or used in PVGF operations; a copy is provided below.

Chemicals and other hazardous substances are stored in accordance with the requirements of their relevant SDS (previously MSDS). SDS's for each chemical used and stored onsite are held in the site office.

Purchasing, storage, handling and disposal of chemicals and hazardous substances will comply with the provisions of explosives and dangerous goods and health and safety legislation as well as codes of practice and Australian standards as referred to under the legislation.

PVGF Hazardous Chemical and Goods Register

HAZCHEM Goods Register										
Number	**Product Name**	**Substance Name**	**Storage location**	**Current MSDS**	**Hazardous Goods (Yes / No)**	**Dangerous Goods (Yes / No)**	**Class & Packaging group**	**Quantity**	**Risk Assessment**	**Comment**
All hazardous substances/dangerous goods must have an up to date Safety Data Sheet and risk assessment no more than five years old.										
1	DIESEL FUEL NO. 2	Petroleum distillate	Fuel Bund	MSDS	No	Yes	Class 3 / Pack group 111	200Lts	..\..\Risk Assessments CTP\Risk Assessments General\Risk assessment Diesel Fuel.docx	Refuelling plant & equipment
2	Unleaded fuel	GASOLINE	Bunded Storage cabinet	MSDS	No	Yes	Class 3 Packing group II Hazchem Code 3YE	< 5Lts		Refuelling plant & equipment
4	Methanol	Methanol		MSDS	Yes	Yes	Class 3 / 2WE / Pack group 11	6000lts		1 x Bulk tank 5000lts / 1 x 1000lt bulky
5	Diggers	Mineral Turpentine	W/shop Flammable Liquids cabinet	MSDS	Yes	Yes	Flammable Liquids 3/UN1300	20Lts		Workshop- parts cleaning etc.
6	Diggers	Methylated Spirits	W/shop Flammable Liquids cabinet	MSDS	Yes	Yes	Flammable Liquids 3/UN1300	1Lt bottle X 2		
7	ASCC	Blue Kerosene	W/shop Flammable Liquids cabinet	MSDS	Yes	Yes	Flammable Liquids 3/UN1223	20Lts		
8	Sure Chem	Ardrox 800/3 Black Magnetic Ink	W/shop Flammable Liquids cabinet	MSDS	Yes	Yes	Flammable Liquids 3	300G tin X2		
9	Machinery Enamel	Caterpillar Yellow paint	W/shop Flammable Liquids cabinet	MSDS	Yes	Yes	Flammable Liquids 3	300G tin		
10	Wattyl	Killrust thinner for gold paint	W/shop Flammable Liquids cabinet	MSDS	Yes	Yes	Flammable Liquids 3/UN1263	1 Lt tin		
11	Sure Chem	ARDROX 8901W White background lacquer	W/shop Flammable Liquids cabinet	MSDS	Yes	Yes	Flammable Liquids 3	300G tin		
12	Septone	Rust Converter	W/shop Flammable Liquids cabinet	MSDS	Yes	Yes	Corrosive 8 phosphoric acid/UN1802	500 ml tin		

HAZCHEM Goods Register

Number	Product Name	Substance Name	Storage location	Current MSDS	Hazardous Goods (Yes / No)	Dangerous Goods (Yes / No)	Class & Packaging group	Quantity	Risk Assessment	Comment
13	Ormonoid	Brushable water proofer	W/shop Flammable Liquids cabinet	MSDS	Yes	Yes	Flammable Liquids 3	4 Lt tin		
14	Dupont	Velpar L Herbicide	W/shop Flammable Liquids cabinet	MSDS	Yes	Yes	Flammable Liquids 3	4 Lt tin		No longer holding product on site
15	Aeroclean Degreaser	Degreaser	Work Shop Flammable Liquids Cabinet	MSDS	No	Yes	Class 2	500Ml/tin X 20		parts cleaning in the workshop and field
16	Auto Spec	Brake Cleaner	Work Shop Flammable Liquids Cabinet	MSDS	No	Yes	Class 2	500Ml/tin X 20		parts cleaning in the workshop and field
17	Inox	MX3 formula lubricant	Work Shop Flammable Liquids Cabinet	MSDS	No	Yes	Class 2	500Ml/tin X 20		parts lubrication/protection in the workshop and field
18	CRC Soft Seal	Long term protection for metal surfaces	Work Shop Flammable Liquids Cabinet	MSDS	Yes	Yes	Class 2	300Gm/tin X 5		metal/compressor parts protection in the workshop and field
19	Selleys No More Gaps	Expanding Foam	Work Shop Flammable Liquids Cabinet	MSDS	Yes	Yes	Class 2	570Gm/tin X 5		workshop and field
20	Turco	Pre-check LF solvent cleaner	Work Shop Flammable Liquids Cabinet	MSDS	No	Yes	UN 1950 Class 2.1	250Gm/tin X 2		NDT testing in workshop and field
21	Turco	DY-Check Developer	Work Shop Flammable Liquids Cabinet	MSDS	No	Yes	UN 1950 Class 2.1	250Gm/tin X 2		NDT testing in workshop and field
22	Bostik	Plumb-Weld PVC Priming Fluid	Work Shop Flammable Liquids Cabinet	MSDS	No	Yes	Flammable Liquid 3	500Ml/tin X 2		PVC pipe fabrication/repairs workshop and field
23	Bostik	Plumb-Weld PVC pipe cement	Work Shop Flammable Liquids Cabinet	MSDS	No	Yes	Flammable Liquid 3	500Ml/tin X 2		PVC pipe fabrication/repairs workshop and field
24	Plumb Tech	PVC pipe cement Green Type P	Work Shop Flammable Liquids Cabinet	MSDS	No	Yes	Flammable Liquid 3	500Ml/tin X 2		PVC pipe fabrication/repairs workshop and field
25	Rocol	Easy Line Paint	Work Shop Flammable Liquids Cabinet	MSDS	No	Yes	UN 1950 Flammable Liquid 3	750Ml/tin X 2		Line marking
26	Wattyl Kill Rust	Epoxy Gloss Enamel Paint	Work Shop Flammable Liquids Cabinet	MSDS	No	Yes	UN 1950 Flammable Liquid 2	750Ml/tin X 2		Painting

