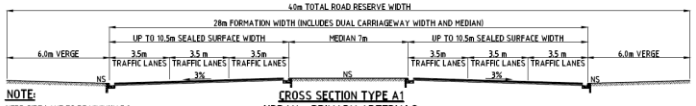
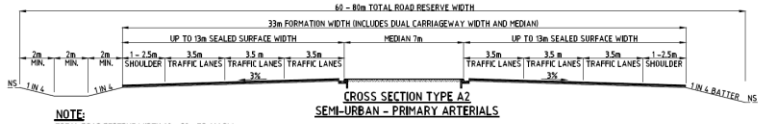
Appendix A Typical Cross Sections For Urban and Rural Environments (NTG, Sept 2017)



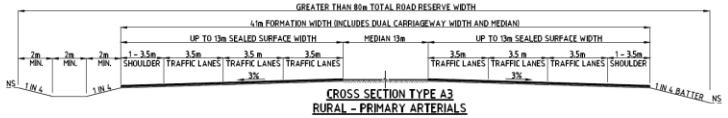
NOTE:
KERB SIDE LANE TO BE MINIMUM 5.0m WIDE DURING STAGE CONSTRUCTION

CROSS SECTION TYPE A1
URBAN - PRIMARY ARTERIALS



NOTE:
TOTAL ROAD RESERVE WIDTH 60 - 80m TO ALLOW FOR SIDE DRAINS AND POSSIBLE SERVICES. SHOULDERS TO BE SEALED, MINIMUM 1.0m.

CROSS SECTION TYPE A2
SEMI-URBAN - PRIMARY ARTERIALS



CROSS SECTION TYPE A3
RURAL - PRIMARY ARTERIALS

URBAN ENVIRONMENT

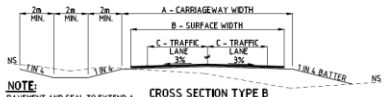
TYPICAL CROSS SECTIONS - URBAN ENVIRONMENT

ROAD CLASSIFICATION	AUSTROAD CLASS	TYPE CROSS SECTION	FORMATION (DUAL CARRIAGEWAY)	TRAFFIC LANES		SEAL WIDTH (m)	COMMENTS
				WIDTH (m)	SURFACE		
URBAN - PRIMARY ARTERIALS:							
URBAN	CLASS 6	TYPE A1	28.0	UP TO 3 x 3.5	SEALED	UP TO 10.5 EACH WAY	KERB SIDE LANE TO BE MINIMUM 5.0m WIDE DURING STAGE CONSTRUCTION. TOTAL ROAD RESERVE WIDTH 40m
SEMI - URBAN	CLASS 6	TYPE A2	33.0	UP TO 3 x 3.5 EACH WAY	SEALED	UP TO 13.0 EACH WAY (INCFULL WIDTH SHOULDER SEAL	SHOULDER TO BE SEALED MINIMUM 1.0m. TOTAL ROAD RESERVE WIDTH 60 -80m TO ALLOW FOR SIDE DRAINS AND POSSIBLE SERVICES.
RURAL	CLASS 6	TYPE A3	41.0	UP TO 3 x 3.5 EACH WAY	SEALED	UP TO 14.0 EACH WAY (INCFULL WIDTH SHOULDER SEAL)	SHOULDER TO BE SEALED MINIMUM OF 1.0m. PAVEMENT & SEAL TO EXTEND A MINIMUM OF 1.0m IN TO THE MEDIAN. TOTAL ROAD RESERVE WIDTH GREATER THAN 80m

TABLE AS PER THE DEPARTMENT'S POLICY FOR STANDARD ROAD CROSS SECTIONS - APRIL 2015 - VERSION 1.0

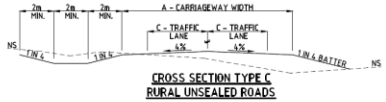
URBAN ENVIRONMENT NOTES:
1. REFER TO LOCAL GOVERNMENT GUIDELINES FOR URBAN SUB ARTERIALS (6000-12000 VPD), URBAN DISTRIBUTOR (LESS THAN 6000 VPD) AND URBAN COLLECTOR (LESS THAN 3000 VPD) ROADS.
2. REFER TO DEPARTMENT GUIDELINES FOR URBAN LOCAL AND URBAN SUBDIVISION REQUIREMENTS.

GENERAL NOTES:
1. REFER TO STANDARD DRAWING CS3002 FOR SHEET 1.



NOTE:
PAVEMENT AND SEAL TO EXTEND A MINIMUM OF 1.0m IN TO THE MEDIAN. SHOULDERS TO BE SEALED, MINIMUM 1.0m.

CROSS SECTION TYPE B
RURAL SEALED ROADS



CROSS SECTION TYPE C
RURAL UNSEALED ROADS

RURAL ENVIRONMENT

TYPICAL CROSS SECTIONS - RURAL ENVIRONMENT

			A	C		B	
ROAD CLASSIFICATION	AUSTROAD CLASS	TYPE CROSS SECTION	CARRIAGE WAY WIDTH (m) (INCLUDING MEDIAN)	TRAFFIC LANES		SEAL/ GRAVEL WIDTH (m)	COMMENTS
				WIDTH (m)	SURFACE		
RURAL - NATIONAL HIGHWAY	CLASS 1	TYPE B	11.0	2 x 3.5	SEALED	8.0	NATIONAL STANDARDS UNDER REVIEW. SEAL WIDTH MAY BE INCREASED TO 9.0m DEPENDING ON LOCAL ISSUES
RURAL ARTERIAL AND SECONDARY ROADS	CLASS 3	TYPE B	10.0	2 x 3.5	SEALED	8.0	> 1000 VPD - 20 YEAR PROJECTED VOLUMES, SEE NOTE 1
	CLASS 4	TYPE B	9.0	2 x 3.0	SEALED	7.0	< 500 VPD - 20 YEAR PROJECTED VOLUMES, SEE NOTE 1
	CLASS 4	TYPE C	9.0	2 x 3.0	GRAVELLED	6.0	SEE NOTE 2
RURAL - LOCAL	CLASS 5	TYPE B	9.0	2 x 3.0	SEALED	7.0	FOR UNSEALED ROADS A 9.0m CARRIAGEWAY MAY BE APPROPRIATE IF FUTURE SEALING IS FORESEEABLE. SEE NOTE 2.
		TYPE C	8.0	2 x 3.0	GRAVELLED	6.0	
RURAL - SUBDIVISIONS	REFER TO CS3002						REFER TO DEVELOPMENT GUIDELINES BY THE TRANSPORT INFRASTRUCTURE PLANNING DIVISION.
PASTORAL ACCESS ROADS							
PASTORAL 1	CLASS 5	TYPE C	4.0	1 x 4.0	FORMED	-	SINGLE USER ACCESS
PASTORAL 2	CLASS 5	TYPE C	6.0	1 x 6.0	FORMED	-	MULTI USER ACCESS FOR UP TO 3 PROPERTIES
PASTORAL 3	CLASS 5	TYPE C	8.0	2 x 3.0	GRAVELLED	6.0	PROVIDES ACCESS TO GREATER THAN 3 PROPERTIES

TABLE AS PER THE DEPARTMENT'S POLICY FOR STANDARD ROAD CROSS SECTIONS - APRIL 2015 - VERSION 1.0

RURAL ENVIRONMENT NOTES:
1. FOR PREDICATED FUTURE VOLUMES OF 500 - 1000 VPD THE STANDARD WILL DEPEND ON TRAFFIC MIX (NUMBERS OF ROAD TRAINS/CARAVANS/BUSES) AND TOPOGRAPHY AND WILL BE ASSESSED ON A CASE BY CASE BASIS. SEAL WIDTHS MAY ALSO BE INCREASED DEPENDING ON LOCAL ISSUES SUCH AS SEASONAL VARIATIONS (TOURISM) AND ENVIRONMENT.
2. THE DECISION IN REGARD TO SEALED VERSUS GRAVEL STANDARD FOR A PARTICULAR ROAD WILL DEPEND ON FACTORS SUCH AS PROPOSED USE (IE HORTICULTURAL), ENVIRONMENT, PREDICTED USE AND THE LIKE AND SHOULD BE REFEREED TO TRANSPORT INFRASTRUCTURE PLANNING DIVISION.

No	DESCRIPTION	DATE	NAME	DEPT/COMPANY
0	ISSUED AS A STANDARD DRAWING	SEPT 2017	J.LEESON	EES/DIPL

AMENDMENTS

WARNING
BEWARE OF UNDERGROUND SERVICES.
THE LOCATIONS OF UNDERGROUND SERVICES ARE APPROXIMATE ONLY AND THEIR EXACT POSITION SHOULD BE PROVEN ON SITE. NO GUARANTEE IS GIVEN THAT ALL EXISTING SERVICES ARE SHOWN.

DRAWN J.LEESON	DATE MAR 2017	CHECKED S.HATZI	DATE MAR 2017
DESIGNED J.LEESON	DATE MAR 2017	CHECKED S.HATZI	DATE MAR 2017
DESIGN LEADER S.HATZI	DATE 1/09/2017	DESIGN DIRECTOR S.JACKSON	DATE 1/09/2017

Northern Territory Government

STANDARD DRAWINGS
TYPICAL CROSS SECTIONS

TYPICAL CROSS SECTIONS
FOR URBAN AND RURAL ENVIRONMENTS

FILE No	ASSET No	SHEET No	DRAWING No	AMEND	SHEET SIZE
-	-	2 OF 2	CS3003	0	A1

Appendix B Weed Management Plan

BEETALOO BASIN EXPLORATION PROJECT

Weed Management Plan

Review record

Rev	Date	Reason for issue	Author	Reviewer	Approver
0	05/10/2018	Issue for release	A Court	M Kernke	M Hanson
1	29/03/2019	Issue for release	A Court	M Kernke	M Hanson
2	20/05/2019	Minor Update	A Court	M Kernke	M Hanson

Review due: 29/03/2022

Weed Management Plan

NT-2050-15-MP-0016

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Table of figures

List of tables

Review due: 29/03/2022

List of appendices

1. Introduction

1.1 Objectives of the WMP

This WMP has been developed to ensure that the risk of weed introduction and spread, resulting from activities associated with Origin Exploration activities are mitigated to protect the economic, community, industry and environmental interests of the Territory.

The plan provides an overview of:

- The project context (Section 2)
- Legal requirements in relation to weed management (Section 3)
- The appointment of a Dedicated Weed Officer (Section 4)
- Identified risks and proposed mitigation measures and management objectives (Section 5 and 6)
- The weed species that are considered likely or known to occur within the Permit Area (Section 6 and 7)
- The Annual Action Plan for those species that are known to occur with the Permit Area (Section 8)
- Control options for species known to occur within the Permit Area (Section 8).
- The monitoring, notification, recording and reporting requirements for the WMP (Sections 9 – 12).

This plan is supported by Appendices that provide guidance on how to identify weed species in the field and collect the necessary data to support the monitoring and reporting requirements of this WMP.

The location of the proposed exploration activities are shown on Figure 1.

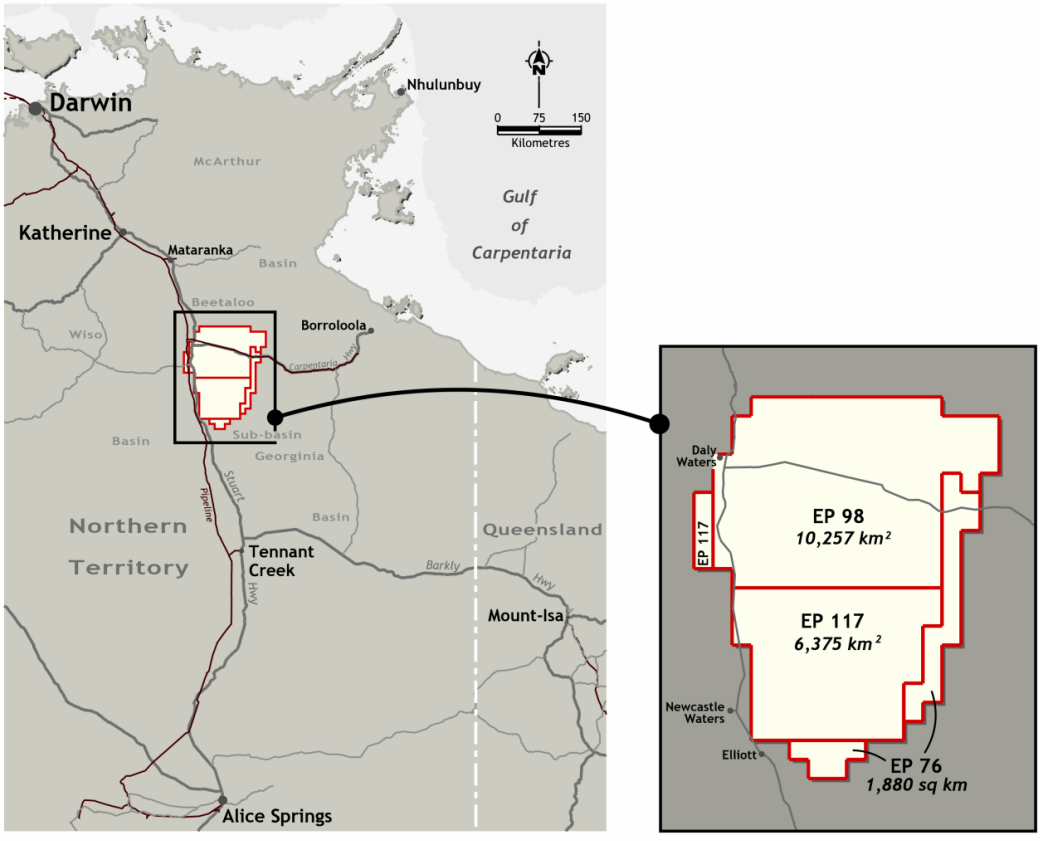

Figure 1 Location of Origin Permit Area

1.2 Intent of the WMP

Weed control is considered to be a significant land management issue in the Northern Territory. This Weed Management Plan (WMP) forms a core component of Origin's overarching environmental management strategy and supports the various project Environmental Management Plan (EMP's).

The movement of rigs, vehicles, machinery and other materials to, from and within the exploration permit area may result in weeds being moved around the pastoral lease, into the lease from surrounding areas or interstate, depending on where the vehicles and materials are sourced from or returned to.

The focus of this WMP is therefore to ensure that infestations are eradicated, or at the very least that existing weed infestations are controlled such that no further weed species colonise the permit area as a result of Origin's activities.

This document is based upon the Weed Management Planning Guide - Onshore Shale Gas Development Projects produced by the Department of Environment and Natural Resources (2018).

2. Project Context

This plan covers all civil, drilling, stimulating, rehabilitation and routine maintenance/monitoring activities undertaken by Origin within permit EP76, EP98 and EP117 as detailed in Table 1. The proposed activities for the 2019/2020 program are highlighted within the table.

Table 1 Coordinates of centroid of proposed exploration lease areas

Exploration Permit	Lease Name	Zone*	Easting	Northing
EP98	Velkerri 98 E1-	53	415515	8180683
EP98	Velkerri 98 N1	53	392292	8189891
EP98	Kyalla 98 W1	53	364955	8177458
EP76	Velkerri 76 S1	53	424362	8113273
EP76	Velkerri 76 S2	53	435488	8136321
EP117	Kyalla 117 N2	53	356175	8137500
EP117	Stuart Highway Intersection	53	332371	8135170
EP117	Velkerri 117 E1	53	428861	8120782
EP117	Kyalla 117 W1	53	368079	8106696

Grey shading are planned sites for 2019/200

** Universal Transverse Mercator (UTM) geographic coordinate system is Geocentric Datum of Australia (GDA) 94.*

The primary activities subject to this WMP are:

- Access track construction, use and maintenance
- Exploration lease pad construction, use and maintenance
- Gravel pit construction and maintenance
- Drilling, stimulating, completing and maintaining petroleum exploration wells
- Routine access, maintenance and monitoring of all exploration areas subject to this plan.

3. Legal Requirements

The following presents the relevant legislation and statutory obligations for the project.

3.1 Northern Territory Petroleum (Environment) Regulations

Petroleum Act 2016, Petroleum (Environment) Regulations 2016 and Code of Practice for Petroleum Activities with in the Northern Territory

The *Petroleum Act 2016* provides legal framework within which persons are encouraged to undertake effective exploration for petroleum and to develop petroleum production so that the optimum value of the resource is returned to the Territory. It regulates the exploration for, and production of petroleum, including environmental protection measures which should be employed during exploration and production activities, including protection of parks and reserves and rehabilitation.

In addition, the Act is supported by the *Petroleum (Environment) Regulations 2016*).

The *Petroleum (Environment) Regulations 2016* requires that regulated activities are carried out in a manner consistent with the principles of ecologically sustainable development, and by which the environmental impacts and environmental risks of the activities are identified and reduced to an acceptable level.

The Code of Practice for Petroleum Activities in the Northern Territory is a mandatory code of practice for the petroleum industry to ensure that petroleum activities in the Northern Territory are managed according to minimum acceptable standards to ensure that risks to the environment can be managed to a level that is as low as reasonably practical (ALARP) and acceptable.

Under these regulations Origin is required to submit an EMP prior to any petroleum exploration or production activity.

EMP's must include:

- potential environmental risks or impacts (in this instance relating to the introduction and spread of weeds);
- appropriate environmental outcomes, environmental performance standards and measurement criteria;
- appropriate implementation strategy and monitoring, recording and reporting arrangements; and
- demonstrate that there has been an appropriate level of engagement with directly affected stakeholders in developing the plan.

This WMP is designed to support and implement the requirements of Origins Project Specific Environmental Management Plans.

3.2 Northern Territory Weeds Management Act

The aim of the *Weeds Management Act (2013)* is 'to protect the Territory's economy, community, industry and environment from the adverse impact of weeds'.

The purpose of the Act, as defined in section 3, is:

- To prevent the spread of weeds in, into and out of the Territory and to ensure that the management of weeds is an integral component of land management in accordance with the Northern Territory Weeds Management Strategy 1996 – 2005 or any other strategy adopted to control weeds in the Territory.
- To ensure there is community consultation in the creation of weed management plans.
- To ensure that there is community responsibility in implementing weed management plans.

The Act identifies declared weeds (those which must be controlled) and provides a framework for weed management. It includes the following weed declaration classes:

Class A – to be eradicated
Class B – growth and spread to be controlled
Class C* – Not to be introduced into the Northern Territory
** All Class A and B weeds are also Class C.*

The Act enables the relevant Minister to approve statutory weed management plans. Management obligations in these plans must be adhered to.

Currently there are statutory management plans for 10 high priority weed species in the Northern Territory.

The WMP must address weeds in accordance with their declaration status and the statutory requirements of any relevant weed management plans.

3.3 Regional Weed Management Plans

Regional Weed Management Plans (RWMP) have been developed for areas of the NT, with the Barkly and the Katherine RWMP overlapping Origin's Beetaloo exploration tenure. the aim of these regional plans is to assist in prioritising weed management by:

- identifying the region's priority weeds and associated pathways of spread to inform management priorities
- identifying landscapes that may need prioritised protection from weed impacts like river corridors or sacred Aboriginal sites
- containing information on alert weeds that are not yet found in the region, but could become major issues if they establish

3.4 Commonwealth Environment Protection Biodiversity Conservation Act

The objectives of the *Environment Protection and Biodiversity Conservation (EPBC) Act* (1999) are, among other things:

- provide for the protection of the environment, especially those aspects of the environment that are matters of national environmental significance; and
- promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources; and
- promote the conservation of biodiversity; and
- promote a co-operative approach to the protection and management of the environment involving governments, the community, land-holders and indigenous peoples; and
- assist in the co-operative implementation of Australia's international environmental responsibilities.

The *EPBC Act* provides for the identification and listing of key threatening processes. A threatening process is defined as a key threatening process if it threatens or may threaten the survival, abundance or evolutionary development of a native species or ecological community. Key threatening processes include invasive species, such as weeds, which have a major impact on Australia's environment, threatening our unique biodiversity and reducing overall species abundance and diversity (DOTEE 2018).

4. Dedicated Weed Officer

As per recommendation 8.3 of the Scientific Inquiry into Hydraulic Fracturing Stimulation there must be a dedicated Weed Officer for each gas field.

The Weed Officer must have relevant skills and experience and availability to successfully manage weed related issues for the project, including:

- Knowledge of the biology/ecology of local weeds.
- Knowledge of relevant weed management frameworks including Northern Territory legislation and plans, the *EPBC Act*.
- Understanding of existing weed management arrangements being undertaken by landholders.

The Weed Officer is responsible and accountable for delivery of all weed related requirements of the project in accordance with the WMP and the overarching Environmental Management Plan, including:

- Planning and execution of weed monitoring requirements, including baseline weed assessments and ongoing monitoring both during periods of gas related activities as well as during the target identification period of February to May.
- Facilitate training all workers (including contractors) in weed management requirements, with support from the Northern Territory Government Regional Weed Officer - Onshore Shale Gas Development.
- Oversight of implementation of weed control mechanisms including but not limited to wash-downs and proactive weed control programs.
- Ensuring all reporting requirements are met.
- Act as the designated point of contact for and rapidly responding to any weed related complaints and incidents in accordance with the pre-determined strategies in this WMP and additional strategies as required developed in consultation with the Regional Weed Officer - Onshore Shale Gas Development and affected landholders.
- Review and update of WMP's to remain effective in communication with relevant landholders and Regional Weed Officer - Onshore Shale Gas Development in consideration of monitoring results and emerging weed issues for both gas and pastoral operations.

Origin has appointed **Robert Wear, Construction Superintendent** as the dedicated Weed Officer of the Beetaloo Exploration Activities.

5. Weed Species Information

Weed surveys completed in august 2018 indicates the abundance of weeds within the proposed project area is low. *Hyptis suaveolens* (Hyptis), was identified along the access track to the proposed Velkerri 98-E1-1 site, whilst Gamba Grass (*Andropogon gayanus*) is also known to be in the broader region and is used by some Pastoralists in the region for wet season pasture. The pastoral properties using Gamba would be required to control the growth and spread to neighbouring areas (NTG, 2000).

Previous surveys within the permit area completed in 2014, 2015 and 2016 also confirmed the presence of Hyptis in the vicinity of the Carpentaria Highway near Velkerri 98 N1-2 (previously known as Amungee NW-1) site. *Parkinsonia aculeata* (Parkinsonia) and *Calotropis procera* (Rubber Bush) have been previously identified along/in close proximity to the Beetaloo access track. Parkinsonia is considered a Weed of National Significance (WoNS), which are weed species that are the focus of national management programs for the purpose of restricting their spread and/or eradicating them from parts of Australia. These species are specifically presented in Table 2 and Section 8.

Figure 2 illustrates the weeds species confirmed in the region during field surveys, along with other weed species that are known to occur or likely to occur within the wider exploration Permit Areas. This information is based on.

- Origin exploration program weed survey data (2014-2018 results)
- Mapping data provided by the Weed Management Branch, DENR.
- Guidelines for the *Management of the Weeds of Beetaloo 2018* (DLRM et al 2018).
- Barkly and Katherine Regional Weed Management Plans (RWMP)
- Department of the Environment and Energy (DOTEE) EPBC Act Protected Matters Report database.

Table 3 has been separated into priority weeds, RWMP alert species and other species previously identified in the area. Priority weed species are considered higher risk of being introduced or spread through the following criteria:

- Weed species that has been confirmed in the area within the relevant RWMP or through field surveys.
- Weed species listed in a RWMP that is in close proximity to Origin tenure.
- Weed species that are at risk of introduction through the use of machinery sourced from other regions in the NT or from other states.

Alert weed species are identified under the Katherine and Barkley RWMP. These species are not yet naturalised in the region, but have the potential to have a high level of impact to the region should it become established. The likelihood of the species naturalising and spreading in the region is perceived to be high (Department of Land Resource Management 2015).

It is noted that Parthenium (*Parthenium hysterophorus*) is a major problem in rangelands and cropping areas of Queensland and is estimated to cost farmers and graziers more than $22 million a year in reduced production and increased management costs. Vehicle, machinery and material movements from Queensland into the project area present a risk of spread of Parthenium if not managed correctly (Department of Primary Industry and Resources 2016).

Additional mapped locations of weeds within the Barkly and Katherine RWMP are provided in Figure 3 and Figure 4.

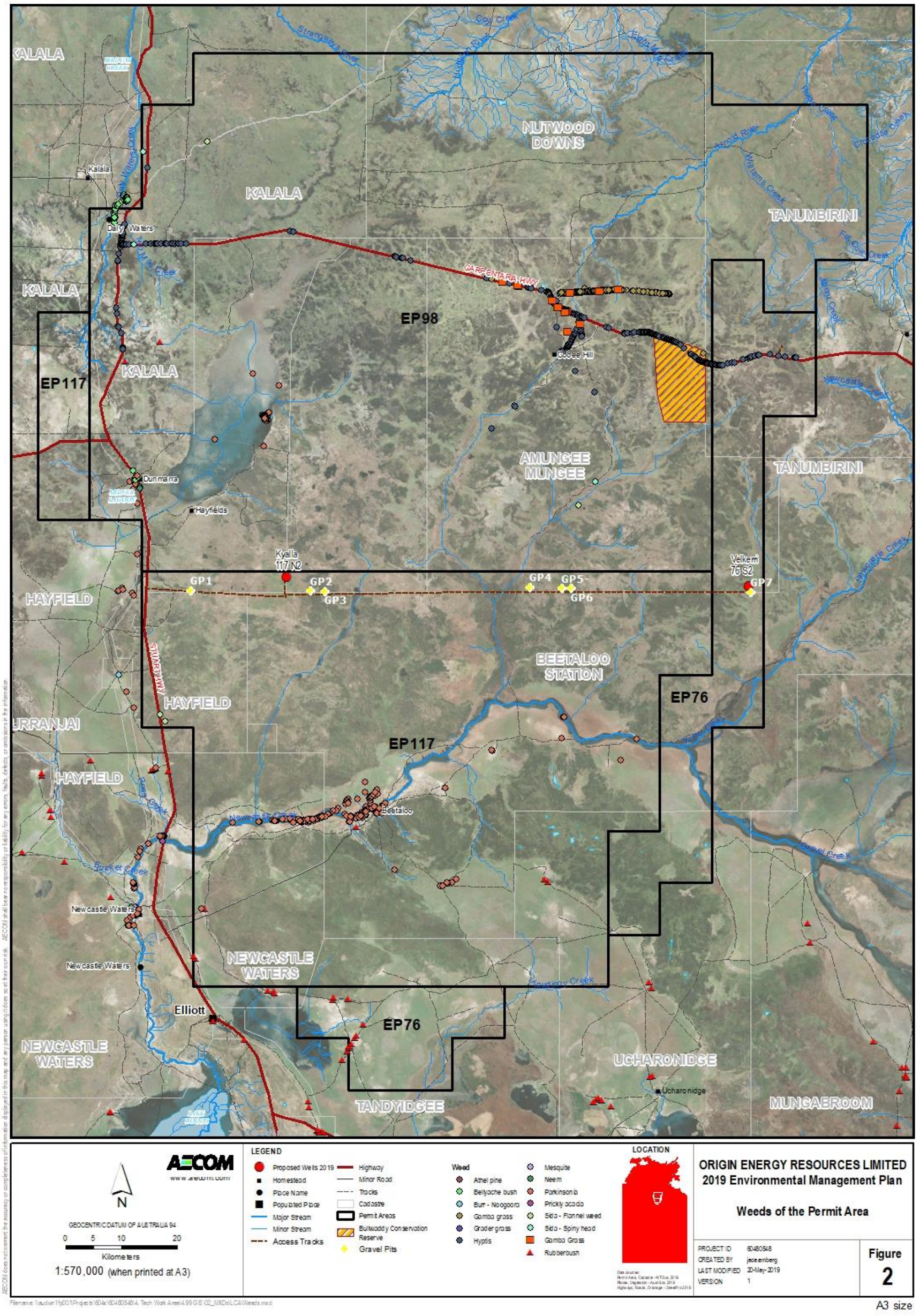

Figure 2 Location of Weeds Species in Permit Areas

Review due: 29/03/2022

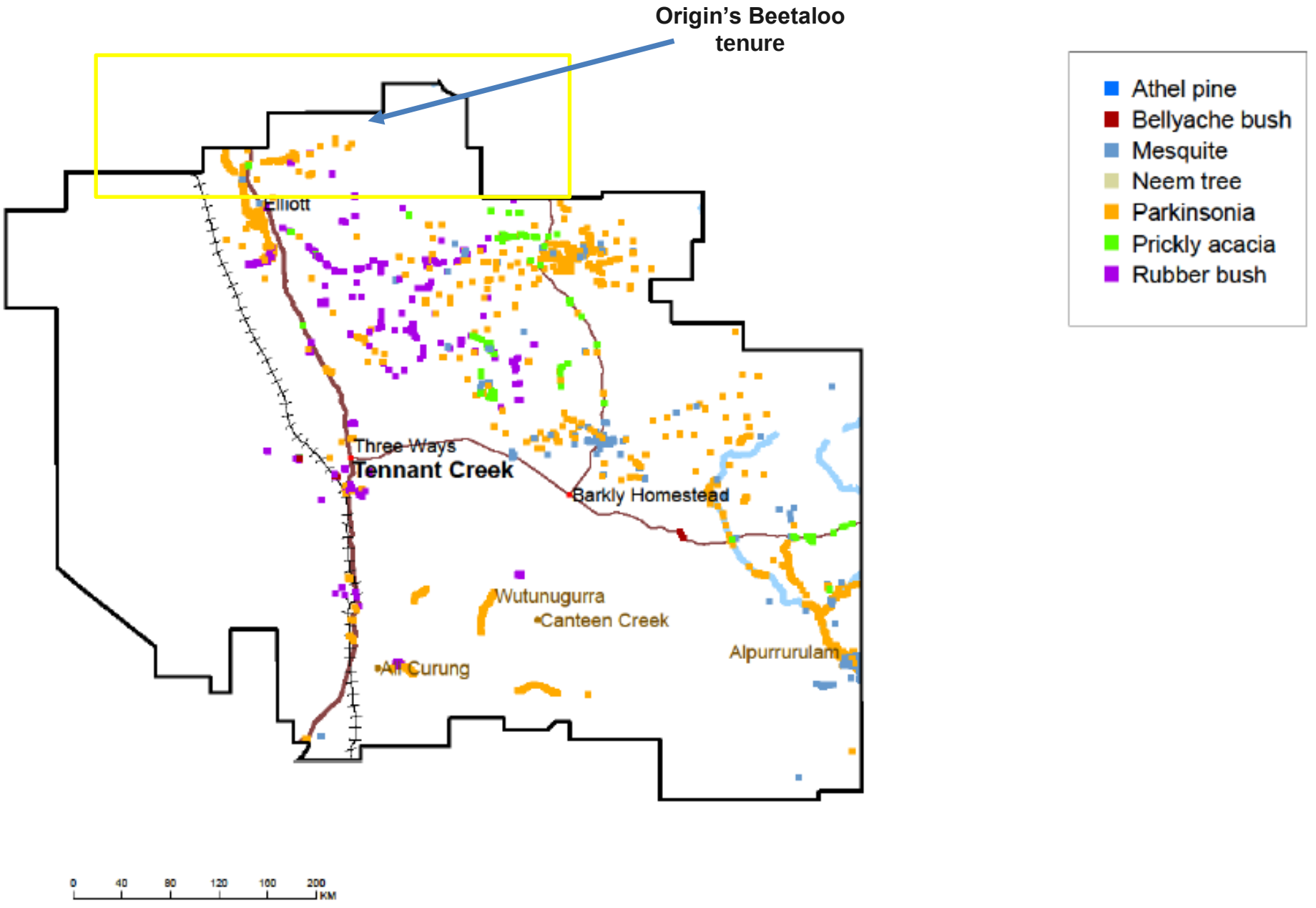

Figure 3 Barkly RWMP mapped priority weed locations

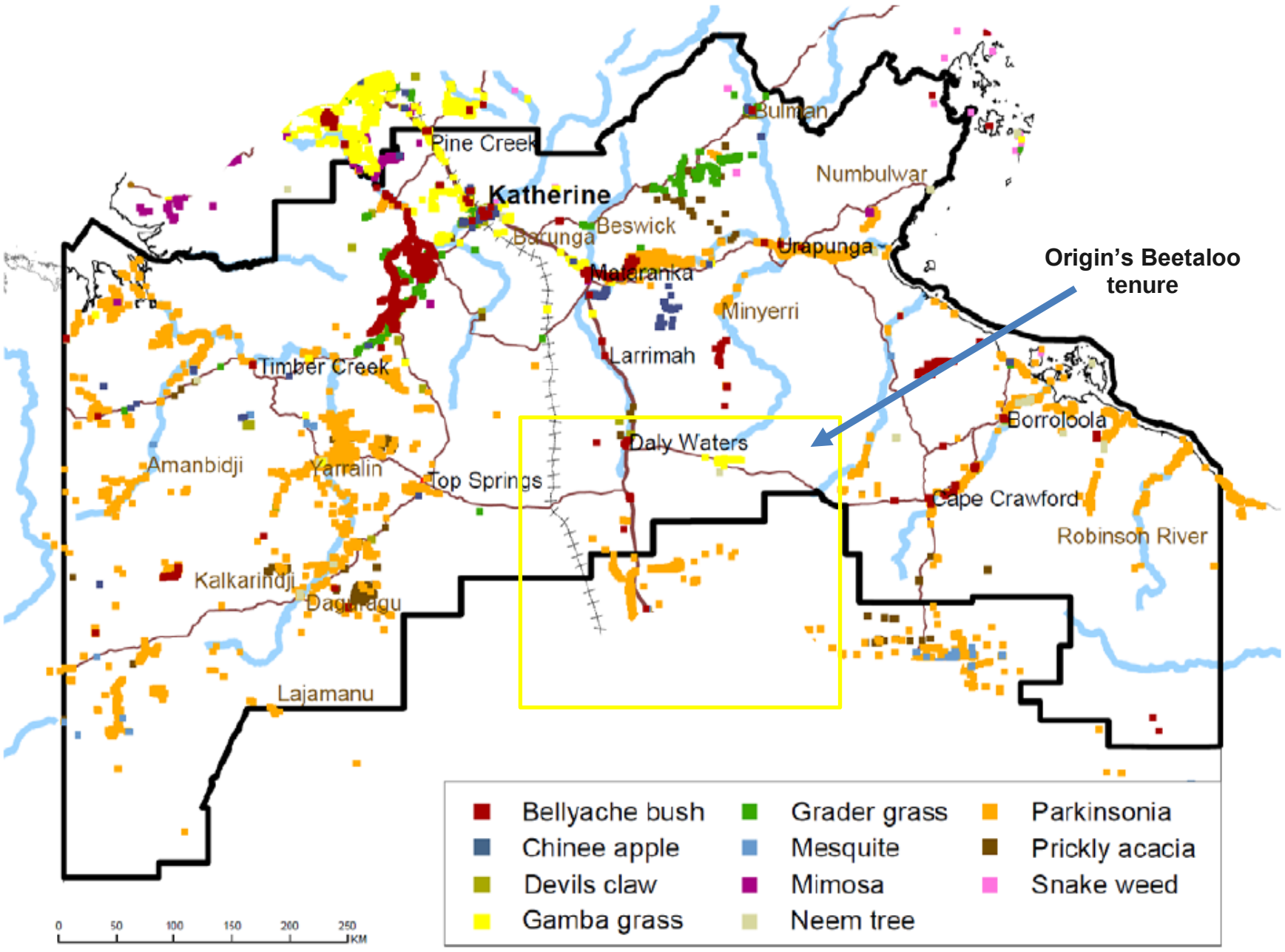

Figure 4 Katherine RWMP mapped priority weeds

Table 2 NT listed weeds known of likely to occur within the Permit Area

Scientific Name	Common Name	Status	Data Source
Priority Weed Species			
Acacia nilotica	Prickly Acacia	Class A, WoNS	Mapped in the exploration lease within the Katherine RWMP
Andropogon gayanus	Gamba Grass	Class A WoNS	Confirmed within exploration lease. High potential introduction through sourcing of equipment from Katherine and Darwin area.
Calotropis procera	Rubber Bush	Class B and C	Mapped in the exploration lease within the Barkly RWMP
Hyptis suaveolens	Hyptis	Class B and C	Confirmed within exploration lease during previous weed Origin surveys
Jatropha gossypiifolia	Bellyache Bush	Class A, WoNS	Mapped in the exploration lease within the Katherine RWMP. Potential introduction through sourcing of equipment from Katherine area.
Parkinsonia aculeata	Parkinsonia	Class B and C, WONS	Confirmed within exploration lease during previous weed Origin surveys and Mapped in the exploration lease within the Katherine RWMP. Potential introduction through sourcing of equipment from Katherine area.
Prosopis pallida	Mesquite	Class A and C, WONS	Mapped in the area surrounding exploration lease within the Katherine and Barkly RWMP
Themeda quadrivalvis	Grader Grass	Class B and C, WoNs	Confirmed within the exploration lease and mapped in the area within the Katherine RWMP. High potential introduction through sourcing of equipment from Katherine area.
Parthenium hysterophorus	Parthenium	Class A and Class C, WoNS	Confirmed by DENR to occur within the exploration lease. Potential introduction through equipment sourced from QLD.
Alert Species under RWMP			
Cenchrus setaceum	Fountain grass	Class B and C	Alert Species within the Barkly Region
Cryptostegia grandiflora	Rubber vine	Class A and C, WONS	Alert Species within the Barkly and Katherine RWMP
Chromolaena odorata	Siam Weed	Class C	Alert Species Katherine RWMP