HAZCHEM Goods Register

Number	Product Name	Substance Name	Storage location	Current MSDS	Hazardous Goods (Yes / No)	Dangerous Goods (Yes / No)	Class & Packaging group	Quantity	Risk Assessment	Comment
27	White Knight	Rust guard Epoxy Enamel	Work Shop Flammable Liquids Cabinet	MSDS	No	Yes	UN 1950 Flammable Liquid 2	310Gm/tin X 10		Painting
28	Pascoes	Mechanix Caustic Soda	Work Shop Flammable Liquids Cabinet	MSDS	No	Yes	Corrosive 8	500Gm/tin X 2		Drain cleaning
29	Aqua Cure	Spa Gene Bromide Tablets	Work Shop Flammable Liquids Cabinet	MSDS	No	Yes	UN 1479 Oxidising Agent 5.1	500Gm/tin X 2		Spa water cleaning
30	MSA	Lens Cleaner	Camp/Office	MSDS	No	Yes	Flammable Gas 2	150Gm/tin X 4		Cleaning the lenses on safety glasses
31	PSA Products	Life Saver Smoke Detector Tester	Camp/Office/wshop	MSDS	No	Yes	Flammable Gas 2	100Gm/tin X 6		Testing Smoke Detectors
32	Bushman	Personal Insect Repellent	Camp/Office	MSDS	No	Yes	Flammable Gas 2	130Gm/tin X 12		Mosquito and Fly repellent
33	Thorley Laboratories	RID Tropical Strength Repellent	Camp/Office	MSDS	No	Yes	Flammable Gas 2	150Gm/tin X 12		Mosquito and Fly repellent
34	Mortein	Fast Knockdown	Camp/Office	MSDS	No	Yes	Flammable Gas 2	200Gm/tin X 12		Mosquito and Fly killer
35	Aerogard	Tropical Strength	Camp/Office	MSDS	No	Yes	Flammable Gas 2	200Gm/tin X 12		Mosquito and Fly repellent
36	Dettol	Glen 20 Spray Disinfectant	Camp/Office	MSDS	No	Yes	Flammable Gas 2	300Gm/tin X 12		disinfectant spray
37	Tonizone/Pacific Products	Spray Starch	Camp/Office	MSDS	No	Yes	Flammable Gas 2	400Gm/tin X 12		Clothing starch
38	AmbiPure	Air freshener	Camp/Office	MSDS	No	Yes	Flammable Gas 2	265Gm/tin X 12		Air Freshener
39	Air Wick	Freshmatic Automatic spray	Camp/Office	MSDS	No	Yes	Flammable Gas 2	174Gm/tin X 12		Air Freshener
40	ProChef CANOLA	Cooking Oil spray	Kitchen	MSDS	No	Yes	Flammable Gas 2	400Gm/tin X 12		Cooking oil spray
41	Selleys	BBQ Tough Clean	Kitchen	MSDS	No	Yes	Flammable Gas 2	400Gm/tin X 12		Cleaning the BBQ plate
42	Mr Muscle	Draino Crystals	Kitchen	MSDS	No	Yes	Corrosive 8	500Gm/tin X 2		Cleaning the drains
43	Pascoes	Drain Clean Crystals	Kitchen	MSDS	No	Yes	Corrosive 8	500Gm/tin X 2		Cleaning the drains
44	Castrol QB 100	Degreaser	Top Shed	MSDS	Yes	No		205 Lt		Cleaning equipment
45	Mobil DTE 26 oil	Lubricating oil	Work Shop Flammable Liquids Cabinet	MSDS	Yes			40Lt		

HAZCHEM Goods Register

Number	Product Name	Substance Name	Storage location	Current MSDS	Hazardous Goods (Yes / No)	Dangerous Goods (Yes / No)	Class & Packaging group	Quantity	Risk Assessment	Comment
46	WD-40	Lubricant	Work Shop Flammable Liquids Cabinet	MSDS	Yes	No		4 Lt		Lubricating parts
47	Ajax Injection Fluid	Lubricant	Top Shed	MSDS	Yes	No				
48	Epirez Stag Jointing Paste	sealant	Work Shop	MSDS	Yes	No		1 Kg		
49	Hi Tech Oil traders	Parts Wash Solvent	Work Shop Flammable Liquids Cabinet	MSDS	Yes	Yes	Class 3	40 Lt		Parts Cleaning
50	Speakman	Eye wash preservative	Work Shop Flammable Liquids Cabinet	MSDS	Yes	No		500ml		Eye wash stations
51	CRC Industries	Brakleen	Work Shop Flammable Liquids Cabinet	MSDS	Yes	Yes		20 X 250ml tin		Brake and general cleaning
52	Caltex Australia Petroleum	Kopr-Kote		MSDS	Yes			10 X 500ml jar		Anti-seize on bolts
53	BP Australia Ltd	Wonder Clean	Wash Bay	MSDS	Yes	No		20 Lt		Cleaning vehicles and parts
54	CRC Industries	Contact Cleaner	Instrument W/shop	MSDS	Yes	No				Cleaning circuit boards etc.
55	Champion Servo	Scortron SGR-4330	PV 4	MSDS	Yes	NO				Water injection
56	Hi Tec oils DD 50 Coolant Red	Radiator Coolant	Workshop bunded area	MSDS	Yes	No	Unclassified	20lts		

15.13 Appendix 13. Detailed Mitigation Measures for all activities across the PVGF

All activities (not directly associated with the drilling of PV-13) carried out in the OL3 Area and Associated Hazards for Risk Assessment

Activity	Hazard
Civil construction works maintenance	**4-7, 9-13 & 16-18.**
Storage, handling and transport of hazardous goods	**5, 7, 8, 10 – 12, & 17 – 19.**
Hydrocarbon extraction, processing and transport	**1 – 4, 7, 8, 10 – 13, 15 & 17 – 19.**
Waste disposal	**5 – 8, 10 – 13, 17 & 18**
General use of the OL3 area	**4-8, 10-14, & 17-19.**
Production water disposal	**1, 3, 4 – 6, 13, 14 & 18**
Unauthorised access	**10 18 19 11 7 13 12 17 8 5 14**
Rehabilitation and closure	**4**

Table 1 details the mitigation measures used to reduce the environmental risks identified to as low as reasonable possible.

Table 1. Detailed Mitigation Measures

Hazard	Causes	Potential Impacts and receptors	Risk Analysis			Valuation and Uncertainty	Mitigation Measures	Residual Risk			Acceptability
			C	L	Risk Rating			C	L	Risk Rating	
1. Well integrity failure	• Well casing failure	Contamination of groundwater from interaction between previously confined layers; potential to impact on groundwater dependant ecosystems in the area	4	3	12	There is a high level of uncertainty in this risk rating and as such it has been graded higher. It would depend on where the integrity failure occurred and how long between remedial actions were taken. Any impacts underground will be difficult to quantify and remediate; this is another reason why the risk rating is so high. Potential to impact the fresh sandstone groundwater aquifers requires failure through the impermeable layers between.	• Routine testing and well head integrity monitoring • Well pressure constantly monitored for any drop indicating well failure • Well design developed using industry best practise • Methods for operation continually updated to meet industry best practise standards Casing used to seal off different geological and hydrogeological strata • Emergency response plan • Spill Response Plan • Well-sealed with cement plugs as soon as determined a casing failure exists	2	2	4	Impacts will be contained for the most part underground. Separate casing sections may assist in restricting the failure to sections that can be controlled. If contamination occurs underground it will be difficult to remediate, hence the consequences rating is still high. The emergency response and oil spill contingency plans are in place to deal with the still high level of risk from this hazard.
2. Hypersaline Produced Water	• Spill in transport • Leak in flow lines • Break in evaporation pond wall integrity • Overflow of evaporation pond due to Insufficient free board • Unapproved and inappropriate disposal • Well integrity failure	Contamination of soil	5	3	15	LES undertook five years of soil sampling downstream from a spill at PV-08. The results indicated that annuals and grasses had started to regrow in this time and that the extent of contamination went for 1km downstream. Quarterly surveys conducted by LES in 2015-16 noticed that large trees were still rehabilitating. Therefore, the level of uncertainty is lower due to past surveyed results.	• All staff trained and inducted into the storage, handling and transport of hazardous wastes • Licensed waste contractor used for transport • NT EPA waste discharge license required for disposal and transport • NPEM 2013 guidelines followed if transport required interstate • Routine maintenance of flow lines and joints or high stress points • Routine inspection of evaporation pit and tanks integrity • Double walled HDPE liner with leak detectors underneath • Maintain sufficient free board (500mm) in evaporation pond to sustain a 1 in 100-year rainfall event • Results from monitoring of previous spill monitoring suggest best practise remediation	2	2	4	Mitigation measures in place have severely reduced the possibility of any contamination of soil due to hypersaline produced water. However, there is still the risk of an incident or accident outside of CP's control that may result in soil contamination. The emergency response plan details measures to effectively and efficiently react to such spills to contain the extent and consequences. LES soil sample monitoring of previous hypersaline spills at PVGF indicate that the best method for remediation is to leave the soil in place and allow rainwater to naturally dilute concentrations over time.