Scientific Name	Common Name	Status	Data Source
Other species potentially found in region			
Alternanthera pungens	Khaki Weed	Class B and C	DLRM databases (DLRM *et al* 2018)
Azadirachta indica	Neem	Class B and C	Weed Management Branch – Mapping data
Cenchrus ciliaris	Buffel Grass	Not declared in NT	DOTEE Protected Matters Report
Cenchrus echinatus	Mossman River Grass	Class B and C	DLRM databases (DLRM *et al* 2018)
Datura ferox	Fierce Thornapple	Class A and C	DLRM databases (DLRM *et al* 2018)
Sida acuta	Spinyhead sida	Class B and C	Weed Management Branch – Mapping data
Sida cordifolia	Flannel Weed	Class B and C	Weed Management Branch – Mapping data DLRM databases (DLRM *et al* 2018)
Sida rhombifolia	Paddy's Lucerne	Class B and C	DLRM databases (DLRM *et al* 2018)
Xanthium occidentale	Noogoora Burr	Class B and C	Weed Management Branch – Mapping data DLRM databases (DLRM *et al* 2018)

Note: Declarations under the Northern Territory Weeds *Management Act 2013*:

6. Weed Introduction and Spread Risks

As part of the development of the EMP for this project, Origin has undertaken a preliminary assessment of the risk of introducing or spreading weeds in the project area. This assessment and the corresponding proposed mitigation measures and management objectives are presented in Table 3 below. Due to the low abundance of weeds within the proposed project area, management controls will primarily focus on preventing the introduction of weed species through appropriate equipment sourcing cleaning and inspection.

Table 3 Risk of weed introduction and spread and corresponding mitigation measures

Environmental Values	Maintain the integrity of significant ecosystems and agricultural productivity		
Management Objectives	Avoid the introduction of weeds Avoid the spread of existing weeds		
Measures Criteria	No introduction or spread of declared weeds resulting from Origins activities.		
Activity	**Potential Risks**		**Management Controls**
	Introduction of new weeds	**Spread of existing weeds**	
Vehicle and equipment movements	Vehicles and equipment sourced from other locations infested with weed species not found in or around Project Area	Traversing of weed infested areas with machinery	- Code of Practice for Petroleum Activities in the Northern Territory Part A- Surface Activities. - Activities will adhere to the guidelines within the NT Weed Management Handbook. - Weed management and control measures to be implemented in alignment with existing landholder biosecurity requirements. - All equipment will have certified equipment wash-down completed prior to entry to the field. Wash-down would occur at Contractors deport or a commercial wash facility prior to mobilisation in a manner that prevents pollution of the surrounding environment. - Machinery to be preferentially sourced locally, with machinery sourced from surrounding areas or Queensland being the 2nd and 3rd preferred option respectively. - Weeds will be actively controlled in cleared/ hardstand areas. - Major equipment moves will be planned from weed-free areas to infested areas and not the other way around. - Ensuring all material imported to or between sites is free of weeds.
Construction of access tracks and monitoring bore pads	Importing materials from areas where weeds are present and creating opportunities for weed species to colonise disturbed areas	Traversing of weed infested areas and creating opportunities for weed species to colonise disturbed areas	- Code of Practice for Petroleum Activities in the Northern Territory Part A- Surface Activities. - Activities will adhere to the guidelines within the NT Weed Management Handbook. - Weed management and control measures to be implemented in alignment with existing landholder biosecurity requirements. - All equipment will have certified equipment wash-down completed prior to entry to the field. - Ensure field staff, contractors and machinery operators are familiar with hygiene protocols and weed identification. - Machinery to be preferentially sourced locally, with machinery sourced from surrounding areas

Environmental Values	Maintain the integrity of significant ecosystems and agricultural productivity		
Management Objectives	Avoid the introduction of weeds Avoid the spread of existing weeds		
Measures Criteria	No introduction or spread of declared weeds resulting from Origins activities.		
Activity	**Potential Risks**		**Management Controls**
	Introduction of new weeds	**Spread of existing weeds**	
			or Queensland being the 2nd and 3rd preferred option respectively. - Weeds will be actively controlled in cleared/ hardstand areas. - Stabilise disturbed areas.
Drilling, stimulation and well testing	Introduction of weed species not found in or around EP area.	Traversing of weed infested areas with machinery	- Code of Practice for Petroleum Activities in the Northern Territory Part A- Surface Activities. - Activities will adhere to the guidelines within the NT Weed Management Handbook. - Weed management and control measures to be implemented in alignment with existing landholder biosecurity requirements. - All equipment will have certified equipment wash-down completed prior to entry to the field. Wash-down would occur at Contractors deport or a commercial wash facility prior to mobilisation in a manner that prevents pollution of the surrounding environment. - Ensure field staff, contractors and machinery operators are familiar with hygiene protocols and weed identification. - Weeds will be actively controlled in cleared/ hardstand areas. - Major equipment moves will be planned from weed-free areas to infested areas and not the other way around. - Drilling and stimulation equipment will be restricted to cleared lease areas. - Ensuring all material imported to or between sites is free of weeds.
Operational/ site management	Personnel unable to identify weeds or unaware of weed species present in areas where machinery and equipment is sourced from	Existing weed distribution not known due to: insufficient survey effort, surveys conducted at wrong time of year, surveyors not familiar with / unable to identify	- Code of Practice for Petroleum Activities in the Northern Territory Part A- Surface Activities. - Staff members responsible for preventing, identifying and managing weeds to be appropriately trained. - Weed desktop and field-based surveys to be provided to identify existing weed areas. - Pre-and post wet (February to May) inspections and periodic audits will be conducted to identify and report weed outbreaks.

Environmental Values	Maintain the integrity of significant ecosystems and agricultural productivity		
Management Objectives	Avoid the introduction of weeds Avoid the spread of existing weeds		
Measures Criteria	No introduction or spread of declared weeds resulting from Origins activities.		
Activity	**Potential Risks**		**Management Controls**
	Introduction of new weeds	**Spread of existing weeds**	
		declared weed species	
	Insufficient management control to prevent the introduction of weeds	Insufficient management control to prevent the spread of weeds	- Staff members responsible for preventing, identifying and managing weeds to be appropriately trained. - Ensure field staff, contractors and machinery operators are familiar with hygiene protocols and weed identification (Weed identification posters and the NTG Weed Deck will be made available) - Weeds will be actively controlled in cleared/ hardstand areas. - Weed management and control measures to be implemented in alignment with existing landholder biosecurity requirements. - New activities will be planned to address prevention of weed or non-indigenous plant spread.

7. Statutory Weed Management Plans

No statutory weeds have been identified during surveys of the Project Area, however the following plans apply to species that have been found/ could be potential found in the broader region.:

- Weed Management Plan for Athel pine (*Tamarix aphylla*)
- Weed Management Plan for Mesquite (*Prosopis* spp.)
- Weed Management Plan for Prickly Acacia (*Acacia nilotica*)
- Weed Management Plan for Bellyache Bush (*Jatropha gossypiifolia*)
- Weed Management Plan for Neem (*Azadirachta indica*)
- Weed Management Plan for Gamba Grass (*Andropogon gayanus*)
- Weed Management Plan for Grader Grass (*Themeda quadrivalvis*).

The weed management plans detail the legislated obligations of all land owners, land managers and land users in the Northern Territory to eradicate or manage and avoid further spread of the weed species. Conducting land management practices in accordance with the weed management plans will secure compliance with the requirements of the Act (Department of Land Resource Management 2015).

8. Annual Action Plan

An action plan for each of the weed species identified in the Project Area is presented in Table 4. Treatment options as contained in the Northern Territory Weed Management Handbook are presented in Section 8.1 to Section 8.3.

This section will be undated if new weed species are discovered over the life of the program to ensure that statutory requirements with relation to declaration status and relevant weed management plans are addressed (refer to Section 7)

As part of the 2019 Annual Weed Management Action Plan, Origin also commits to undertaking finer detailed weed mapping of all permit area, lease pads, access tracks and gravel pits, as well as any other areas disturbed as part activity.

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Table 4 Annual Weed Management Action Plan

Management objective	- Avoid the introduction of weeds - Avoid the spread of existing weeds			
Weed species	**Survey time/s**	**Treatment time/s**	**Control options**	**Where located**
Hyptis *Hyptis suaveolens*	6 monthly- pre-and post wet season	- Preferred Dec – Mar - Also Nov and April	Refer to section 7.1.	Beetaloo access track Access track to Velkerri 98-E1-1 site
Parkinsonia *Parkinsonia aculeata*	6 monthly- pre-and post wet season	- Preferred Mar – May - Also all year round	Refer to section 7.2.	Beetaloo access track
Rubber Bush *Calotropis procera*	6 monthly- pre-and post wet season	- Preferred October – March - April - July	Refer to section 7.3.	Close proximity to the Beetaloo access track

8.1 Hyptis (*Hyptis suaveolens*) treatment options

Table 5 includes herbicide and non-chemical treatment options for Hyptis *(Hyptis suaveolens) (*Northern Territory Government 2015).

Table 5 Hyptis *(Hyptis suaveolens)* treatment options

Weed Species	Hyptis *(Hyptis suaveolens)*		
Control Methods	**Chemical and concentration**	**Rates**	**Weed growth stage, method and comments**
Herbicides	**2, 4-D amine 625 g/L** Various trade names	320 mL / 100 L	**Seedling or adult (individuals or infestation):** Foliar spray - apply when actively growing.
	Glyphosate 360 g/L Various trade names and formulations	15 mL / 1 L	**Seedling or adult (individuals or infestation):** Foliar spray - apply when actively growing.
Non-chemical applications	- Manually remove all plant material; slash to encourage competition from desirable species.		

Source: Northern Territory Weed Management Handbook (Northern Territory Government 2015).

8.2 Parkinsonia (*Parkinsonia aculeata*) treatment options

Table 6 includes herbicide and non-chemical treatment options for Parkinsonia *(Parkinsonia aculeata) (*Northern Territory Government 2015).

Table 6 Parkinsonia *(Parkinsonia aculeata)* treatment options

Weed Species	Parkinsonia *(Parkinsonia aculeata)*		
Control Methods	**Chemical and concentration**	**Rate**	**Weed growth stage, method and comments**
Herbicides	**Aminopyralid 8 g/L + Triclopyr 300 g/L + Picloram 100 g/L** Grazon™ Extra	350 mL / 100 L or 3 L / ha	**Seedling (individuals and infestation)** Foliar spray – avoid spraying if plants are stressed or bearing pods – Uptake Spraying Oil required Foliar spray – plants up to 2 m or 2 years old - Uptake Spraying Oil required.
	Triclopyr 240 g/L + Picloram 120 g/L Access™	1 L / 60 L (diesel) 1 L / 60 L (diesel)	**Seedling or adult (individuals or infestation)** Basal bark < 5 cm stem diameter Cut stump > 5 cm stem diameter
	Tebuthiuron 200 g/kg	1.5 g / m2	**Seedling or adult (individuals or infestation)** Granulated herbicide - ground applied Do not use within 30 m of desirable trees or apply to continuous area > 0.5 ha. Do not use if fire is eminent. Apply when there is soil moisture or prior to rain.
Non-chemical applications	- Blade-ploughing, stick-raking, bulldozing and chaining can be effective if the root layer is removed from the soil. - Cultivation of pasture or native vegetation after mechanical control will help to prevent re-sprouting and seedling establishment. - Fire destroys seed in the soil surface and can be used as a follow-up to remove seedlings after other control efforts. - Fire may also be used to manage mature trees. Hand grubbing for single plants or small outbreaks, ensure removal of the root system. - Biocontrol options are available with Uu establishing slowly in some areas.		

Source: Northern Territory Weed Management Handbook (Northern Territory Government 2015).

8.3 Rubber bush (*Calotropis procera*) treatment options

Table 7 includes herbicide and non-chemical treatment options for Rubber bush *(Calotropis procera) (*Northern Territory Government 2015).

Table 7 Rubber bush *(Calotropis procera)* treatment options

Weed Species	Rubber bush *(Calotropis procera)*		
Control Methods	**Chemical and concentration**	**Rate**	**Weed growth stage, method and comments**
Herbicides	**Triclopyr 300 g/L + Picloram 100 g/L** **Conqueror®** **+ Aminopyralid 8 g/L** Grazon™ Extra	750 mL / 100 L (water) 500-750mL / 100 L (water)	**Seedling (individuals or infestation):** Foliar spray. Check label for recommended adjuvant product. More effective on plants <2m as thorough coverage on all leaves is required
	Triclopyr 240 g/L + Picloram 120 g/L Access™	 1 L / 60 L (diesel) 1 L / 10 L (diesel) 1 L / 60 L (diesel)	**Adult (individuals and infestation):** Basal bark < 5cm stem diameter. Spray all stems. Spray to point of runoff. Thin Line up to 5cm stem diameter. Cut stump > 5cm stem diameter.
	Tebuthiuron (200g/kg) Graslan Pending registration. Please check with Weed Management Branch for status confirmation.	1.5-2g/m2	**Seedling or adult:** Application to black clay soils in conjunction with seasonal rainfall. Spread granules according to density of the infestation.
	Fluroxypyr (333g/L) Starane™ Advanced	3 L / 100 L (diesel)	**Adult:** Cut stump method for plants up to 10cm diameter and 3m high.
Non-chemical applications	- This plant is difficult to eradicate as the deep roots survive almost any treatment. - Maintenance of a dense pasture sward will assist in preventing invasion.		

Source: Northern Territory Weed Management Handbook (Northern Territory Government 2015).

9. Notification Procedure

The Regional Weed Officer – Onshore Shale Oil Gas Development at the Weed Management Branch of the DENR should be notified within 48 hours of the discovery of a new weed species in the Project Area.

Initial notification may be verbal, with follow-up written notification provided within seven working days. The notification should include a preliminary species identification and location information. The Regional Weed Officer will advise what further action is required.

It is noted that some species spread rapidly so immediate action may be required to control spread. For example, as stated above *Parthenium (Parthenium hysterophorus) is a Class A (to be eradicated) and Class C (not to be introduced) weed in the Northern Territory as well as being classified as a Weed of National Significance. Early detection is crucial in not allowing this species to spread in the Northern Territory* (Department of Primary Industry and Resources 2016).

In addition, it is noted that under the *Weeds Management Act* that:

'The owner and occupier of land must… within 14 days after becoming aware of a declared weed that has not previously been, or known to have been, present on the land, notify an officer of the presence of the declared weed'.

All weed outbreak incidents will be reported in Origin's OCIS and corrective action initiated.

10. Recording

Records of weed inspections will be maintained by Origin.

Data on weed distribution will be maintained within Origin's GIS and provided to the Weeds Officer at DENR as part of the annual report on performance against the Weed Management Plan, or as requested.

Data will be collected as per the requirements of the Northern Territory Weed Data Collection Manual - Section One Technical Data Description (Weed Management Branch, 2015).

Data will be recorded using the guidelines provided in Appendix A using the data sheet provided in Appendix B (Weed Management Branch, 2015).

The Northern Territory Weed ID Deck (Northern Territory Government 2017) will be referenced to assist with identification of species that have been identified as likely or know to occur in the Permit Area.

Field data will be submitted directly to the Weed Management Branch in a shapefile format or as an Excel spreadsheet, including incidental identification of weeds and following completion of field surveys.

11. Reporting

All weed outbreak incidents will be reported in Origin's OCIS and corrective action initiated.

A report on the performance against this Weed Management Plan will be submitted to DENR on an annual basis.

At a minimum, this should include:

a) Details of activities implemented to address weed spread and introduction risks (e.g. vehicle wash down/ blow down locations, examples of track construction from working from weed free areas into weed infested areas to reduce spread).

b) Details of survey and monitoring events, including dates, personnel, maps and track data.

c) Submission of all weed data collected.

d) Overview of weed control events and success rates (weed control should be captured in detail through the data collection process and submitted as a component of (a)).

12. References

Department of the Environment and Energy. 2018. *Key threatening processes under the EPBC Act.* http://www.environment.gov.au/biodiversity/threatened/key-threatening-processes accessed14 September 2018.

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Weed Management Branch, Northern Territory Government. 2015. *Northern Territory Weed Data Collection Manual - Section One Technical Data Description.*

Appendix A Weed Data Collection Methodology

Field data collection for weed infestations

The following is a guide to efficiently evaluating and recording a weed site in the field.

Each record must identify the person or organisation taking the record, as well as the details explained below.

How to record weed area as a point record

1. Record the species.

When a weed is sighted, move to the area and confirm identification of the weed. If you cannot positively identify the weed record it as “Unknown weed” and take a sample or photograph, do not try to guess. If more than one weed species is present then repeat the process with separate records for each species.

2. Assess the size of the weed patch.

Look across the area of weeds to the furthest weed plant and decide the diameter. Decide if the area is best fits in a circle of either 20, 50 or 100 metres. If it is a single plant or small patch you would choose 20 metres. The size 100 metres extends about as far as you can see on the ground, if the weeds extend out of sight you will need to make another point further on. You may place overlapping circle areas to reflect different densities.

3. Assess the density of weeds within the circle.

Decide how much of the area is covered by weeds. Assign a score from 2 to 5 based on the percentage table below. It will be useful (if possible) to move into the centre of the weed circle. Consider the whole circle size chosen in step 2 deciding on the density score. Area covered should be determined by a ‘projected canopy’ method.

Density categories

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

4. Record the location.

Take the GPS location (ideally) from the centre of the circle. If weed seeds may be spread or it is difficult to access the centre it is acceptable to take the reading from the location as close to the centre as practical.

5. Record the treatment.

Record the method you apply a treatment to the weeds, or record ‘No Treatment’.
Choose from the list of treatment methods
i.e: No treatment, Unknown, Treated, Foliar spray etc.

How to record weed area as a line (polyline) record

1. Record the species.

When a weed is sighted, move to the area and confirm identification of the weed. If you cannot positively identify the weed record it as “Unknown weed” and take a sample or photograph, do not try to guess. If more than one weed species is present then repeat the process with separate records for each species.

2. Assess the ‘best fit’ width in metres of the linear weed area.

Look along the area of weeds to the furthest weed plant and decide a width that best sums up the width of the infestation from values of 5, 20, 50 or 100 metres. If the width is too variable you may need to make more than one line or consider recording as points or as a polygon.

3. Assess the density of weeds within the line.

For the area of the line, being from start to finish at the designated width, decide the area covered by weeds. Assign a score from 2 to 5 based on the percentage table below. Consider the whole line area when deciding on the density score. Area covered should be determined by a ‘projected canopy’ method.

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

4. Record the location.

Start the GPS track, or line sketch from one end of the linear weed area. Walk or sketch a line as best fit through the middle of the linear weed area and finish at the end point.

5. Record the treatment.

Record the method you apply a treatment to the weeds, or record ‘No Treatment’.
Choose from the list of treatment methods
ie: No treatment, Unknown, Treated, Foliar spray etc.

How to record weed area as a polygon record

1. Record the species.

When a weed is sighted, move to the area and confirm identification of the weed. If you cannot positively identify the weed record it as “Unknown weed” and take a sample or photograph, do not try to guess. If more than one weed species is present then repeat the process with separate records for each species.

2. Assess the extent of the weed area an ensure it can be practically enclosed.

Polygons are good for clearly delineated areas of weeds, you should be able to walk around the edge of the weed area with confidence. Ensure the defined area of weed at a similar density can be delineated before attempting to create the area, you may need more than one polygon. If the area is poorly defined then the point method may be a more useful.

3. Assess the density of weeds within the polygon.

Assess the area covered by weeds for density, you may need to move to several vantage points to get a clear picture. Assign a score from 2 to 5 based on the percentage table below. Consider the whole area within the polygon when deciding on the density score. Area covered should be determined by a ‘projected canopy’ method.

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

4. Record the location.

Start the GPS track, or polygon sketch from one point of the polygon weed area. It is useful to start from a landmark or flagging tape. Create the polygon edge line by walk a path or sketching along the outer edge of the weed area until you return to the start point. If using a GPS track to create the polygon ensure that you cross your start point so as to close the polygon.

5. Record the treatment.

Record the method you apply a treatment to the weeds in the area, or record ‘No Treatment’. Choose from the list of treatment methods

ie: No treatment, Unknown, Treated, Foliar spray etc.

Appendix B Example Weed Data Collection Sheet

Weed Management Plan

NT-2050-15-MP-0016

RECORDER:					PROJECT:							LOCALITY:		
ORG_NAME:					GPS NAME/MODEL:							RECORDING METHOD :		
SITE_ID	DATE_REC	LAT_G94	LONG_G94	WEED_NAME	SIZE_DIA_M	DENS_CAT	SEEDLINGS	JUVENILES	ADULTS	SEED_PRES	PAST_TREAT	TREATMENT	HERBICIDE	COMMENTS

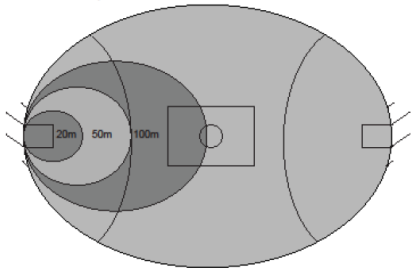
Notes:

Treatment method
Control method applied today as per below.
If none, record 'No treatment'

- Foliar spray
- Residual application
- Basal bark
- Cut stump
- Stem injection
- Aerial spray
- Slashed or cut
- Hand pull

Herbicide	The active ingredient(s) of the herbicide applied today (if any)
GPS waypt	Waypoint ID as entered in the GPS
Weed name	Common name or scientific name for the weed recorded
S (y/n)	Seedlings: Are seedlings visible?
J (y/n)	Juveniles: Are juvenile plants visible?
A (y/n)	Adults: Are there adult plants, or seeds, or evidence of past seeding present?
Seed (y/n)	Seeds: Are seeds visible today? Or plants with seeds or pods?
Treat (y/n)	Treatment: Did you apply treatment to this site?
Comment	Record any notes for yourself here.

Size dia m Size/diameter of the area you are recording information about (in metres). Use 20m, 50m or 100m.

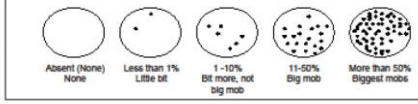


Example of size/diameter compared to a football oval. (Sizes 20m, 50m, 100m)

Dens cat Density of weeds in the assessed area using categories described below

1 = No weeds (absent)	2 = Single plant or very few (<1%)	3 = A few plants (1-10%)
4 = Many weeds, up to half (11 – 50%)	5 = Mostly weeds, more than 50%	6 = Density not assessed

Density category (Dens cat) examples



(extracted from *Northern Territory Weed Data Collection Manual - Section One Technical Data Description.*

Review due: 29/03/2022

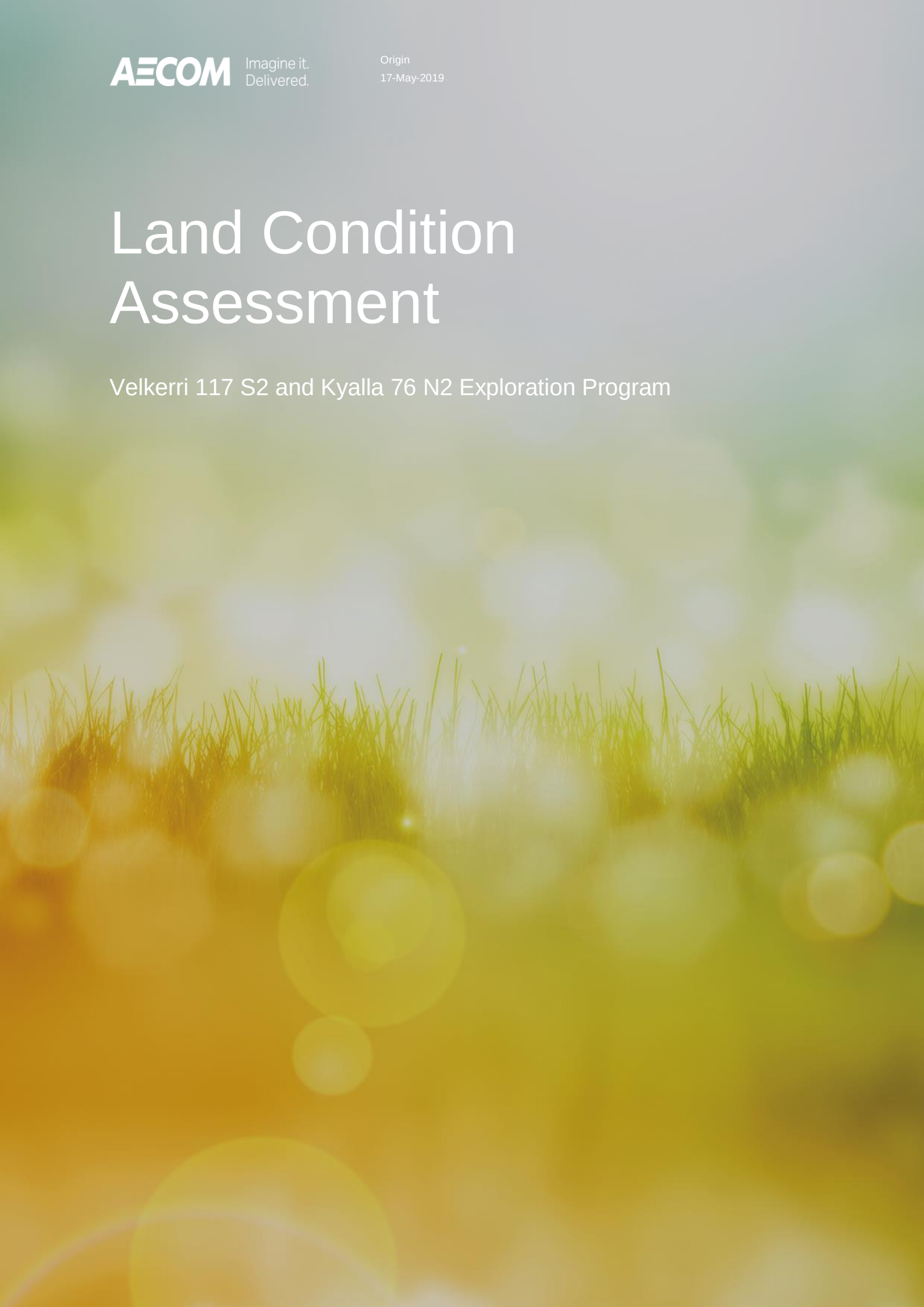
Appendix C Land Condition Assessment

AECOM Imagine it. Delivered.

Origin
17-May-2019

Land Condition Assessment

Velkerri 117 S2 and Kyalla 76 N2 Exploration Program



Land Condition Assessment

Velkerri 117 S2 and Kyalla 76 N2 Exploration Program

Client: Origin

ABN: 66 007 845 338

Prepared by

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17-May-2019

AECOM in Australia and New Zealand is certified to ISO9001, ISO14001 AS/NZS4801 and OHSAS18001.

Quality Information

Document	Land Condition Assessment
Ref	60480548
Date	17-May-2019
Prepared by	Alana Court
Reviewed by	Abe Francis

Revision History

Rev	Revision Date	Details	Authorised	
			Name/Position	Signature
0	20-Sep-2018	August 2018 Land Condition Assessment	Alana Court Principal Scientist	
1	5-Mar-2019	Revised for 2019 program	Alana Court Principal Scientist	
2	16-May-2019	Revision 2 for 2019 program	Alana Court Principal Scientist	

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Table of Acronyms

Acronym	Meaning
^{o}C	Degrees Celsius
%	Percentage
AAPA	Aboriginal Areas Protection Authority
ALA	Atlas of Living Australia
AS	Australian Standard
BOM	Bureau of Meteorology
CLA	Cambrian Limestone Aquifer
Cth	Commonwealth
DoH	Department of Health (NT)
DotEE	Department of the Environment and Energy (Cmwlth)
DENR	Department of Environment and Natural Resources (NT)
DPIR	Department of Primary Industries and Resource (NT)
DLPE	Department of Lands, Planning and the Environment (NT)
EPA	Environment Protection Authority (NT)
EP##	Exploration Permit (e.g. EP76, EP98 and EP117)
EMP	Environmental Management Plan
EPBC	Environmental Protection and Biodiversity Conservation
ESCP	Erosion and Sediment Control Plan
GPS	Global Positioning Device
Ha	hectare
IBA	Important Bird Area
ILUA	Indigenous Land Use Agreement
Km	Kilometre
km^2	Square Kilometres
km/hr	Kilometre per hour
LCA	Land Condition Assessment
m	metre
MD	Measured Depth
MNES	Matters of National Environmental Significance
mm	millimetre
NLC	Northern Land Council
NT	Northern Territory
OHS	Occupational Health and Safety
RWA	Restricted Work Area
TO	Traditional Owner
TPWC Act	*Territory Parks and Wildlife Conservation Act*

Acronym	Meaning
WoNS	Weed of National Significance

1.0 Introduction

1.1 Purpose of this Report

AECOM Australia Pty Ltd (AECOM) conducted a land condition assessment (LCA) to support Origin Energy's (Origin) application to the Northern Territory Department of Environment and Natural Resources (DENR) for an Environmental Management Plan (EMP) for various exploration activities.

The purpose of the LCA was to gather baseline information to provide an environmental condition assessment to support the proposed exploration activities to be carried out by Origin at two proposed lease sites during 2019/2020.

1.2 Project Boundary

Origin are proposing to undertake a series of activities required to expand their exploration program in the Beetaloo Basin. Origin are targeting two sites for the 2019/2020 exploration program, Velkerri 76 S2 and Kyalla 117 N2. The location and proposed disturbance area are presented in Table 1 and Figure 1.

Table 1 Proposed Lease Area for Exploration Activities and Disturbance Area

Exploration Permit	Name	Station	Zone*	Easting	Northing	Disturbance Area (ha)
EP76	Velkerri 76 S2-1	Amungee Mungee	53	435488	8136321	7.2
EP117	Kyalla 117 N2-1	Hayfield/Shenandoah	53	356175	8137500	5.7
EP117	Stuart Highway Intersection	Hayfield/Shenandoah	53	332371	8135170	0.5
EP117	Gravel Pit 1	Hayfield/Shenandoah	53	339883	8135005	1.0
EP117	Gravel Pit 2	Hayfield/Shenandoah	53	360366	8135138	1.0
EP117	Gravel Pit 3	Hayfield/Shenandoah	53	362841	8135102	1.0
EP117	Gravel Pit 4 and access track	Hayfield/Shenandoah	53	397906	8136039	2.1
EP117	Gravel Pit 5 and access track	Hayfield/Shenandoah	53	403386	8135809	1.6
EP117	Gravel Pit 6 and access track	Hayfield/Shenandoah	53	405049	8135927	1.7
EP76	Gravel Pit 7	Amungee Mungee	53	435749	8135306	1.0
Total Disturbance Area (Ha)						**22.8 ha**

** Universal Transverse Mercator (UTM) geographic coordinate system is Geocentric Datum of Australia (GDA) 94.*

^ Existing Origin Leases, previously known as Amungee NW-1h and Beetaloo W-1.