Hazard	Causes	Potential Impacts and receptors	Risk Analysis			Valuation and Uncertainty	Mitigation Measures	Residual Risk			Acceptability
			C	L	Risk Rating			C	L	Risk Rating	
		Contamination of hydrology	4	2	8	The area is void of permanent surface water, with all watercourses being ephemeral in nature. The potential for impacts to surface water is low due to re-injection or disposal at Lake Lewis. If the evaporation dam wall was to break then potentially the hypersaline water may migrate off site, however climatic conditions (rainfall run-off) would need to align. Previous spills have not impacted on any surrounding surface water courses.	is to leave the to remove as much impacted material as possible from the spill and monitor long term impacts, with further remediation occurring if required. • All staff trained and inducted into the storage, handling and transport of hazardous wastes • No unapproved disposal • NT EPA waste discharge license required for disposal and transport • NPEM 2013 guidelines followed if transport required interstate • Consultation and approval by affected stakeholders before any disposal outside of licensed facilities • See mitigation measures for well casing integrity failure	3	1	3	As the majority of operations for the disposal of hypersaline water are removed from watercourses the likelihood of any contamination of watercourse is minimal. However, there is potential for an incident or accident to release the hypersaline water into a watercourse during times of flow (all watercourse is ephemeral). The emergency response plan details measures to effectively and efficiently react to such spills to contain the extent and consequences
		Contamination of groundwater.	5	2	10	Due to the know geology and impermeable confining layer between the re-injection layer and fresh groundwater sources, the potential for impacts on groundwater are lower		3	1	3	Contamination of the fresh sandstone aquifer is low due to the impermeable siltstone layer between it and the targeted aquifer for gas and hypersaline water re-injection. The aquifer being re-injected is the same as the produced water is sourced from, so there is no contamination of this layer. A surface spill is also unlikely to impact on the fresh water aquifer due to surface rock, the fractured rock nature of the top aquifer and depth to.
		Loss or damage to native flora	5	3	15	Monitoring of impacts to vegetation from the early hypersaline water disposal into the environment indicate 3-5 years before good vegetation growth is noted. There is low uncertainty in this risk assessment due to on-ground survey data.		4	1	4	Mitigation measures have reduced the likelihood of contamination of native flora through preventative actions. Any spill or accident outside of CP's control, impacts to native flora will be covered by the emergency response plan.

Hazard	Causes	Potential Impacts and receptors	Risk Analysis			Valuation and Uncertainty	Mitigation Measures	Residual Risk			Acceptability
			C	L	Risk Rating			C	L	Risk Rating	
		Loss or damage to native fauna	3	2	6	Monitoring of impacts to fauna from the early hypersaline water disposal into the environment indicate minimal impacts to local fauna in the area. There is low uncertainty in this risk assessment due to on-ground survey data.		2	2	4	Mitigation measures have reduced the likelihood of contamination of native fauna through preventative actions. Any spill or accident outside of CP's control is unlikely to impact native fauna as they will be able to mobilise away from the spill and are unlikely to drink the liquid due to taste. Further monitoring of any spills will reduce the uncertainty in this rating
3. Well control event	• Release of liquid hydrocarbons to the environment • Release of gaseous hydrocarbons to the environment	Contamination of soil	5	1	5	The extent of soil contamination would depend on the well at which the event occurred. The risk rating is based on the fact that the field has never produced any liquid hydrocarbons. Any release of gas will be discharged to the atmosphere and will not contaminate the soil.	• Routine maintenance and inspection of well heads • Emergency well shut off valve • Spill Response Plan and emergency response plan in place • Emergency response drills conducted regularly • All staff trained and inducted into emergency drills and Spill Response Plan	3	1	3	Mainly hydrocarbon gas releases, routine maintenance and inspection to pick up if any potential for failure. Each well head fitted with remote sensing equipment so that any leaks can be detected from the main monitoring hub off-site. Spill and emergency response plans to account for residual risk of accident outside of CP's control.
		Contamination of hydrology	3	1	3	The extent of impact on local hydrology would depend on the well at which the event occurred. The risk rating is based on the fact that the field has never produced any liquid hydrocarbons. Any release of gas will be discharged to the atmosphere and will not contaminate the local creek beds.		2	1	2	Ephemeral watercourses, majority of uncontrolled release would be gaseous and emergency shut off valve likely to contain spill before it becomes too big
		Contamination of ground water.	3	1	3	The extent of impact on ground water would depend on the well at which the event occurred. The risk rating is based on the fact that the field has never produced any liquid hydrocarbons. Any release of gas will be discharged to the atmosphere and will not contaminate the ground water.		2	1	2	Due to groundwater location, emergency response procedures and remote monitoring any material released in a well control event is unlikely to impact on the groundwater in the area.

Hazard	Causes	Potential Impacts and receptors	Risk Analysis			Valuation and Uncertainty	Mitigation Measures	Residual Risk			Acceptability
			C	L	Risk Rating			C	L	Risk Rating	
		Native flora and fauna	4	1	4	Localised impacts on flora and fauna, depending on extent and duration of incident this would be a direct impact or inhalation by fauna of a local gas leak. Impact would be to the local ecosystem only.		2	1	2	The area around each drill pad is cleared and a vegetation buffer maintained. There is a chance that fauna may be directly impacted due to their unpredictable nature and movements.
		Air pollution.	2	3	6	As in a remote area the impacts of air pollution would be minimal and dissipated by the larger clean air surrounding. As the PVGF sits on top of a ridge with no close stakeholders, impacts would be minimal.		2	2	4	The main component released during a well control event will be gaseous hydrocarbons. Due to remote location and lack of other industrial sources of air pollution in the area, the cumulative impact of these effects will be minimal. There is a chance of direct impact with avifauna or migratory birds in the area. However, this is unpredictable and outside of the control of CP, the emergency response plan aims to mitigate any unpreventable accidents.
4. Rehabilitation	• Infrastructure not removed • Top soil not re-spread or re-distributed adequately • Contaminated sites not remediated • Soil profile dissimilar to surrounding profile • Erosion and sedimentation controls not installed following DENR and IECA best practise guidelines • Compacted soils not ripped or scarified to allow infiltration	Loss of top soil.	4	4	16	This risk evaluation is based on long term impact potential from leaving the site un-rehabilitated. There is uncertainty in the risk rating based on the unpredictable state that PVGF may be left in post closure if there is no rehabilitation.	• All infrastructure removed after closure of PVGF • Photo point monitoring established before disturbance and continued after to identify any areas requiring further rehabilitation work • Follow up photo point monitoring and vegetation surveys to monitor successful rehabilitation of sites • If no successful re-growth of vegetation after 12 months, active re-seeding with local seed mix investigated • All sites rehabilitated in accordance with this FEMP • Security bond held by the DPIR to conduct rehabilitation measures in the case that CP is not able to. • Ensure all contaminated sites are remediated • No outstanding action items remain on the incident register	2	2	4	Acceptable as employment of good top soil management will have a high success rate. Any non-conformances or loss of top soil notice in follow up rehabilitation audits can be remediated as required
		Erosion and sedimentation	4	4	16	Long term stability of the site is dependent on soil stability and lack of erosion and sedimentation issues. High certainty in impacts if present, lower certainty in if impacts will occur. Area is not prone to erosion as has been seen evident through extensive survey effort of the area by LES>		2	2	4	Guidelines developed by DENR and the IECA have a high success rate if developed and implemented correctly. Inspection following the first wet season or significant rainfall event will locate any areas requiring further attention to reach 100% effectiveness. These measures will influence the success of all other environmental aspects impact by rehabilitation hazards