For the purpose of this assessment, the project boundaries were defined as the areas which may be affected by the proposed exploration activities, including:

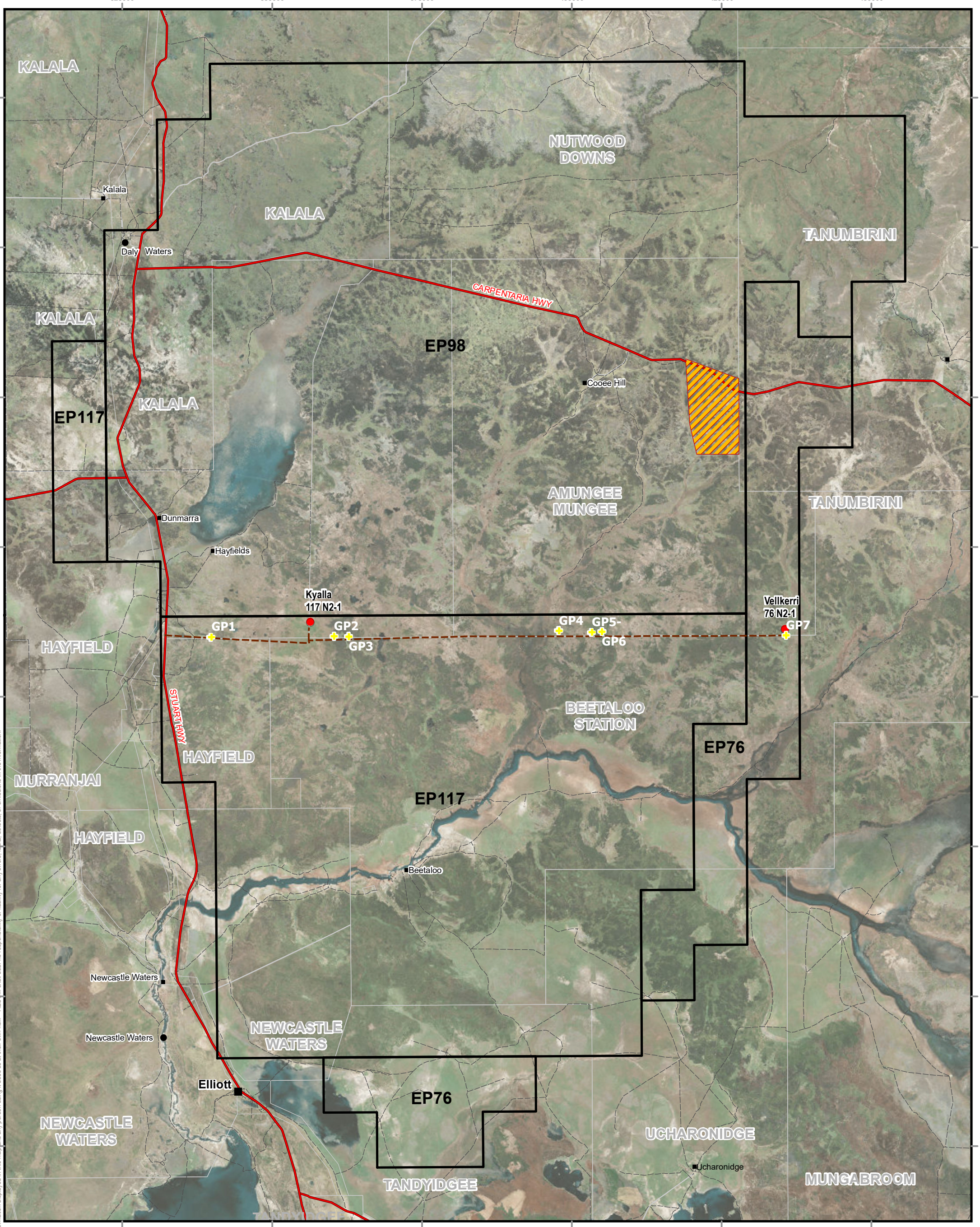
- A 4.5-ha area around the proposed lease sites including an additional 500 m buffer to allow for future flexibility.
- A 1.2-ha camp pad.
- A 0.25-ha helipad and 1 ha wet weather storage area at the Velkerri 76 S2.

- 650 m long x 8 m wide (0.52-ha) lease pad turn in to Kyalla 117N2 connecting the proposed lease pad to the existing access track.
- 1,100 m long x 8 m wide (0.88-ha) lease pad turn in to Velkerri 76 S2 connecting the proposed lease pad to the existing access track.
- Minor intersection upgrade works at the intersection with the Stuart Highway of approximately 0.5-ha.
- Utilise approximately 107 km of existing access track.
- Obtain gravels, as required, for construction of drill pads and sections of the access track at up to seven proposed borrow pits (7 gravel pits up to 1 to 2.1 ha).

1.3 Scope of works

The scope of work for the LCA involved:

- a review of historical data and reports prepared during the previous Beetaloo onshore oil and gas exploration programs
- a search of the Commonwealth Department of the Environment and Energy (DoTEE) Protected Matters database (27 August 2018)
- a search of the NT Natural Resource Management InfoNet Database (flora and fauna database) (4 September 2018)
- a search of the Atlas of Living Australia (ALA) database for flora and fauna records (2014 and 2016)
- completion of LCA field survey of the proposed exploration lease areas drilling program.
- Preparation of this report.



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GEOCENTRIC DATUM OF AUSTRALIA 94

0 5 10 20

Kilometers

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LEGEND

- Proposed Wells 2018
- Homestead
- Place Name
- Populated Place
- Gravel Pits
- Highway
- Tracks
- Access Routes
- Cadastre
- Permit Areas
- Bullwaddy Conservation Reserve

LOCATION

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

ORIGIN ENERGY RESOURCES LIMITED
2019 Environmental Management Plan

Site Location

PROJECT ID	60480548
CREATED BY	jace.emberg
LAST MODIFIED	20-May-2019
VERSION	1

Figure 1

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A3 size

2.0 Assessment Method

2.1 Desktop Review

The existing data collected between 2005 and 2016 for the permit areas was mapped based on image interpretation, with ground-truthing of the proposed exploration areas being completed during the field assessment (refer Section 2.2). This information was reviewed prior to the field work to identify the following:

- terrestrial vegetation types and flora and fauna species occurring within the region and with potential to occur within the project area, using existing documents and aerial / satellite imagery.
- terrestrial Commonwealth or Territory listed threatened species or communities identified within the region and with potential to occur within the project area.
- matters of national environmental significance or other matters protected by the Environment Protection and Biodiversity Conservation Act (EPBC Act) that are likely to occur within the project area.
- existing weeds or feral animals listed under the EPBC Act, *Weeds Management Act* or the *Territory Parks and Wildlife Conservation Act* and with potential to occur within the project area.

Table 2 provides a chronological list of reports previously compiled for the exploration permit area between 2004 and 2016, in relation to environmental approvals and management support for petroleum exploration activities in the Beetaloo Basin, NT.

The extent of work undertaken since 2004 has enabled a good understanding of the natural and cultural environment, which has been used in assessing the proposed exploration areas within the Permit Area.

Table 2 Summary of existing Environmental Assessments and Reports for the Beetaloo Basin (2004 to 2018)

Date	Report
Sweetpea Petroleum	
Jul- Aug 2004	Baseline land condition assessment
	Site database established
Jul 2005	Exploration EMP finalised and approved
Petrohunter Australia (Partner to Sweetpea)	
Dec 2006	Baseline vegetation assessment
Apr 2007	Drill site assessments
Apr 2007	Annual report
Jun 2007	Update of the existing EMP to include the new Exploration Permit areas
Jul 2007	Drill Site maps
Jul 2007	Supplemental Environmental Management Plan, Drilling Program 2007, Beetaloo Basin, NT
Jul 2007	Soil erosion assessment
Jul 2007	Groundwater quality
July 2007	Emergency Maps
Jul 2007	Environment & Heritage Induction Materials
Aug 2007	Site-based Drilling EMP
Falcon Oil and Gas	
Dec 2010	Drill site condition assessments

Date	Report
Jan 2011	Archaeological survey
March 2011	Site-specific drilling EMP
2011	Falcon Shenandoah 1 Stimulation and Testing Groundwater Monitoring
2011/2012	Shenandoah 1 Re-Entry Environment Plan (EP)
July 2012	EP99 Archaeological Survey, Beetaloo Basin
2013	EP99 Seismic Exploration Environmental Management Plan
2013	Sweetpea 2006 Closeout Environmental Survey
Origin	
2015 and 2016	Beetaloo Basin Environmental and Heritage Assessment and preparation of Approval documentation.
October 2018	Land Condition Assessment

2.2 Field assessment and reporting

The LCA of the proposed exploration lease areas, including access tracks, was conducted on 28 to 29 August 2018 by Principal Environmental Scientist, Abe Francis. The survey involved helicopter and pedestrian survey of the proposed exploration lease areas and access tracks and was accompanied by the AECOM Principal Heritage Consultant, Luke Kirkwood and the Department of Environment and Natural Resource (DENR) Regional Weed Officer (Onshore Shale Gas Development), Tahnee Hill.

The LCA used rapid assessment techniques, which allowed for large areas to be surveyed over a relatively small period of time. The helicopter provided a good platform to enable the field team a degree of flexibility by allowing an aerial view of the access tracks and proposed exploration lease areas, as well as the ability to land in otherwise remote locations for ground-truthing.

The primary aim of the LCA was to identify and document site condition prior to the proposed activities occurring in the footprint of the two lease areas and proposed access tracks and inform the preparation of the programs Environmental Management Plan (EMP).

Following the desktop review, AECOM undertook a condition assessment at each of the nominated sites and access tracks to record site-based characteristics, including:

- the presence of drainage lines and the direction of surface flows
- the distance to the nearest sensitive receptors (such as significant vegetation communities or fauna habitats)
- soil characteristics and intactness
- terrestrial vegetation community types (note that the vegetation descriptions would be based on dominant species for each vegetation structural component)
- listed threatened flora species and fauna habitat features, such as hollows, logs and burrows (the fauna habitat quality for each mapped vegetation community type would be assessed)
- incidental fauna sightings
- the presence of weeds and/or feral animals (i.e. indication of scats, tracks, wallows etc.)
- general land use description.

For this assessment, the environmental scouting included a 4-hectare area around the proposed exploration areas, plus an additional 500 m buffer to allow for future flexibility for the proposed Origin exploration activities.

A 250 m buffer each side of an existing access track were scouted to allow for locating camps, gravel pits and water supply bores in the future. Where the access tracks were located on a property boundary, the buffer was 500 m out into the property the track was located on.

It is noted that not all of the nominated areas scouted for the exploration areas and/or access tracks will be affected by site activities, but sufficient size was allowed to provide flexibility in the siting of infrastructure and borrow pits, which in turn can be used to minimise environmental and heritage impacts (e.g. significant tree or habitat avoidance, Sacred Site/archaeological artefact avoidance).

3.0 Land Condition Assessment

The results of the LCA and desktop review has been summarised in the following sections. The area covered during the assessment is shown in Figure 2. During the helicopter survey, two sites proposed for exploration activities were ground-truthed, along with the proposed access tracks (refer Section 1.2). Scoping for the gravel pits was also conducted.

3.1 Climate

The climate of the Origin permit areas can be described as arid to semi-arid, with rainfall decreasing in frequency and quantity from north to south. The climate is monsoon influenced, with a distinctive wet and dry season experienced through the year. The area experiences a wet season during the summer months between October and March, which is dominated by hot and wet conditions. Whilst the dry season during the winter months experiences mild days and cool nights between May to August. September and April are transitional months, with occasional rainfall. The average annual rainfall in the north of the permit area is listed at 680 mm at Daly Waters. The southern portion of the permit area records an average annual rainfall of 535 mm at Newcastle Waters and 608 mm listed at Elliott. Approximately 90% of the rainfall occurs during the Wet Season, and annual totals show moderate variability from year to year.

The maximum rainfall for the permit area occurs during January and February. Daly Waters experience the highest rainfall in the region at this time, with 165 mm during each month, followed by Elliott (133-164 mm during each month) and Newcastle Waters (125-130 mm during each month). July and August experience the least amount of rainfall and are the driest months across all three weather monitoring sites, ranging from one to four mm of rainfall. The annual rainfall pattern within the area is highly variable and becomes increasingly unpredictable the further move away from the coast. Drought conditions are known to occur in the region once every ten years (Holt and Bertram, 1981).

The land condition assessment was undertaken between 28 and 29 August 2018. The timing of the assessment was such that it fell within the dry season. The Daly Water airstrip station recorded a higher than average rainfall of 590 mm between January to April 2018 wet season compared to the mean rainfall from 1939 to 2018 of 482 mm.

The average annual rainfall experienced across the region (which includes the BOM data from Daly Waters Airstrip and Elliot) is shown in Table 3.

Table 3 Annual rainfall 2016-2018

Year	Annual Rainfall (mm)		Months Rain was recorded	
	DW	NW	DW	NW
2016	608	570	12	9
2017	866	607	7	6
2018*	590	270	4	4

DW – Daly Waters Airstrip, NW – Newcastle Waters.

Data sourced from Bureau of Meteorology, Climate Averages for Station 014626 Daly Waters Airstrip recorded from 1939-2018, Station 015131 Elliot recorded from 1949-2018. * note 2018 is only current to date (October 2018)

Due to the timing of the LCA occurring at the end of the dry not all species were able to be identified, however sufficient data was able to be captured to obtain a good understanding of the land condition within the proposed lease areas to help inform required management measures for the protection of the environment.

The proposed lease sites and the short access roads are unlikely to be impacted by the onset of the wet season because they are located outside of the adjacent major flow paths and creeklines within the permit area (refer to Section 3.2).

KALALA
BIRDUM CREEK
NUTWOOD DOWNS
Kalala
KALALA
TANUMBIRINI
Daly Waters
KALALA
EP98
Cooee Hill
KALALA
EP117
AMUNGEE MUNGEE
TANUMBIRINI
Dunmarra
MILNER LAGOON
Hayfields
Kyalla 117 N2
Vellkerri 76 N2
GP1
GP2
GP3
GP4
GP5-
GP6
GP7
HAYFIELD
BEETALOO STATION
EP76
HAYFIELD
MURRANJAI
EP117
HAYFIELD
Beetaloo
Newcastle Waters
NEWCASTLE WATERS
Newcastle Waters
Elliott
EP76
NEWCASTLE WATERS
UCHARONIDGE
Ucharonidge
LAKE WOODS
TANDYIDGEE
MUNGABROOM

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Kilometers

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LEGEND

- Homestead
- Place Name
- Populated Place
- Highway
- Minor Road
- Tracks
- Access Tracks
- Cadastre
- Permit Areas
- Bullwaddy Conservation Reserve
- Helicopter Transects
- Gravel Pits

LOCATION

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

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2019 Environmental Management Plan

Heritage Assessment Transects

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Figure 2

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A3 size

3.2 Topography, Surface Water and Drainage

The permit area is located within three main topographic zones. These are primarily made up of black soil plains in the south, laterite plains in the north and small sections of bedrock hills in the south west and north east of the permit areas (Tickell, 2003). The proposed lease areas occur within the lateritic plains. The topography of the two sites have low relief and surface water flow ultimately drains in a south and south westerly direction.

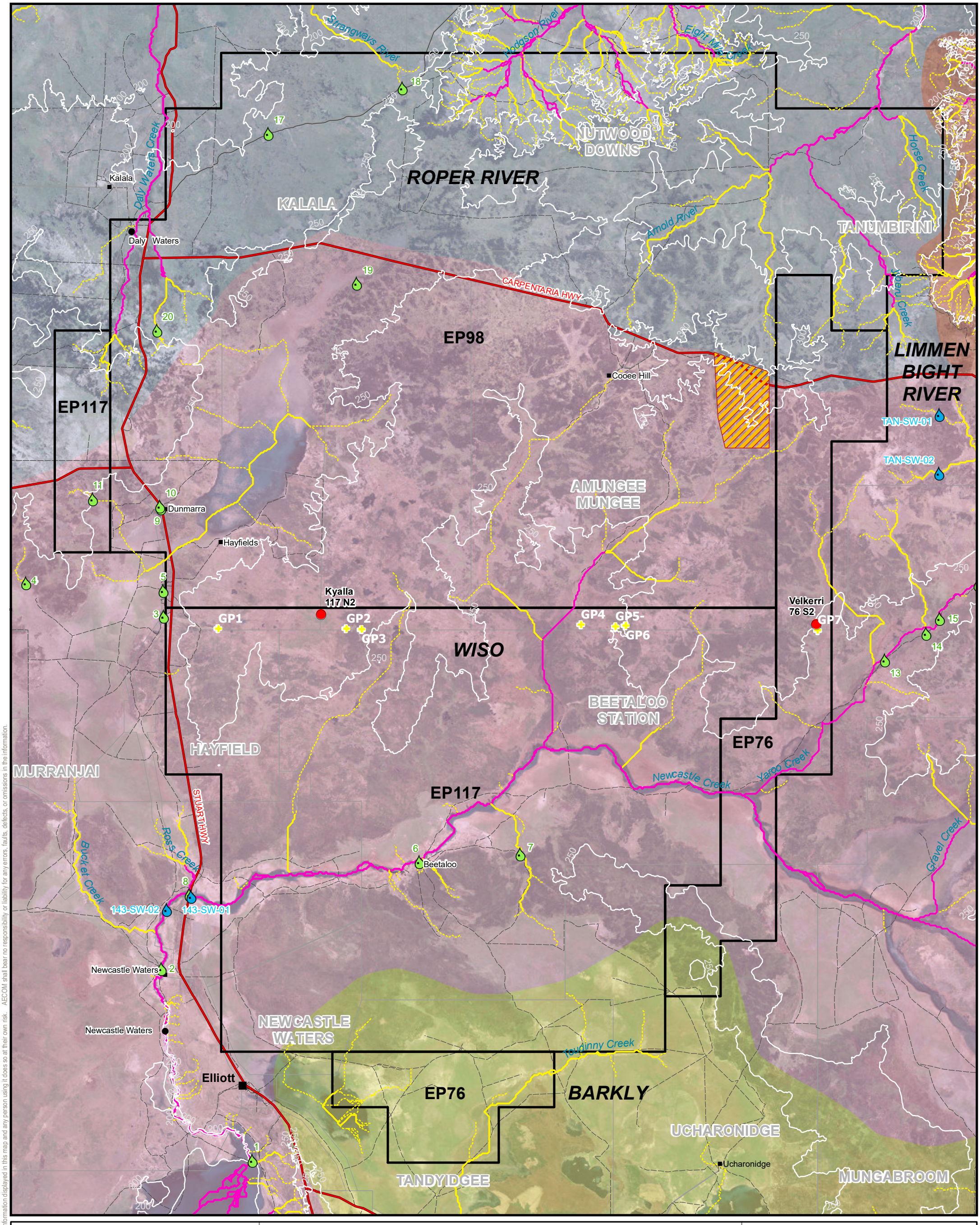
Three main river basins, Roper River Basin to the north, Wiso River Basin in the centre and the Barkly River Basin in the south occur within the exploration permit area (Figure 3). All the proposed lease areas are located within the Wiso River Basin. The Wiso River Basin covers the southern half of EP98 (south of the Carpentaria Highway) and the majority of EP117 and is internally drained by Newcastle Creek and a number of small ephemeral creeks. Newcastle Creek flows into Lake Woods, which is located south of Newcastle Waters Station.

Lake Woods covers an area of inundation of approximately 50,000 ha in normal rainfall years, extending to 80,000 ha in exceptionally wet years, after which it can retain water for several years (AECOM, 2015). Lake Woods is described as a major quasi-permanent surface water body in the region, although some semi-permanent and many ephemeral waterholes are located across the permit area (HLA, 2006b) and is listed as a Site of Conservation Significance by the Department of Environment and Natural Resources (DENR) and is listed on the Directory of Important Wetlands in Australia. Lake Woods is listed as a wetland of national significance in the Directory of Important Wetlands in Australia (DIWA: NT013 Lake Woods). The site meets criteria 1, 2, 3, 4, 5 and includes DIWA wetland types: B1, B6, B10, B13 and B14.

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

Newcastle Creek (Stream Order 4) and a number of small intermittent streams (Stream Order 1 and 2) are located along the proposed access tracks to Velkerri 76 S2 site (refer Figure 3). The streams only flow for a short period during the wet season, with waterholes forming at the beginning of the dry season. If the wet season is poor, the waterholes will often remain dry, whereas, during heavy wet seasons, large areas of the internal drainage systems are flooded. The stream banks are often lined with a scatter of small trees which highlights them from the surrounding plains.

The two proposed lease pad areas are not located within the major flow pathway of Newcastle Creek and the small intermittent streams. During the wetseason it is likely the region would experience widespread surface flooding, to a depth of 30 cm, which has previously been identified by debris being collected on fence lines (HLA, 2005).



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0 5 10 20

Kilometers

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LEGEND

- Proposed Well 2018
- Homestead
- Place Name
- Populated Place
- Contours
- Gravel Pits
- Surface Water 2007
- Contours
- Surface Water 2015
- DLRM Surface Water
- Highway
- Minor Road
- Tracks
- Bullwaddy Conservation Reserve
- Cadastre
- Permit Areas

River Basins

- Barkly
- Limmen Bight River
- Roper River
- Wiso

Stream Order

Intermittant Streams

- 1
- 2

Creeks

- 3
- 4

Rivers

- 5
- 6
- 7

LOCATION

Data sources:
Permit Area, Cadastre, Basin - NT Gov 2014.
Places - Aust Gov 2014
Highways, Roads, Drainage - StreetPro 2014

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Environmental Management Plan 2019

Surface Water and Stream Order of Permit Area

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Figure 3

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A3 size

3.3 Land System

Land systems are defined because of their distinct differences from the surrounding areas and by the recurring pattern of geology, topography, soils and vegetation. Land system mapping for the permit area developed is a compilation of the Northern Land Systems (scale 1:250 000) and the Southern Land Systems (scale 1:1 000 000) (Department of Land Resource Management 2013). The data set is made up of the following:

- *Land Systems of the Northern Part of the Northern Territory* is an amalgamation of 16 existing Land System surveys with modifications to some of the original interpretations. This land system dataset is the Northern Territory contribution to Australian Soil Resource Information System (ASRIS) national soils database at scale 1:250,000.
- *Land Systems of the Southern Part of the NT* is a compilation of three existing land system surveys and the Atlas of Australian Soils (scale 1:2,000,000). It covers the southern part (approx 70%) of the Northern Territory. Published maps were made digital and edited to accommodate overlaps, gaps and mismatching boundaries. Where possible, the land system descriptions have been extrapolated into areas covered by the broader scale Atlas mapping.

Using the available information, there are 22 different land systems located within the exploration permit areas. The Velkerri 76 S2 and Kyalla 117 N2 proposed lease area and seven proposed gravel pits all occur within the Beetaloo Land System which is characterised by:

- gently undulating lateritic plains and rises
- lateritic red earths and lateritic podzolic soils
- *Acacia shirleyi* (Lancewood) forest.

3.4 Soils

The dominant soils encountered within the permit area have been derived from ancient rock formations and ancestral soils that were formed during the earlier weathering cycles. The soils are deeply weathered and leached (Orr and Holmes, 1984). The soils in the permit area have been influenced by:

- past wetter conditions that formed relict Tertiary plains which comprise highly leached and lateritic soils
- extensive areas of Post-Tertiary Alluvia on which a variety of mature soils formed
- the dissected hilly country that is dominated by skeletal soils or rocky outcrops
- a range of parent materials of residual soils, ranging from basic volcanic and highly calcareous rocks to granitoid rocks and sandstones (Christian *et al*, 1951).

The lateritic plains, located within the permit area, are classed as very strongly leached soils of the Tertiary land surface. The three main soil types located within the permit area, include:

- **Tertiary Lateritic Red Earths**, which occur on the gently undulating topography. The soil profile can be described as:

  A-Horizon Grey-brown sandy loam

  B-Horizon Reddish brown sandy clay loam

  C-Horizon Red-brown to red light clay, overlying heavy ferruginous gravel and massive laterite

- **Tertiary Lateritic Red Sands**, which occur on gently undulating to undulating topography of the Tertiary Lateritic Plain, formed from sandstones and complex parent materials of the deep sandy soils. The soil profile can be described as:

  A-Horizon Grey-brown to brown sand

  B-Horizon Brown sand

C-Horizon Red-brown to yellow-brown sand overlying pisolitic ferruginous gravel and massive laterite. Altered colouring of highly siliceous parent sandstone is only evident in the mottled and pallid zones.

- **Tertiary Lateritic Podzolic Soils**, formed on the gently undulating topography over a variety of rocks. These soils are located in the northern section of the Barkly Basin. The soil profile can be described as:

  A-Horizon Grey sand

  B-Horizon Yellowish-grey sand

  C-Horizon Yellow-grey sandy loam with ferruginous gravel overlying massive laterite, mottled and pallid zones.

Geotechnical investigations have confirmed the proposed lease sites consist of red silty sand with some gravel pieces. Although Velkerri 76 S2 test result indicated a higher percentage of gravel content compared to Kyalla 117 N2 both sites should be characterised as red silty sand. The surface soils collected during the field survey indicated the soils were slightly acidic (ph range of 5.0 to 6.2) across the permit area. A dispersion test was also undertaken on the samples which indicated that the soils were non-dispersive and maintained their shape when submerged in water. Results from the soil testing is provided in Appendix A.

There are also small sections of the proposed access track that may traverse through Black soil plain country. Black Soil Plains are located within the Barkly Tablelands, including EP76, the southern part of EP117 and a small section of EP98. The soils usually crack widely in the upper profile upon drying and have a loose, self-mulching surface. The soils are neutral to alkaline, calcareous and commonly have depths to one metre (Fisher, 2001). The cracking clay soils occur mostly on flat or gently undulating plains (‘downs’) and are associated with the exposure and weathering of sedimentary or basic volcanic rocks. The Black soils also occur on the more recent depositional landscapes in the form of alluvial clays associated with drainage lines and major river systems.

3.4.1 Erosion Susceptibility

Soil erosion susceptibility varies throughout the permit area, dependent upon the soil types, slope and extent of ground disturbance. Apart from the erosive impact of climatic conditions, soil erosion is influenced mainly by the inherent properties of the soils and the processes which occurred during the formation of the landscapes (Aldrick and Wilson, 1992).

Erosion will occur in the permit area if the land is used beyond its capacity, as is seen if land is overstocked or vehicle movements not controlled, for example. The location of proposed lease areas has been examined on the ground, to determine the risk of erosion occurring. Factors considered include the following.

- Soil type – soils with higher clay content are prone to generation of bulldust and are easily eroded by wind and water. Gravelly soils tend to be more robust to disturbance on the scale expected during the exploration program. Both sites reported a soil type of red silty sand.
- Slope – the slope of the site will determine the risk of erosion during rainfall events, with steeply inclined areas a higher risk than small undulations in the landform. All the proposed lease sites were in very flat (low relief) with a slope of <1%. During the program, the crossings of the access track on the small ephemeral streams and Newcastle Creek will require additional controls.
- Aspect – the position of the access track and pads in relation to the direction of the contour should be considered and creation of tracks across (as opposed to parallel with) the contour should be avoided.
- Rainfall – Table 4 present the erosion risk rating based on average monthly rainfall using the rating system provided in the IECA (2008) Table 4.4.2 for Daly Waters. The construction activities for all exploration activities is proposed to be commence following the wet season from April 2019 onwards. Most of the soil disturbance activities will be completed prior to the onset of the wet season in November 2019. As such, based on rainfall during the construction period, the overall risk of erosion is considered very low for the Velkerri 76 S2 and Kyalla 117 N2 sites.

Table 4 Erosion Risk Rating based on average monthly rainfall at Daly Waters

-Item	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall (mm)	165.4	165.4	120.1	23.6	5.0	5.6	1.5	1.7	4.9	22.5	59.4	110
Erosion Risk*	H	H	H	VL	VL	VL	VL	VL	VL	VL	M	H

** E = Extreme (>225 mm); H = High (100+ to 225 mm); M = Moderate (45+ to 100 mm); L = Low (30+ to 45 mm); VL = Very Low (0 to 30 mm)*

Based on the sites descriptions and the results from the soil samples, the erosion risk for the proposed lease areas is considered None/Slight erosion risk. This was confirmed during the field survey in August 2018 which reported no evidence of erosion within the proposed lease areas.

Certain sections of the proposed access tracks are likely to encounter more erosion susceptible soils, such as the access track to the southern sites and where streams and Newcastle Creek are crossed (refer Section 3.2). Mitigation measures will need to be established to minimise the risk for erosion along the track and are stabilised leading up to the wet season.

Overall, the main issues to be managed in relation to soils during exploration activities in the permit areas include:

- the generation of bull dust along the access tracks. Noting previous observations have indicated bull dust had formed where the surface crust had been disturbed and then subjected to repeated ground disturbance (AECOM 2015). This was primarily in grassland areas.
- The formation erosion gullies along inappropriately placed tracks and fence lines, where a slope was present. Scolding to bedrock has previously been observed in other areas of the permit, as well as pooling of water in areas of compaction and subsidence.

3.5 Biological Environment

3.5.1 Vegetation Communities

The Interim Biogeographic Regionalisation of Australia is a nationally recognised ecosystem classification system (Environment Australia, 2000). Bioregions are large, geographically distinct ecosystems that are distinguished by broad physical and biological characteristics, which can be further classified into Subregions. These regions and subregions are used as the basis for regional comparisons and conservation of flora and floristic communities.

Of the 85 bioregions mapped nationally, 20 occur within the Northern Territory and only two within the Origin permit areas, the Sturt Plateau bioregion and the Mitchell Grass Downs bioregion. The 2018 proposed lease sites all fall within the Sturt Plateau Bioregion which comprises undulating plains on sandstone, with predominantly neutral sandy red and yellow earth soils. Dominant vegetation associations included extensive areas of Lancewood (*Acacia shirleyi*) - Bullwaddy (*Macropteranthes kekwickii*) vegetation. Land condition in the bioregion is moderate to good but is threatened by impacts from weeds, feral animals, pastoralism and changed fire regimes.

Vegetation communities within the permit areas have been ground-truthed during baseline assessments in 2004, 2006 (HLA, 2006; 2006c), 2010, 2014, 2016 (AECOM, 2011; 2014; 2016) and more recently in August 2018, along with assessments of weeds, habitat, erosion and land condition.

Kyalla 117 N2 vegetation community including the turn-in is described as *Corymbia* spp open woodland with mixed *Terminalia* spp. shrubland over low tussock grassland (*Triodia bitextura*). Whereas, Velkerri 76 S2 vegetation community is described as *Eucalyptus/Corymbia spp.* low open woodland with *Iseilema spp.* mixed tussock grassland. Directly to the west and south of Velkerri 76 S2 there is a large stand of Bullwaddy and Lancewood vegetation community which the proposed access track previously traversed. Following site survey the project has determined that the access track will now be diverted around the Lancewood/Bullwaddy stand to minimise impact on a known sensitive vegetation community.

Figure 4 provides vegetation communities across the entire permit area, while Figure 5 and Figure 6 provides the vegetation communities on the proposed lease sites, Kyalla 117 N2 and Velkerri 76 S2.

KALALA
NUTWOOD DOWNS
Kalala
KALALA
TANUMBIRINI
Daly Waters
CARPENTARIA HWY
KALALA
EP98
Cooee Hill
EP117
KALALA
AMUNGEE MUNGEE
TANUMBIRINI
Dunmarra
Hayfields
Kyalla 117 N2-1
Vellkerri 76 N2-1
GP1
GP2
GP3
GP4
GP5-
GP6
GP7
HAYFIELD
STUART HWY
HAYFIELD
BEETALOO STATION
EP76
MURRANJAI
EP117
HAYFIELD
Beetaloo
Newcastle Waters
Newcastle Waters
NEWCASTLE WATERS
Elliott
EP76
NEWCASTLE WATERS
UCHARONIDGE
Ucharonidge
TANDYIDGEE

Vegetation
1 Melaleuca open forest/Melaleuca low open woodland/Pseudoraphis (mixed) low open forbland
2 Melaleuca woodland/Melaleuca low open woodland/Chrysopogon (mixed) open forbland
3 Melaleuca low woodland/Pandanus (mixed) low open woodland/Eleocharis forbland
4 Melaleuca woodland/Asteromyrtus low open woodland/Triodia (mixed) low open forbland
5 Melaleuca low woodland/Calytrix (mixed) sparse shrubland/Chrysopogon (mixed) low open forbland
6 Eucalyptus woodland/Flueggea (mixed) sparse shrubland/Sehima (mixed) tussock grassland
7 Melaleuca low woodland/Melaleuca sparse shrubland/Eulalia (mixed) low open forbland
8 Corymbia low woodland/Terminalia (mixed) sparse shrubland/Chrysopogon (mixed) low tussock grassland
9 Eucalyptus low woodland/Carissa (mixed) sparse shrubland/Chrysopogon (mixed) tussock grassland
10 Eucalyptus low woodland/Eucalyptus (mixed) low open woodland/Iseilema (mixed) tussock grassland
11 Eucalyptus low open woodland/Carissa (mixed) sparse shrubland/+Chrysopogon (mixed) low tussock grassland
12 Eucalyptus low open woodland/Acacia low sparse shrubland/Astrebla low tussock grassland
13 Eucalyptus low open woodland/Chenopodium low sparse chenopod shrubland
14 Corymbia low open woodland/Acacia low open mallee woodland/Triodia low hummock grassland
15 Eucalyptus low open woodland/Acacia sparse shrubland/Triodia low open hummock grassland
16 Eucalyptus low open woodland/Acacia open shrubland/Triodia (mixed) low tussock grassland
17 Eucalyptus low open woodland/Jacksonia sparse shrubland/Triodia low open hummock grassland
18 Lysiphyllum low open woodland/Atalaya (mixed) sparse shrubland/Eulalia (mixed) low tussock grassland
19 Melaleuca low woodland/Flueggea (mixed) sparse shrubland/Chrysopogon (mixed) low open tussock grassland
20 Acacia open forest/Acacia tall open shrubland/Chrysopogon (mixed) low open tussock grassland
21 Macropteranthes tall shrubland/Acacia sparse shrubland/Aristida (mixed) low open tussock grassland
22 Melaleuca woodland/Melaleuca low open woodland/Pseudoraphis low open forbland
23 Acacia low open forest/Eriachne (mixed) low open tussock grassland
24 Acacia low woodland/Eriachne (mixed) low open tussock grassland
25 Acacia woodland/Eriachne (mixed) open tussock grassland
26 Macropteranthes low woodland/Panicum low open tussock grassland
27 Macropteranthes (mixed) low woodland/ Chrysopogon (mixed) open tussock grassland
28 Acacia low woodland/Eragrostis (mixed) low open tussock grassland
29 Acacia tall sparse shrubland/+Astrebla low tussock grassland
30 Acacia tall sparse shrubland/Acacia sparse shrubland/+Triodia low open hummock grassland
31 Eucalyptus low woodland/-9999 (mixed) sparse shrubland/+Chrysopogon (mixed) tussock grassland
32 Unknown

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Kilometers

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LEGEND
- Proposed Wells 2019
- Homestead
- Place Name
- Populated Place
- Highway
- Permit Areas
- Bullwaddy Conservation Reserve
- Gravel Pits

LOCATION

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

ORIGIN ENERGY RESOURCES LIMITED
2019 Environmental Management Plan

Vegetation Communities

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CREATED BY	jace.emberg
LAST MODIFIED	20-May-2019
VERSION	1