Hazard	Causes	Potential Impacts and receptors	Risk Analysis C	L	Risk Rating	Valuation and Uncertainty	Mitigation Measures	Residual Risk C	L	Risk Rating	Acceptability
	and establishment of vegetation	Altered hydrology	3	3	9	Local hydrology has been altered due to development of hardstands and process areas. If not returned to as close as possible once rehabilitated these have the potential for long term damage. Uncertainty as there are limited well defined drainage courses in the vicinity of PVGF	• disturbance and continued after to identify any areas requiring further rehabilitation work • Ensure all disturbed surfaces no longer active; undergo rehabilitation in conformance to rehabilitation plan outlined in this FEMP. • Erosion and sediment control devices installed where necessary in conformance with the DENR and IECA guidelines • Vegetation survey conducted before disturbance to provide baseline reference to determine post revegetation success. • All compacted hardstands and laydown areas deep ripped to encourage infiltration and water retention. • Pre-rehabilitation earthworks survey • Remove any fauna found within areas requiring heavy earthworks	2	1	2	PVGF has been in operation since the 1980s, and changes to hydrology from the establishment of roads, hardstands and drill pads have resulted in minimal impacts to the surrounding hydrology or the Finke River. Following DENR and IECA principles and the mitigation measures outlined in this FEMP will ensure that there are minimal impacts to hydrology. Follow up surveys used to reduce uncertainty in this analysis
		Lack of vegetation re-growth.	4	4	16	Uncertainty due to level of compaction across site, rainfall conditions and available seed in surrounding area.		2	2	4	A majority of vegetation regrowth in central Australia is from root stock. If surfaces are left in the conditions prescribed in this FEMP then adequate water should be retained to encourage new growth. Follow up surveys to determine vegetation success and potential active re-vegetation techniques.
		Loss of fauna habitat	3	3	9	As a secondary impact due to erosion or altered hydrology, high uncertainty as it is based on follow on impacts from other impacts of rehabilitation lack of.		2	1	2	The new disturbance and loosening of soil will likely =create new fauna habitat. Survey conducted prior to and closure activities will reveal if any fauna habitat may be impacted by the rehabilitation works.
		Native fauna	2	3	6	Largely uncertain as to how fauna would react to un-rehabilitated site. Evidence form other relic mine sites suggest that faun make new homes in un-rehabilitated areas. Potential positive.		2	2	4	Less mobile species potentially impacted by use of heavy machinery, however this risk is acceptable due to the unpredictability of fauna. All staff trained in identification of fauna and the pre-rehabilitation audit to determine if any fauna residing in the area
5. Introduction and spread of weeds, invasive species, and diseases	• Contaminated fill • Machinery carrying weed seeds or pathogens • Spread into disturbed areas	Infection of soil with diseases and pathogens.	3	3	9	Uncertain due to unknown source of fill and potential for pathogens transported.	• Any fill sourced from weed free area and approved for use by DPIR before being brought on site • Disturbed areas checked for emergence of weeds, and removed or dealt with in accordance with DENR and WoNS guidelines	2	1	2	Soil disease and pathogens are not prevalent in the NT; fill would have to come from outside the NT for this to be a risk. Screening of any fill brought to site and the source location will reduce this risk to an acceptable level.

Hazard	Causes	Potential Impacts and receptors	Risk Analysis C	L	Risk Rating	Valuation and Uncertainty	Mitigation Measures	Residual Risk C	L	Risk Rating	Acceptability
		Infestation of weeds in cleared areas	3	4	12	High certainty if weeds are brought onto site, they quickly establish in disturbed areas.	• Any sand and fill materials removed at the completion of operations • Photo monitoring before and after any disturbance • Vegetation survey conducted before and after any disturbance or clearing operations to determine if new noxious species present • Vehicle and machinery to undergo weed free check and compliance before mobilisation to site • Bi-annual environmental survey and photo point monitoring of OL3 area to check for prevalence of weed species • Annual weed map updated based on surveys/audits • Weed control actions taken at a level appropriate to NT Weeds branch advice (DENR) depending on NT declared weed classification (Class A, B or C) and Weeds of National Significances (WoNS) • Follow CP policy Weed Management Plan	2	1	2	Constant monthly monitoring of the OL3 area will quickly identify weeds and allow them to be removed before an infestation begins.
		Native flora	4	4	16	High certainty as weeds and invasive species are known to out-compete native species, particularly in recently disturbed areas, i.e. after clearing or fires.		2	2	4	If weed species are removed using chemical spraying then the area will be difficult for new native vegetation to grow in for some time. Follow-up surveys will refine the impacts of weed removal of the potential for future vegetation re-growth
		Native fauna	4	3	12	Weed and invasive species are known to impact the habitat of naïve fauna, due to changed fire regimes and food.		2	1	2	If weed management techniques are carried out as per recommendation of the DENR and care is used during spraying any weeds with chemicals, there is minimal chance of impacting native fauna. Follow up survey and incidental observations to determine if any noticeable impacts to fauna.
		Hydrology	4	3	12	Weeds transport readily along water course due to available water source and transport mechanism. In many areas, Todd River (Mexican Poppy) and Finke (Athel Pine), weed infestation have become widespread, altering the channel flow and water movement. Low likelihood due to ephemeral nature of water course and distance removed from the Finke River.		2	2	4	Weed species can become readily established in watercourse, due to water supply. Monthly removal and control of weeds will ensure that infestations do not spread. If weeds present in watercourse need to ensure that the weed have not spread outside of the OL3 area.
6. Wastes	• Hazardous wastes and chemicals not removed at end of use • Waste receptacles not adequately secure • Wastes not removed frequently enough, overfill • Inappropriate disposal of wastes oil or chemicals	Contamination of soil	4	4	16	Potential for leachate from waste stockpiles onto ground if not bunded, uncertainty due to type of wastes stored and location. Low rainfall will reduce potential for leachate forming and transported.	• All waste removed by licensed contractor at end of use • Clean-up materials and wastes appropriately contained for off-site disposal • All waste disposed of in animal proof bins, in designated areas • Program in place to minimise the volume of wastes generated. • Maintenance of mandatory waste records including type and volumes. • Routine removal of wastes as required	2	1	2	All waste removed and soil remediated as documented in the RCCA.
		Contamination of surface water	3	3	9	Due to ephemeral hydrology and location of waste storage outside of any watercourse increased certainty.		2	1	2	If all contamination is removed or contained in bunded areas for rehabilitation any impacts to surface water will be contained in the bunded area and able to be treated on site by the grey water system.