Figure 4

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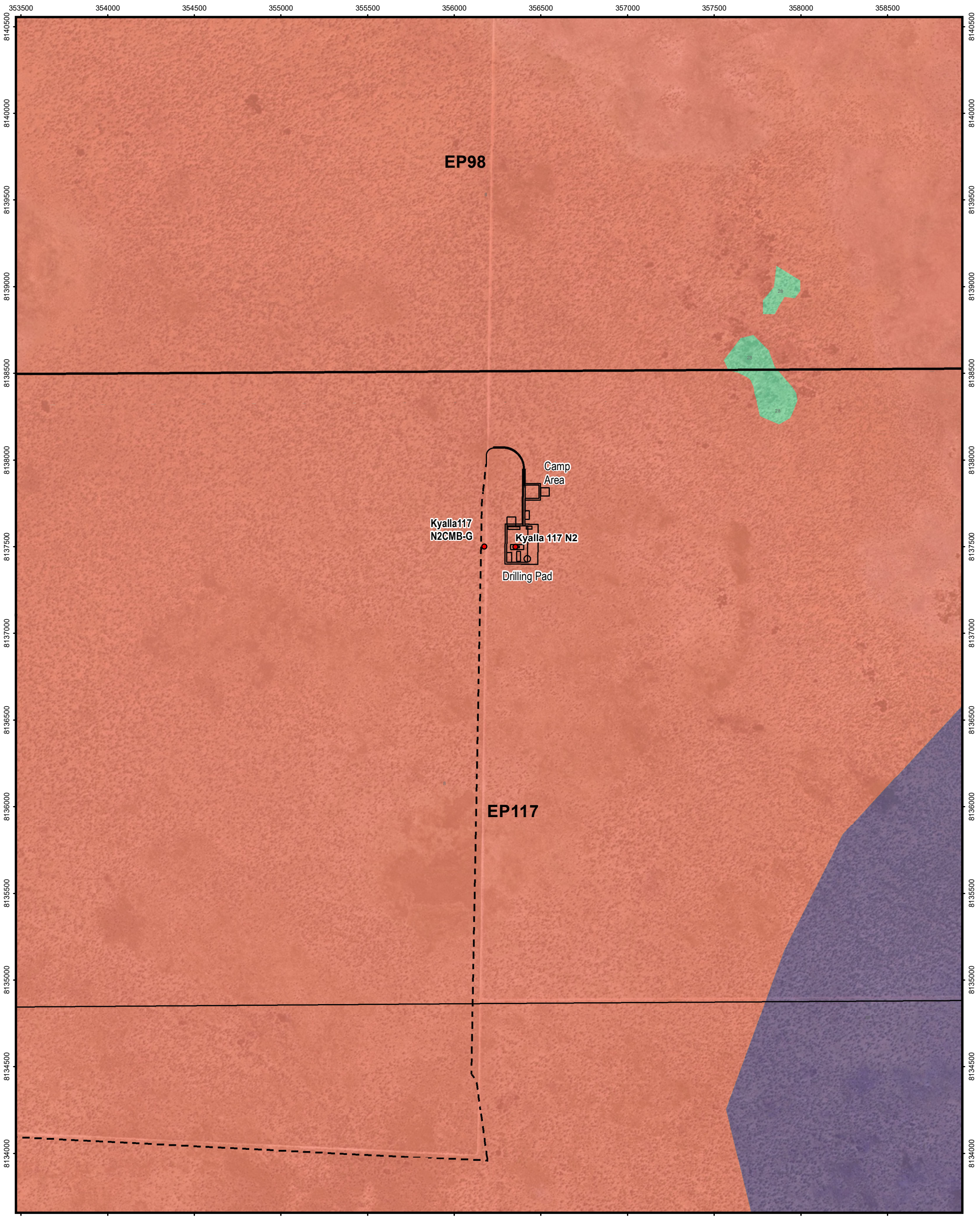
A3 size



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LEGEND

- KYA117-N2 CMB-G
- Proposed 2019
- Drill Pad and Services Location
- Permit Areas

Vegetation Community

- Acacia low woodland/Eragrostis (mixed) low open tussock grassland
- Acacia open forest/Acacia tall open shrubland/Chrysopogon (mixed) low open tussock grassland
- Corymbia low woodland/Terminalia (mixed) sparse shrubland/Chrysopogon (mixed) low tussock grassland

LOCATION

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

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2019 Environmental Management Plan

Kyalla 117 N2-1
Vegetation Community

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LAST MODIFIED	04-Mar-2019
VERSION	1

Figure 5

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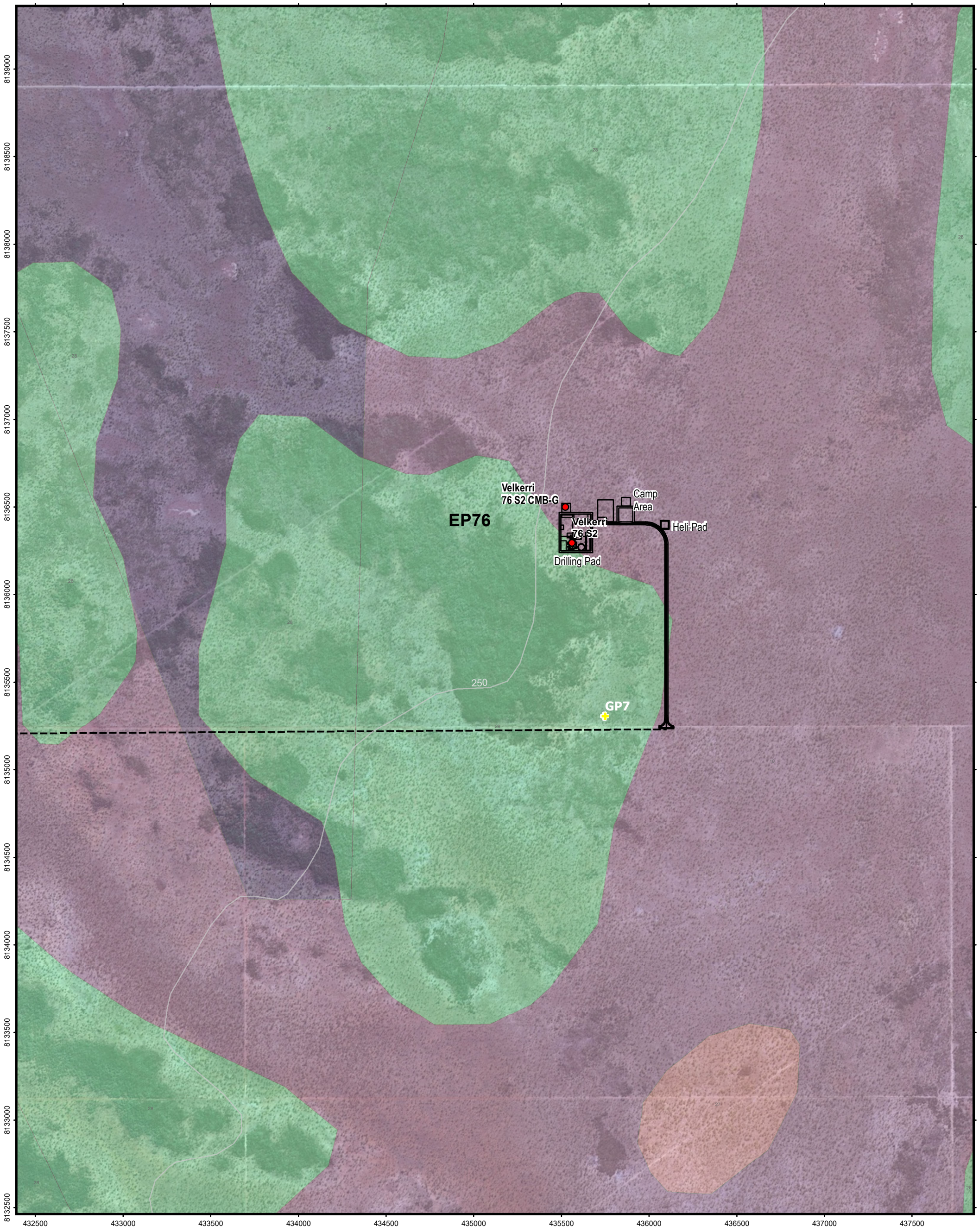

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LEGEND

- Velkerri76 S2 CMB-G
- Velkerri76 S2
- Permit Areas
- Tracks
- Contours
- Gravel Pits

Vegetation

- Acacia low woodland/Eragrostis (mixed) low open tussock
- Acacia open forest/Acacia tall open shrubland/Chrysopogon (mixed) low open tussock grassland
- Eucalyptus low woodland/Eucalyptus (mixed) low open woodland/Iseilema (mixed) tussock grassland
- Macropteranthes (mixed) low woodland/Chrysopogon (mixed) open tussock grassland

LOCATION

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

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2019 Environmental Management Plan

Velkerri 76 S2-1

PROJECT ID	60480548
CREATED BY	jace.emberg
LAST MODIFIED	20-May-2019
VERSION	1

Figure 6

Filename: \\audwn1fp001\Projects\604x\60480548\4. Tech Work Area\4.99 GIS\02_MXDs\LCA\Velkerri.mxd

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The approximate 107 km of the existing access track is predominantly surrounded by the same vegetation unit as Kyalla 117 N2, with patches of Bullwaddy and Lancewood, including at the proposed entrance off the Stuart Highway and surrounding some of the Gravel Pits. In addition, there are some areas of minor stands of Melaleuca low open wood and mixed acacia woodlands.

Previous exploration activities in the permit area provided some understanding on how the vegetation communities regenerated following clearing and rehabilitation. The rehabilitation monitoring following previous exploration programs were undertake during 2007 and again in 2013 (HLA, 2007 and 2013). It was noted that in the first year the success of rehabilitation was greatest in communities with grassland understory (primarily due to annual grass growth), whereas woodlands (mainly Lancewood and Bullwaddy) showed low levels of natural regeneration. By 2013, six years after disturbance the origin seismic lines through the Lancewood were such that there was almost no difference in the canopy height to the surrounding Lancewood communities.

The vegetation types described for the identified gravel pit locations are described in Table 5.

Table 5 Gravel Pit Vegetation Description

Gravel Pit	Vegetation Description
GP1	Corymbia low woodland/Terminalia (mixed) sparse shrubland/Chrysopogon (mixed) low tussock grassland
GP2	Acacia open forest/Acacia tall open shrubland/Chrysopogon (mixed) low open tussock grassland
GP3	Acacia open forest/Acacia tall open shrubland/Chrysopogon (mixed) low open tussock grassland
GP4	Macropteranthes (mixed) low woodland/Chrysopogon (mixed) open tussock grassland
GP5	Corymbia low woodland/Terminalia (mixed) sparse shrubland/Chrysopogon (mixed) low tussock grassland
GP6	Corymbia low woodland/Terminalia (mixed) sparse shrubland/Chrysopogon (mixed) low tussock grassland
GP7	Acacia low woodland/Eragrostis (mixed) low open tussock grassland

The vegetation throughout the permit area during the August 2018 survey appeared in very good condition with minimal impacts from grazing, fire and erosion.

3.5.2 Flora

A total of 805 plant species have been recorded within the wider region, during the August 2018 survey 10 dominant flora species were identified at Kyalla 117 N2 and Velkerri 117 S2 (Appendix B). As the survey was conducted during the late dry season, grasses and other annual species were difficult or impossible to identify due to the lack of inflorescence or because they had already died-back.

No Commonwealth or NT threatened plant species were identified as occurring by the Protected Matters Searches (refer Appendix C). One species, the prostrate, herbaceous vine *Ipomoea argillicola*, is listed as Near Threatened under Section 29 of the *Territory Parks and Wildlife Conservation Act 2000* (TPWC Act) and could potentially occur in the project sites, although has not been reported in previous and current surveys. NT flora data base shows that this species has been recorded from the Bullwaddy Conservation Reserve and at locations surrounding the area in previous searches (AECOM, 2015).

The region supports fragmented stands of Bullwaddy, which is listed under the TPWC Act as 'Least Concern', which refers to species that are either widespread or common and cannot be categorised as Critically Endangered, Endangered, Vulnerable, Near Threatened or Data Deficient. However, Bullwaddy is significant in terms of the habitat it provides for a range of native species. The extent of Bullwaddy in the permit area is far more extensive than that indicated by the NT Herbarium records.

3.5.3 Weeds

Weeds remain an increasing threat to the Barkly region's natural assets. This threat is not new and considerable time and effort has already been invested in weed management across the region (Department of Land Resource Management, 2015).

Figure 7 and Table 6 provides a list of weed species that are known to occur or likely to occur within the wider exploration Permit Areas.

This information is based on:

- Mapping data provided by the Weed Management Branch, DENR.
- Guidelines for the *Management of the Weeds of Beetaloo 2018* (DLRM et al 2018).
- Department of the Environment and Energy (DotEE) EPBC Act Protected Matters Report database.
- Previous data collected by AECOM in the permit area.

Table 6 NT listed weeds known of likely to occur within the Permit Area

Scientific Name	Common Name	Status	Data Source
Acacia nilotica	Prickly Acacia	Class A and C, WoNS	Weed Management Branch – Mapping data DotEE Protected Matters Report
Alternanthera pungens	Khaki Weed	Class B and C	DLRM databases (DLRM *et al* 2018)
Andropogon gayanus	Gamba Grass	Class A and C, WoNS	Weed Management Branch – Mapping data
Azadirachta indica	Neem	Class B and C	Weed Management Branch – Mapping data
Cenchrus ciliaris	Buffel Grass	Not declared in NT	DotEE Protected Matters Report
Cenchrus echinatus	Mossman River Grass	Class B and C	DLRM databases (DLRM *et al* 2018)
Datura ferox	Fierce Thornapple	Class A and C	DLRM databases (DLRM *et al* 2018)
Hyptis suaveolens	Hyptis	Class B and C	Weed Management Branch – Mapping data DLRM databases (DLRM *et al* 2018)
Jatropha gossypiifolia	Bellyache Bush	Class B and C, WoNS	Weed Management Branch – Mapping data DLRM databases (DLRM *et al* 2018) DotEE Protected Matters Report
Parkinsonia aculeate	Parkinsonia	Class B and C, WONS	Weed Management Branch – Mapping data DLRM databases (DLRM *et al* 2018) DotEE Protected Matters Report
Prosopis pallida	Mesquite	Class A and C, WONS	Weed Management Branch – Mapping data

Scientific Name	Common Name	Status	Data Source
			DLRM databases (DLRM *et al* 2018)
Sida acuta	Spinyhead sida	Class B and C	Weed Management Branch – Mapping data
Sida cordifolia	Flannel Weed	Class B and C	Weed Management Branch – Mapping data DLRM databases (DLRM *et al* 2018)
Sida rhombifolia	Paddy's Lucerne	Class B and C	DLRM databases (DLRM *et al* 2018)
Tamarix aphylla	Athel pine	Class B and C, WONS	Weed Management Branch – Mapping data
Themeda quadrivalvis	Grader Grass	Class B and C, WoNs	Weed Management Branch – Mapping data
Tribulus terrestris	Caltrop	Class B and C	DLRM databases (DLRM *et al* 2018)
Xanthium occidentale	Noogoora Burr	Class B and C	Weed Management Branch – Mapping data DLRM databases (DLRM *et al* 2018)

Note: Declarations under the Northern Territory Weeds *Management Act 2013*:

- a Class A weed is to be eradicated
- a Class B weed is to have its growth and spread controlled
- a Class C weed is not to be introduced to the NT.

* All Class A and B weeds are also Class C.

They survey undertaken in August 2018 of the proposed exploration sites did not identify any weed species. This suggests that the habitat condition in the areas of the proposed sites and surrounding areas were good.

Previous surveys within the Permit Area in 2014, 2015, 2016 and 2018 of drill sites and access tracks have also found that the proposed areas had a low number of weed species which suggests the habitat condition was fairly high in and around the Permit Area. Specifically, three listed species, *Parkinsonia aculeate* (Parkinsonia), *Hyptis suaveolens* (Hyptis) and *Calotropis procera* (Rubber Bush) have been recorded. These records were not located in close proximity to the proposed 2019 exploration sites.

Parkinsonia is considered a Weed of National Significance (WoNS), which are weed species that are the focus of national management programs for the purpose of restricting their spread and/or eradicating them from parts of Australia.

Calotropis procera (Rubber Bush) (Class B and C) was recorded in close proximity to the Beetaloo access track. It is possible that additional species are present but were present in low abundance or difficult to identify due to stage of growth.

These weed species surveyed within the Permit Area and their corresponding Northern Territory *Weeds Management Act 2013* declarations are listed in Table 7.

Table 7 Species found within the permit area

Scientific Name	Common Name	Declaration	Where located
Hyptis suaveolens	Hyptis	Class B and C	Beetaloo access track Access track to Velkerri 98-E1-1 site
Parkinsonia aculeate	Parkinsonia	Class B and C, WONS	Beetaloo access track
Calotropis procera	Rubber bush	Class B and C	Close proximity to the Beetaloo access track

In addition to these 18 species a range of annual grass weeds are known to occur along road corridors throughout the region. This includes Buffel Grass, a weed that has the potential to alter fire regimes, which was introduced and cultivated for livestock feed and is useful in soil stabilisation.

The *Guidelines for the Management of the Weeds of Beetaloo 2018* (DLRM et al 2018), also identifies a number of introduced plants that have previously been recorded within the proposed permit areas and have been identified as problem weeds in one or more locations across Northern Australia. It is noted that these are not listed under the NT *Weeds Management Act* but could be of concern elsewhere in Australia. Understanding the potential weeds likely to occur within the Permit Area is particularly important when proposed activities include transporting machinery and equipment during the construction process.