Hazard	Causes	Potential Impacts and receptors	Risk Analysis C	L	Risk Rating	Valuation and Uncertainty	Mitigation Measures	Residual Risk C	L	Risk Rating	Acceptability
	• Waste not stored in bunded area if required • Unauthorised onsite disposal • Waste not separated and stored appropriately	Contamination of groundwater	3	2	6	More certainty due to nature of groundwater in the area being at depth and with fractured rock.	• Ensure all hazardous waste material are separated in the appropriate area for disposal according to SDS and this FEMP • All waste generated away from the main area, to be brought back and placed in on-site waste receptacle • Vehicles cleaned out daily for any waste accumulated throughout the day • Licensed contractor used for off-site disposal • Sewage treated and solids disposed off-site by licensed contractor, with water released into rubble drains onsite • Grey water tested and used for dust control. • All chemical, oils and hazardous material stored in bunded area; sufficient for 110% of all material • No waste or hazardous material stored with potential for over flow impact on water courses • No unauthorised disposal of wastes • All visitors must be accompanied by CP staff whilst on site • All contractors inducted into this FEMP and CP policy's • Community consultation with affected stakeholders currently accessing the property on third party business separate from CP • NT EPA waste discharge license and stakeholder approval before any waste disposed outside of licensed facility • Solid wastes such as scrap wood, metal, packaging and litter segregated and stored in covered rubbish skips for offsite recycling or disposal by waste management contractor.	1	1	1	Due to nature of groundwater and quick response time to remediate any spill or leak of hazardous material in routine inspections. There is a low risk of surface spills of hazardous material impacting on groundwater.
		Native flora	3	2	6	Uncertainty due to location of waste interaction with environment. Waste storage areas are in disturbed environments		2	2	4	All care taken to avoid impacts to native flora from waste material spills, however in the case of an accidental spill or leak flora may be impacted through direct contact. However, this risk is acceptable due to the emergency response plan and the low density of flora in the area.
		Native fauna	3	2	6	Potential for fauna to habituate around waste, potential to breed disease or be infected. Uncertainty in type of disease may be present or type of waste ingested.		2	2	4	All care taken to avoid impacts to native fauna from waste material spills, however in the case of an accidental spill or leak fauna may be impact through direct contact. However, this risk is acceptable due to the emergency response plan and the low population of fauna in the area.
		Visual amenity	2	2	4	High certainty due to remote location of site		2	1	2	PVGF is remote from any population centre, all mate3rials contained and stored as per this FEMP, there will be no loss of visual amenity for surrounding stakeholders.
		Increased predator and pest species	3	4	12	Potential due to creation of food sources if bins not made faun proof, high certainty that it will attract predator and pest species due to bugs and previous results from other operations with open waste facilities in remote locations.		2	2	4	Predator species will be attracted to organic wastes. Ensuring bins are predator proof and there is no chance for predator to scavenge has reduced this risk to acceptable. Monthly and bi-annual surveys of the OL3 area will reduce the uncertainty in this rating.

Hazard	Causes	Potential Impacts and receptors	Risk Analysis			Valuation and Uncertainty	Mitigation Measures	Residual Risk			Acceptability
			C	L	Risk Rating			C	L	Risk Rating	
7. Hazardous material	• Lack of appropriate bunding around storage and refuelling areas • Inappropriate storage of fuel, oil or chemical containers • Inappropriate handling of fuel, oil or chemicals during use	Contamination of soil,	3	3	9	Small amount of hazardous materials located on site, in general central locations. If spill near bunded area, lower risk as in disturbed area, higher risk if spill occurs during transport in an undisturbed area. Uncertainty in location, amount and type of material spilled. See hazardous material register for each chemical risk assessment storage location and amount.	• Drip trays used for re-fuelling • All chemical, oils and hazardous material stored in bunded area; sufficient for 110% of all material • Containers and bunded areas routinely checked to ensure no leaks. • Fuel, oil and chemical storage areas appropriately segregated, labelled and bunded, as required. • No waste or hazardous material stored with potential for over flow impact on water courses • All contractors and staff made aware of location of waste receptacles around the site • All staff trained and inducted into the storage, handling and transport of hazardous wastes • All staff trained and inducted into the storage, handling and transport of hazardous wastes • Clean-up/Spill kits in all relevant areas.	2	2	4	Small spills or contamination of soil likely during transport, handling or re-fuelling process. These are acceptable as any major leak or spill would be contained. Remediation of any soil contamination reduces the consequence of this hazard on soil
		Contamination of surface water	3	2	6	As above		2	2	4	Break or failure of bunding may occur in coincidence with large rainfall events, with the potential to impact hydrology in the area. The emergency response plan and updates of weather forecast will reduce this uncertainty and allow for forward planning to ensure bunding is intact and secure. Area receives low annual rainfall (<300mm per year) and as such impacts would be sporadic
		Contamination of groundwater	3	2	6	As above, depth of groundwater unlikely to impact.		2	2	4	Bunding to contain all hazardous material. Any bunding failure to be picked up during routine inspection and remediated as soon as possible. Groundwater at sufficient depth and in fractured rocks, difficult for penetration in small quantities
		Native flora	3	4	12	As above		2	2	4	All care taken to avoid impacts to native flora from hazardous material spills, however in the case of an accidental spill or leak flora may be impacted through direct contact. However, this risk is acceptable due to the emergency response plan and the low density of flora in the area.

Hazard	Causes	Potential Impacts and receptors	Risk Analysis			Valuation and Uncertainty	Mitigation Measures	Residual Risk			Acceptability
			C	L	Risk Rating			C	L	Risk Rating	
		Native fauna	3	3	9	As above		2	2	4	All care taken to avoid impacts to native fauna from hazardous material spills, however in the case of an accidental spill or leak fauna may be impact through direct contact. However, this risk is acceptable due to the emergency response plan and the low population of fauna in the area.
8. Remediation - Waste hazardous liquids, materials and spills not properly remediated	• Incidents not recorded in RCCA • Incidents on the RCCA not closed out • Adequate contaminated site assessment and remediation measures not conducted	Contamination to soil, water, flora and fauna causing fatalities and loss.	4	4	16	Potential for off-site migration on hazardous spills not remediated, transported through surface run-off. Depends on rainfall and location of spill. Risk assessment based on worst case, however uncertain due to above mentioned comments.	• Any incident, spill or leak recorded in the RCCA register for close out • RCCA register checked daily to track progress of any incidents and remediation progress • All staff trained in the appropriate handling of all hazardous materials on site • Any spill or leak of hazardous liquid or material recorded in the RCCA, reported to the PVGF site manager and to the DPIR as soon as possible or within 24hrs depending on the incident • A contaminated site investigation carried out by independent third party, with GPS reference point and photo monitoring established • Remediation measures recommended, actioned and recorded. • Follow-up photo monitoring • No item on the RCCA left open	2	1	2	Comprehensive incident close-out records and procedures reduce the risk of any contamination left un-remediate
		Contamination to off-site receptors	3	3	9	Uncertain due to climatic conditions following that will impact on the distribution of the spill off-site, or if it will break down in-situ. Also, it depends on the type of fluid released.		2	1	2	Comprehensive incident close-out records and procedures reduce the risk of any contamination left un-remediate
9. Fire	• Spill of flammable hazardous substance • Change in climatic conditions • Increased ignition sources • Open flames • Bushfire	Loss of native flora	4	2	8	Uncertainty exists in this risk rating in duration and intensity of fire. The spatial extent and intensity of fires in the environment is governed by climatic conditions and available fuel loads. PV gas field does not have a flare or flare pit as part of routine operations.	• Combustible materials stored in designated areas with acceptable fire breaks (as per FESA/DPIR requirements). • SDS available next to flammable material • Monitor weather websites and latest fire danger warnings from government websites • Assign designated smoking areas with appropriate bins for cigarette disposal • Only diesel vehicles used in operations • Ensure vegetation stockpiles are stored away from ignition sources and in low profile mounds	2	2	4	Risk acceptable as all measures possible have been taken to reduce increase hazard of fire from activities at PVGF. There is still the risk that there will be a bushfire that impacts on flora within the PVGF, all appropriate mitigation measures have been taken to reduce the severity of consequences within the PVGF and emergency response plan details methods for handling bushfires

Hazard	Causes	Potential Impacts and receptors	Risk Analysis			Valuation and Uncertainty	Mitigation Measures	Residual Risk			Acceptability
			C	L	Risk Rating			C	L	Risk Rating	
		Destruction of native fauna habitat	4	2	8	Depending on intensity and location of fire this risk may be lower. Often fires in central Australia are low intensity and have minimal impact on local flora and fauna; however, a more intense fire can have devastating impacts on fauna habitat	• No open flames outside of designated areas • Assign designated smoking areas with appropriate bins for cigarette disposal • Fire breaks maintained to a minimum of 4 m around any infrastructure • Adequate fire equipment maintained and located on-site; personnel trained in its use. • Fire drills and emergency response drills conducted regularly	2	2	4	Any bushfire in the area caused from natural sources or external third-party ignition will likely impact on native fauna habitat, the severity of these impacts will be determined by intensity, duration and spread of fire. The emergency response plan aims to minimise the negative impacts of fire on fauna habitat where possible
		Native fauna mortality	3	2	6	Based on low mobility fauna, potential to impact more mobile species however this is depending on fires location and intensity. Uncertainty due to unpredictable nature of fire.		3	1	3	Impacts outside of the control of CP, fire likely to impact on less mobile fauna. Fire breaks and cleared areas around the well heads, CTP and CCS can act as refuge for fauna during fire.
10. Increased use of the OL3 area by introduced and predator species	• Standing water sites left unfenced • Food sources available	Increase introduced species	3	3	9	Most introduced species present are also predator species, due to the rocky nature of the PVGF area there are few introduced herbivores. The increase in predator species will be determined through on-going monitoring	• All standing water fenced, with top wire unbarbed for avifauna • Standing water removed if no longer required for safe operation of PVGF • All waste disposed of in animal proof bins, in designated areas • No feeding fauna policy • All food stored inside or in sealed containers	2	2	4	Due to the rocky location introduced species will be restricted to more mobile fauna, e.g. cats and foxes. Bi-annual monitoring will reduce the uncertainty in this risk rating by determining presence of and if numbers are increasing. Elimination of food and water sources will greatly reduce habituation of introduced species at PVGF.
		Increased predator species	4	3	12	Increased predator species places increased pressure on less mobile native species in the area. This risk analysis is reasonably certain due to studies done in other areas (REF), however the long-term impacts of increased predator species would need to be monitored at each site, as increased numbers of predators may not be able to survive once the food source (local prey) is exhausted or severely impacted on.		2	2	4	Insects attracted to lighting and open water sources may still attract avifauna predators which will place an increased pressure on smaller fauna species in the OL3. However, their impact on native fauna will be minimal, bi-annual surveys will reduce uncertainty in this assessment and determine if further measures are required.

Hazard	Causes	Potential Impacts and receptors	Risk Analysis			Valuation and Uncertainty	Mitigation Measures	Residual Risk			Acceptability
			C	L	Risk Rating			C	L	Risk Rating	
		Increase of predator and introduced species into quarantine areas, i.e. Finke Gorge National Park	5	3	15	The Finke Gorge National Park is an important refuge for conservation significant and endemic species, any unnatural increase in predator species or increase in introduced species could severely impact on the preservation of these environmentally sensitive aspects. The impacts of introduced and predator species on fauna and flora (herbivores) has been well researched, however impacts at individual species level will vary and the risk given here is for the worst case on the most impacted species.		4	1	4	There is a low likelihood that an increase in predator species within the PVGF would lead to an increase in the Finke Gorge National Park. However due to the sensitivities of the Park, the consequences would be high. The National Park is maintained by Rangers who have an introduced fauna removal plan, to control any increase within the National Park.
11. Ignition sources	• Increased traffic use • Vegetation stockpiles	Loss of vegetation	4	4	16	Increased ignition sources increase the likelihood of bushfires occurring. The amount of vegetation lost through bushfires is dependant of vegetation growth prior to fire and the intensity and duration of the fire event. A high vegetation cover will generally result in high fuel loads, if this is coupled with a fire during hot dry and windy conditions the amount of vegetation loss will increase. However, a fire during cooler months with low vegetation growth can often be easily controlled and have minimal damage and even provide beneficial results in reducing future fuel load levels.	• Fire breaks maintained to a minimum of 4 m around any infrastructure • Adequate fire equipment maintained and located on-site; personnel trained in its use. • Fire drills and emergency response drills conducted regularly • Fire breaks maintained to a minimum of 4 m around any infrastructure	4	1	4	See Hazard ID 9. All potential ignition sources at PVGF have been controlled. Still a risk of human error resulting in an unplanned and unapproved fire. Fire and emergency response plan to manage these risks.
		Loss native fauna	4	2	8	During intense bushfires less, mobile native fauna species could be fatally affected. The increase in ignition sources has the potential to increase frequency and intensity of fires in the area.		3	1	3	All potential ignition sources at PVGF have been controlled; impact from fire caused from PVGF activities on native fauna is acceptable. Fire response and emergency response plan to control any accidental fire.

Hazard	Causes	Potential Impacts and receptors	Risk Analysis C	L	Risk Rating	Valuation and Uncertainty	Mitigation Measures	Residual Risk C	L	Risk Rating	Acceptability
		Loss of native fauna habitat	4	3	12	This is an indirect consequence of fires caused through an increase in potential ignition sources. The impact on loss of top-soil from fire is related to amount of ground cover lost and following climatic conditions, i.e. heavy rain following versus light rains which would increase new vegetation growth thus increasing soil stability. Therefor the impacts to soil stability are uncertain.		3	1	3	All potential ignition sources at PVGF have been controlled; impact from fire caused from PVGF activities on native fauna habitat is acceptable. Fire response and emergency response plan to control any accidental fire.
12. Fauna Strike	• Unpredictable movement of animals • Vehicles travelling at high speeds • Vehicles travelling at dawn or dusk or in times of poor visibility	Fauna death or injury	3	4	12	Due to the unpredictability of fauna movement there is always a risk of fauna strike when travelling at times of poor visibility and high fauna activity. This risk will be dependant of travel time, location and general abundance of fauna in the area. Fauna numbers in the arid environment fluctuate due to conditions.	• Ensure vehicles are inspected regularly and have working lights and/or spot lights. • No off road driving • Limit vehicle speeds to 60km/h and 10km/h around camp and facilities, except in the event of an emergency • Limit vehicle activities to daylight hours when fauna are more visible and only drive at night if absolutely necessary or in the event of an emergency	3	1	3	Individual species potentially still impacted due to the unpredictable movement of fauna. All reasonable preventative measures have been taken to reduce the likelihood of impacts.
13. Erosion and Sedimentation	• Flow concentration points not removed • Final landform dissimilar to surrounding landscape • Poor top soil management • Change in natural waterways and drainage channels • Compacted soils not uncompacted to allow infiltration	Loss of top soil.	4	2	8	Top soil is crucial for the ongoing development of vegetation in the OL3 area and surrounds, any occurrence of erosion or sedimentation will remove top soil. The extent and distribution of the removed top soil is uncertain and depends on the extent of erosion or sedimentation. This uncertainty will be reduced through routine monitoring of the site and early identification of any erosion or sedimentation processes.	• Ensure all surface are rehabilitated in conformance with this FEMP and following best practise guidelines by DENR and IECA • Install erosion and sedimentation devices where appropriate following DENR and IECA best practise guidelines • Remove any erosion gully heads • Remove all flow concentrations points • Re-assess all rehabilitated surface following first significant wet season and fix as appropriate • Return all disturbed landforms to as close as possible the natural terrain Manage top soil stockpiles in accordance with DENR guidelines to ensure viable seed stock for repatriation • Restore all drainage channels and water course to their original alignment and elevation • Ensure all surface are rehabilitated in conformance with this FEMP and following best practise guidelines by DENR and IECA • Install erosion and sedimentation devices where appropriate following DENR and IECA best practise guidelines	3	1	3	Small loss of top soil may still be possible due to bare open ground directly after disturbance or rehabilitation activities. Acceptable due to arid environment, there are naturally times when there will be minimal groundcover. Preserving topsoil as outlined will have maximum success of preventing top soil loss.
		Loss of soil stability.	3	2	6	Unmitigated erosion severely reduces the stability of soil, through top soil and sub soil loss. It can have flow on effects impacting a large area from an initial small gully or rill. Due to extensive past survey efforts by LES and the length of operations at PVGF, erosion has been identified to have a low potential in the OL3 area due to good management and soil types present		3	1	3	DENR and IECA guidelines provide industry best practise methods for ensuring soil stability. Potential high impacts if stability lost bi-annual survey to pick up any area requiring further touch ups.

Hazard	Causes	Potential Impacts and receptors	Risk Analysis			Valuation and Uncertainty	Mitigation Measures	Residual Risk			Acceptability
			C	L	Risk Rating			C	L	Risk Rating	
		Loss of flora and fauna habitat.	3	2	6	High certainty in the risk analyse due to past quarterly surveys of the site and no impacts evident due to routine operations.	• Deep rip compacted areas	2	2	4	Erosion and changed hydrology will be biggest impacts on flora and fauna habitat. These should be adequately contained following mitigation measures in this FEMP. Bi-annual monitoring will determine if there are any impacts for changed hydrology on flora and fauna habitat.
		Diverting natural run-off to downstream receptors and waterways.	3	2	6	High certainty in the risk analyse due to past quarterly surveys of the site and no impacts evident due to routine operations.		3	1	3	Any water diverted will be redistributed back into existing watercourses where possible. Bi-annual survey to determine if changed hydrology is affecting downstream receptors and alter management accordingly.
		In filling of existing waterways	4	3	12	Due to high stability of soils on site and good management practises conducted so far and reiterated in this FEMP, there is a low risk that there will be impacts to watercourse due to routine activities at PVGF		3	1	3	No large erosion or sediment movement noted on surveys by LES at PVGF to date. If PVGF and the OL3 are maintained as prescribed in this FEMP there is an acceptable level of risk for in filling of surrounding watercourses.
14. Indigenous and/or non-indigenous heritage sites	• Onsite indigenous heritage sites not previously determined during ethnographic study	Damage to indigenous heritage sites	4	2	8	Extensive surveys involving TOs and heritage and archaeological consultants have been carried out over the whole site prior to clearing. There is a high level of certainty that there are no indigenous heritage sites that will be disturbed during normal operations or suspension.	• Sites located, clearly marked with all staff made aware and instructed to avoid indigenous cultural areas. • Consultation with the CLC – adherence to exclusion and restricted work areas. • Personnel trained in local cultural/ heritage sensitivities during induction	3	1	3	All sites in operation have been surveyed and any object identified and placed in a restricted area or removed. Potential for damage to existing or yet discovered heritage site through accident. Emergency response plan in place to deal with such an incident and consultation with CLC and relevant government department
		Damage to non-indigenous heritage sites	4	2	8	Extensive surveys involving TOs and heritage and archaeological consultants have been carried out over the whole site prior to clearing. There is a high level of certainty that there are no non-indigenous heritage sites that will be disturbed during normal operations or suspension.		3	1	3	All sites in operation have been surveyed and any object identified and placed in a restricted area or removed. Potential for damage to existing or yet discovered heritage site through accident. Emergency response plan in place to deal with such an incident and consultation with relevant government department

Hazard	Causes	Potential Impacts and receptors	Risk Analysis			Valuation and Uncertainty	Mitigation Measures	Residual Risk			Acceptability
			C	L	Risk Rating			C	L	Risk Rating	
15. Gas flaring	• Flaring required during operations	Contribution to global greenhouse gas emissions (with associated "knock-on" effects, i.e. global warming)	2	2	4	Flaring is not a routine operation at the PV Gas Field. Greenhouse gas emissions are recorded, calculated and submitted under the *National Greenhouse and Energy Reporting Act* (NGER Act)	• Obtain approval from DPIR and FESA during restricted burn periods for flaring. • If a flare pit is required for non-routine operations such as drilling ensure flare pit is constructed to best practise principles • Minimise volume of gaseous wastes to be flared where possible	2	2	4	Amount of flaring required is minimal as the majority of excess gas is used to run PVGF. Monitoring of gas to flare ratio and ensuring a sparker is present reduces gas release to the atmosphere and incomplete combustion
		Bushfire	2	3	6	Area around gas flare pit is cleared of vegetation and combustible material. No hazardous materials or flammable material is stored or transported close to the flare pit. Use of flare pit is remotely monitored from the Brewer Estate complex, should any unusual activity occur staff will be immediately dispatched to site to control any event. Weather and climatic conditions are monitored daily to avoid flaring during period of high velocity hot dry winds.		2	1	2	Flare pit contained in suitable bund with all combustible material removed from at least a 4 m buffer around the pit. Impacts controlled through emergency response plan and fire response plan, see Hazard ID 9 for more details on fire control.
16. Contamination in flare pit	• Incomplete combustion • Spill or leak in hydrocarbons transported or stored next to flare pit	Contamination of soil, surface water or groundwater.	2	1	2	Soil contamination is unlikely due to the fact that there is not recorded history of liquid hydrocarbons in this field. Gas flaring combustion is monitored to determine if any contamination is likely to be present.	• Volume of gas to flare monitored and flame adjusted to maintain full combustion • Measures to ensure flare pit does not lose combustion, e.g. pilot light, automatic sparker • Flare pit bunded to contain flame. • Regular inspection of the flare pit to determine if contamination occurring • No transport or storing of hydrocarbon material within 25m of flare pit	2	1	2	Monitoring of gas to flare ratio ensure full combustion. Impurities in gas to flare may result in incomplete combustion of certain components which may lead to atmospheric contamination, inspections will reveal any contamination and it will be remediated accordingly.
		Loss or damage to local flora and fauna	2	2	4	Flare pit is a pit with high walls to contain flaring and any contamination that may occur. There is small likelihood that fauna will access the flare pit and come into contact with any contamination. Ongoing monitoring will reduce this uncertainty by determining actual numbers entering.		2	1	2	No native flora in the flare pit or within 4 m of flare pit. Contamination in flare pit would be remediated as discovered and so would not propose a long-term potential for impacts to native flora. Fauna ingress into the pit is highly unlikely due to gas flaring activities, however still a possibility. Inspection of the flare pit to occur monthly during suspension and more frequently during operation.

Hazard	Causes	Potential Impacts and receptors	Risk Analysis			Valuation and Uncertainty	Mitigation Measures	Residual Risk			Acceptability
			C	L	Risk Rating			C	L	Risk Rating	
17. Traffic	• Movement of heavy machinery on public roads	Inconvenience to local landholders, residents and other road users	2	4	8	The main access to the site is along the one public road servicing Hermannsburg and surrounding pastoralists. Therefore, any increase in traffic along this section of the road will directly impact residents and surrounding stakeholders. However, the population at Hermannsburg is low (~625 (Census, 2011))	• Due to remote location, traffic volume is minimal. • General area has a low population density and is removed from the closest densely populated area • Consult with surrounding stakeholders when major operation will occur	2	2	4	Low populated area, traffic volume is low; peak traffic period is during the winter months associated with tourist using the Mereenie loop road. Adequate stakeholder consultation will ensure all traffic using the road is aware of expected high traffic activity to PVGF.
18. Visual Amenity	• Disorganised storage and appearance of PVGF • Areas no longer required not rehabilitated within PVGF	Disturbance to local stakeholders	1	3	3	OL3 is in a remote area not directly visible to any surrounding populated places or stakeholders. There is low uncertainty in this risk rating	• Store all hazardous substances in central locations • Ensure containers are sealed and without leaks • Ensure all spills or leaks are remediated • Store in appropriate bunding • Remote location, not directly visual impacting surrounding stakeholders • Areas no longer required rehabilitated within 6 months of completion	1	1	1	Remote location not directly visible to the public or local stakeholders. All waste and equipment on site stored orderly and contained on site.
19. Noise and Vibrations.	• Noise generated during routine operations	Disturbance to local native fauna	2	2	4	OL3 is in a remote area with low noise and vibrations during normal operations. There is low uncertainty in this risk rating	• General area has low population density and is remote from high density populations e.g. Ntaria. • Consult with surrounding land users • Maintain noise complaints register • Clearing works conducted during daylight hours • All vehicles and equipment maintained and regularly serviced	2	2	4	There have been no identified impacts to local native fauna from operational noise at PVGF from survey work by LES to date.
20. Facility Lighting	• Artificial lighting required for safety during 24-hour operation	Disturbance to local native fauna	2	2	4	OL3 is in a remote area with only minimal lighting used for safe operation of the site. There is low uncertainty in this risk rating	• General area has a low population density and is removed from the closest densely populated area • Effects will be highly localised	2	2	4	There have been no identified impacts to local native fauna from operational noise at PVGF from survey work by LES to date.
21. Fugitive Emissions	• Wear and tear of gas pipe fittings	Contribution to global greenhouse gas emissions (with associated "knock-on" effects, i.e. global warming)	2	3	6	Any gas leak is detected through remote monitoring of gas flows and routine monthly plant inspection of all pipe fittings. Any fugitive emission is quickly identified and remediated. Fugitive greenhouse gas emissions are recorded, calculated and submitted under the *National Greenhouse and Energy Reporting Act* (NGER Act)	• Routine maintenance of flow lines and joints or high stress points	2	2	4	Continual monitoring of the gas field and flow lines from Brewer estate will quickly identify any leaks or fugitive emission from PVGF

15.14 Appendix 14. Licences.

Potable Water transport

NORTHERN TERRITORY GOVERNMENT

DEPARTMENT OF HEALTH

Environmental Health Central Australia

Postal Address:
PO Box 721
ALICE SPRINGS NT 0871

T 08 8955 6122
E EnviroHealthCA@nt.gov.au

VARIX PTY LTD
PO BOX 7801, ALICE SPRINGS NT 0870

Rego. No.: 2018/1732EH
Risk Class.: 2 - Medium

Dear VARIX PTY LTD,

RE: REGISTRATION OF A FOOD BUSINESS

Trading Name: **Wanna Lift? Crane Hire**
Premises Address: **8 Coulthard Court, ALICE SPRINGS NT 0870**
Registration Due: **25 June 2019**

Please find enclosed your Certificate of Registration for the above business registered in accordance with section 70 of the NT *Food Act 2004*. Please note the conditions of registration under which the food business can trade. Please note that under the *Food Act 2004* the following applies:

Display of notice of registration

- Your certificate of registration must be displayed in a conspicuous place in each trading location.
- Any person transporting or selling food away from the registered premises must be able to produce a copy of the certificate of registration when requested.

Variation of conditions of registration

- If any particulars on the certificate of registration change, you must notify this office of the changes; this may include, trading location, nature of food handling.

Selling or closing your food business

- If you sell, close or cease to operate your business in any way, you must notify this office with the relevant details.
- Registration of a food business is not transferable to another proprietor.

Please note that approval to operate a food business within the terms of *Food Act 2004* is in no way to be construed as approval from other Northern Territory Government agencies or building certifiers.

Environmental Health Central Australia
26 June 2018

www.health.nt.gov.au

Waste and Produced water transport

ntepa Northern Territory Environment Protection Authority

ENVIRONMENT PROTECTION LICENCE

(Pursuant to section 34 of the *Waste Management and Pollution Control Act*)

Licensee	J.J. Richards and Sons Pty Ltd
Licence Number	**EPL164**
Registered Business Address	J.j. Richards And Sons Pty Ltd 3 Grant Access Cleveland QLD 4163
ABN	40 000 805 425
Premises Address	Lot 04918 Town of Alice Springs Plan(s) S 75/019 (70 Elder St, Ciccone)
Anniversary Date:	23 September
Commencement Date:	23/09/2015
Expiry Date:	22/09/2020
Scheduled Activity	Schedule 2, Part 2, Item 3
Licenced Activity	Operating **premises**, other than a sewage treatment plant, associated with collecting, transporting, storing, re-cycling, treating or disposing of a **listed waste** (as per Table 1) on a commercial or fee for service basis.

Description

Page **1** of **14**

ntepa Northern Territory Environment Protection Authority

ENVIRONMENT PROTECTION LICENCE

(Pursuant to section 34 of the *Waste Management and Pollution Control Act*)

Licence Details

Licence Number:	**EPL105-06**
Commencement Date:	28 November 2013
Expiry Date	27 November 2018

Licensee Details

Legal Entity Name:	J.J. Richards & Sons Pty Ltd
ABN:	40 000 805 425
ACN:	000 805 425
Registered Business Address:	3 Grant Street CLEVELAND QLD 4163
Postal Address:	PO BOX 235 CLEVELAND QLD 4163
Contact Person:	Kurt Whalan
Position Title:	General Counsel (Environment)
Contact Details:	
b/h:	07 3488 9600
fax:	07 3488 9681
email:	kurt.whalan@jjrichards.com.au

24 hour emergency response

Contact Person:	Kurt Whalan
Position Title:	General Counsel
Telephone Numbers:	
b/h:	07 3488 9600
mobile:	0478 306 760

Licensed Activity

An activity of the type identified in Item 2 and 3, Part 2, Schedule 2 of the Act as outlined below and as authorised by Table 1.

(2) Collecting, transporting, storing re-cycling, treating or disposing of a listed waste on a commercial or fee for service basis, other than in or for the purpose of a sewage treatment plant.

(3) Operating premises, other than a sewage treatment plant, associated with collecting, transporting, storing, re-cycling, treating or disposing of a listed waste on a commercial or fee for service basis.

EN2013/0087~0064

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