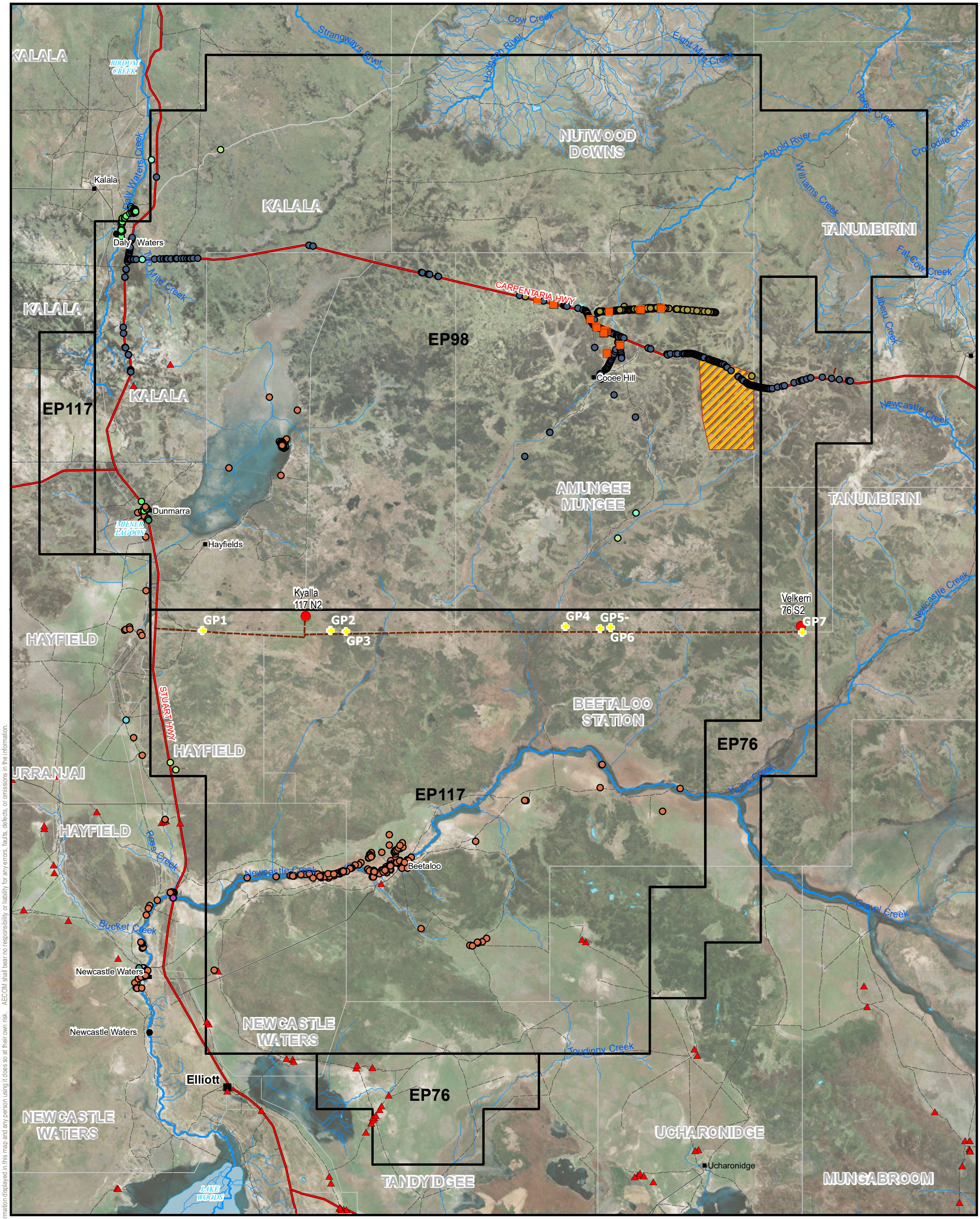
The *Barkly Regional Weed Management Plan* provides additional information on regional weed management priorities and management actions to support landholders in their obligations to manage weeds on their land (DLRM, 2015).

This plan includes a list of alert weed species. These species are not yet naturalised in the region but have the potential to have a high level of impact to the region should they become established. The likelihood of the species naturalising and spreading in the region is perceived to be high (DLRM, 2015).

The alert species identified the *Barkly Regional Weed Management Plan* are listed in **Error! Reference source not found.**. If found the program EMP requires the Weed Management Branch to be contacted for identification and disposal.

Table 8 Alert species identified in the Barkly Region

Scientific Name	Common Name	Declaration
Cenchrus setaceum	Fountain grass	Class B and C
Parthenium hysterophorus	Parthenium	Class A and C, WONS
Cryptostegia grandiflora	Rubber vine	Class A and C, WONS



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GEOCENTRIC DATUM OF AUSTRALIA 94

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LEGEND

- Proposed Wells 2019
- Homestead
- Place Name
- Populated Place
- Major Stream
- Minor Stream
- Access Tracks
- Highway
- Minor Road
- Tracks
- Cadastre
- Permit Areas
- Bullwaddy Conservation Reserve
- Gravel Pits

Weed Name

- Athel pine
- Bellyache bush
- Burr - Noogoora
- Gamba grass
- Grader grass
- Hyptis
- Mesquite
- Neem
- Parkinsonia
- Prickly acacia
- Sida - Flannel weed
- Sida - Spiny head
- Gamba Grass
- Rubberbush

LOCATION

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

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2019 Environmental Management Plan

Weeds of the Permit Area

PROJECT ID	60480548
CREATED BY	jace.emberg
LAST MODIFIED	20-May-2019
VERSION	1

Figure 7

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3.5.4 Fauna and Habitat

Previous surveys and database searches indicate that the permit areas are an important area for a diverse array of fauna. The NT Fauna database provides records for the following fauna species (excluding migratory birds): 32 species of mammal, 198 species of birds, 96 species of reptiles and 19 species of frogs. Surveys undertaken elsewhere within the region have recorded:

- 78 bird, 33 reptile, 11 mammal and six frog species in the Bullwaddy Conservation Reserve (PWCNT, 2005)
- 148 bird, 47 reptile, 21 mammal and six frog species in the Junction Stock Reserve and nearby Newcastle Waters (Fleming *et al*., 1983)
- 157 bird species within the project area as determined by a search of the Birds Australia bird atlas database (Birds Australia, 2010).

The proposed exploration sites are all located within similar habitat types consisting primarily of open *Eucalyptus*/*Corymbia* woodland with a tussock grass understorey. There are Bullwaddy/Lancewood communities around the proposed sites and individuals of both species are dispersed throughout. In the wider landscape, including proposed access tracks, additional vegetation types include those associated with drainage lines, grasslands/floodplains and acacia shrublands.

Eucalypt/Corymbia woodland provides habitat for a range of species. The proposed sites had high native grass cover and included numerous species suitable for granivorous birds (seed eaters). Dense leaf litter and numerous logs provide suitable refuge and foraging sites for fauna such as reptiles. Although most of the species found in this vegetation type are widespread in the tropical savannas of the Northern Territory, some such as the threatened Crested Shrike-tit (*Falcunculus frontatus whitei*) are rare and known to utilise this habitat (DoTEE, 2014, Ward, 2008). Many of the sites have a high density of hollow-bearing trees that provide important habitat for many fauna species. Avoiding clearing large hollow-bearing trees will reduce the impact to native wildlife within the permit area.

Savanna grasslands and open woodland provide suitable habitat for species such as Emu (*Dromaius novaehollandiae*) and Australian Bush Turkey (*Ardeotis australis*. Drainage lines and seasonally inundated grasslands may also provide habitat for migratory species during the wet season and are breeding areas for frogs. Limiting disturbances in these areas and avoiding these areas during the wet season would limit impacts on fauna.

3.5.4.1 Threatened Fauna

A search of the DotEE Protected Matters database of nationally significant fauna (PMST), the NT Government fauna database (NRM Infonet), and records from the Atlas of Living Australia (ALA) was undertaken for the proposed lease areas and access tracks. The search results indicate the potential presence of 15 fauna species listed as threatened under the EPBC Act and/or the TPWC Act (Table 9). These included ten birds, eight mammals and two reptiles.

The likelihood assessment of species occurrence is based on the availability of suitable habitat within the permit area, records in the vicinity and distributional data. Therefore many of the threatened and migratory fauna species indicated in databases as ‘occurring’ or ‘likely to occur’ have been assessed as *unlikely to occur* within the proposed exploration lease areas. As some areas in the proposed lease area have not been subject to intensive survey and some species are very cryptic, a conservative approach has been taken to assess species presence. A full description of each species, their distribution and habitat associations are outlined in Table 9 below.

No core habitat for threatened fauna was identified at the sites. However, some species may possibly occur and are known to occur in the wider landscape. Threatened species that may possibly occur include:

- Gouldian Finch *Erythrura gouldiae* (E-EPBC Act, VU-TPWC Act)
- Crested Shrike-tit (northern) *Falcunculus frontatus whitei* (VU-EPBC Act, NT-TPWC Act)

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

2015). No nesting habitat was recorded during the surveys and it is unlikely this species breeds in close vicinity of the sites. During the wet season Gouldian Finches move from breeding habitat on hillsides with suitable trees down to lower lying areas where they forage on perennial grasses such as *Triodia* sp., *Alloteropsis semialata*, and *Chrysopogon fallax* (Palmer *et al*. 2012). Some of the perennial grasses were recorded during recent surveys so potential foraging habitat is present; however, there are limited records in the vicinity of the sites suggesting it is not an important area for this species.

The Crested Shrike-tit lives in dry Eucalypt forests and woodland where it feeds on insects from the canopy and also under bark (Ward, 2008). It has been recorded in wet Melaleuca open woodlands, woodlands dominated by Nutwood (*Terminalia arostrata*), Bloodwoods with flaky bark and ironwood (DoE, 2014, Ward, 2008). In the NT, nesting has been recorded from September through to January and nests are built in terminal branches at the top of trees (Ward *et al*., 2009). The stronghold of this species is north of this location and only one old record exists near Borroloola. Although it is possible this species may be present in the area, it is unlikely to represent an important area for this species and the impact of the proposed activities, given their size, would be small.

The Grey Falcon (*Falco hypoleucus*) is a widespread species listed as Vulnerable in the NT that is considered possibly to be present in the study area. The Painted Honeyeater (*Grantiella picta*) has been known to occur in the study area, however, given it does not breed in the NT it would only be present intermittently for foraging. Based on the field assessment there was no breeding habitat recorded, and depending on grass seed and water availability it is unlikely the study area comprises core habitat for this species.

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

Table 9 EPBC and TPWC Listed Threatened Species and Likelihood of Occurrence

Species	Conservation Status		Distribution	Habitat	Likelihood of Occurrence
	EPBC	NT			
Birds					
Calidris ferruginea Curlew Sandpiper	Marine Migratory	VU	In the NT this species occurs around Darwin, north to Melville Island and Cobourg Peninsula, and east and south-east to Gove. It has been recorded inland from Victoria River Downs and around Alice Springs (Higgins & Davies 1996).	Coastal habitats, inland it has been found around lakes, dams and ephemeral/permanent waterholes.	Unlikely (suitable habitat not present at survey sites but potential sporadic in wider landscape)
Erythrotriorchis radiatus Red Goshawk	VU	-	Found across most of Northern Australia, in the NT most records are from the Top End but there are records from central Australia (Pizzey & Knight, 2012).	Red Goshawks occupy a range of habitats, often at ecotones, including coastal and sub-coastal tall open forest, tropical savannahs crossed by wooded or forested watercourses. In the NT, it inhabits tall open forest/woodland as well as tall riparian woodland (Aumann & Baker-Gabb, 1991).	Unlikely (no records and core habitat absent)
Erythrura gouldiae Gouldian Finch	E	VU	Formerly widespread across northern Australia. In the NT they are found in the Top End south past Daly Waters (Palmer *et al*., 2012).	Gouldian Finches occupy different habitat types in the breeding and non-breeding season. Breeding habitat consist of hillsides with suitable nesting trees. In the non-breeding season they are found in lowland drainages to feed on suitable perennial grasses (Dostine & Franklin, 2002).	Possible (sporadic, foraging only, no recent records)
Falcunculus frontatus whitei Crested Shrike-tit (northern)	VU	NT	This species has a very patchy distribution with records from the Victoria River District to Maningrida. Only one record near Borroloola (1930) (Woinarski & Ward, 2012).	Occupies wet and semi-arid melaleuca and eucalypt open woodlands. May be associated with bloodwoods with flaky bark and ironwood (Ward, 2008).	Possible (no records in vicinity although suitable habitat present, very rare)

Species	Conservation Status		Distribution	Habitat	Likelihood of Occurrence
	EPBC	NT			
Falco hypoleucos Grey Falcon	-	VU	This species has a widespread distribution and records for this species exist throughout the NT. However, most records are from arid and semi-arid regions (Pizzey and Knight, 2012).	Grey Falcons inhabit lightly treed inland plains, gibber desserts, sandridges, pastoral lands, timbered watercourses and, occasionally, the driest deserts. (Pizzey and Knight, 2012). Also found also in association with inland drainage systems.	Likely (probably not at proposed lease areas but likely in floodplains across the permit area)
Geophaps smithii Partridge Pigeon	VU	VU	Occurs across the Top End of the NT, declined/disappeared from lower rainfall areas (Woinarski, 2007).	Found predominantly in open eucalypt forest and woodland with grassy understories (Woinarski, 2007).	Unlikely (no records, occurs north of the permit area although some habitat present)
Grantiella picta Painted Honey Eater	VU	VU	This species is found throughout eastern Australia but breeding is known from south-eastern Australia (Pizzey and Knight, 2012). This species is rare.	This species specialises on the fruit of mistletoes although it may also forage on nectar and insects (Garnett *et al.*, 2011). Numerous large tracts of *Acacia shirleyi* with abundant mistletoes were recorded in the vicinity of the Beetaloo sites.	Possible (records from Barkly Tablelands but none in close vicinity, habitat present, foraging only)
Polytelis alexandrae Princess Parrot	VU	VU	Occupies arid lands in Australia where it is patchily distributed (Woinarski, 2007).	Found in sand dune habitat, spinifex with eucalypts, and shrubs such as acacias, hakeas, and eremophilas (Pizzey and Knight, 2012; Woinarski, 2007).	Unlikely (most records from southern arid region, not primary habitat)
Rostratula australias Australian Painted Snipe	CE	VU	In the NT, probably occurs in central and southern area although it also possible occurs in the northern portion of the area (Woinarski *et al*, 2007).	These birds prefer a habitat of recently flooded temporary vegetated wetlands during the non-breeding period and brackish temporary freshwater wetlands with minimum vegetation during breeding periods. Birds usually forage in thick, low vegetated areas during the day (Curtis *et al*, 2012).	Unlikely* (one record, no suitable habitat at drill sites but may be present in the wider landscape during the wet season)
Tyto novvaehollandiae kimberli	VU	VU	Distributed in Northern Australia although not well	This species inhabits tall open eucalypt forest in the NT, especially those associated	Unlikely

Species	Conservation Status		Distribution	Habitat	Likelihood of Occurrence
	EPBC	NT			
Masked Owl (northern)			known. In the NT, occurs from Cobourg south to Katherine and the VRD and east to the McArthur River (DOTE, 2014)	with *E. Miniata* and *E. tetrodonta (*Woinarski, 2007*)*. Also found in riparian and monsoonal forest and rainforest (DOTE, 2014)	(primary habitat absent)
Mammals					
Dasyurus hallucatus Northern Quoll	E	CE	Found throughout most of Northern Australia although now restricted to six main areas (Menkhorst & Knight, 2011). In the NT it is found in the Top End as far southeast as Boroloola (DOTE, 2014). One previous record from Shenandoah Pastoral Lease (unknown date).	Northern Quolls do not have highly specific habitat requirements although the most suitable appear to be rocky habitats (Woinarski, 2007). They occur in a variety of habitats across their range, including open forest and woodland. Daytime den sites provide important shelter. Shelter sites include rocky outcrops, tree hollows, hollow logs, termite mounds, goanna burrows and human dwellings.	Unlikely (no recent records, no core habitat)
Pseudantechinus mimulus Carpentarian Antechinus	–	VU	Found in QLD and the NT. In the NT it has been reported from the Sir Edward Pellew Island group, and Pungalina reserve near Borroloola.	This species is distributed in rocky habitat including sandstone boulders and outcrops with hummock grasses (Woinarski, 2004). In QLD, this species has been recorded on rocky ridges and hill-slopes (Lloyd *et al*., 2013).	Unlikely (one record but no suitable habitat)
Isodon auratus Golden Bandicoot	V	E	This species used to be found across northern, central and western Australia but decline after European settlement (Woinarski, 2007). Now only found on Marchinbar Island in the NT and small area of the NW Kimberley (Fisher and Woinarski, 1994; Woinarski, 2007).	Previously inhabiting a range of arid and semi-arid habitats, in the NT it occupies heathland and shrubland and hummock grasslands on sandstone, vine thickets and grassy woodlands (Menkhorst and Knight, 2011; Woinarski, 2007).	Highly unlikely (only persists in NE Arnhemland)

Species	Conservation Status		Distribution	Habitat	Likelihood of Occurrence
	EPBC	NT			
Macroderma gigas Ghost Bat	VU	NT	The species' current range in northern Australia ranges from relatively arid conditions in the Pilbara region of Western Australia to humid rainforests of northern Queensland. A large colony occurs in a series of gold mine workings at Pine Creek, NT. This species have also been recorded throughout the mainland Top End north of approximately 17º latitude.	The distribution of this species is influenced by the availability of suitable caves and mines for roost sites (NTG, 2018).	Unlikely (no recent records, no suitable cave located near proposed sites)
Macrotis lagotis Greater Bilby	VU	VU	This species occurs in south-western Queensland and in arid north-western Australia (Western Australia and Northern Territory). This species was previously widespread in arid and semi-arid Australia (Pavey, 2009). The most northern records are from Newcastle Waters and Wave Hill (Southgate & Paltridge, 1998).	In the NT, this species is found on sandy soils dominated by spinifex (Pavey, 2009). Low shrubs such as *Acacias* and *Melaleucas* are also common in this habitat. Also hummock grassland associated with low lying drainage systems and alluvial areas.	Unlikely (no recent records, primary habitat limited in permit area)
Saccolaimus saccolaimus nudicluniatus Bare-rumped Sheath-Tailed Bat	CE	DD	Wide distribution from India through south-eastern Asia to the Solomon Islands, including north-eastern Queensland and the NT. The north-eastern Australian populations are described as the subspecies S. s. nudicluniatus, although it is	Previous specimens have been collected from Open *Pandanus* woodland fringing the sedgelands of the South Alligator River in Kakudu National Park (Friend and Braithwaite, 1986). In the NT, it has also been recorded from eucalypt tall open forests (Churchill, 1998)	Unlikely (no records and primary habitat not present)

Species	Conservation Status		Distribution	Habitat	Likelihood of Occurrence
	EPBC	NT			
			not clear whether this should be applied to the NT population (Duncan et al. 1999). There have been very few (<5 confirmed) records since (McKean et al. 1981; Thomson 1991). All confirmed records have been from the Kakadu lowlands.		
Trichosurus vulpecula vulpecula Common Brushtail Possum	–	E	Previously widespread in the NT, this species is now found in isolated locations in the southern NT (Woinarski, 2007).	This species occupies riparian habitat in the vicinity of rocky outcrops or slopes (Kerle *et al*., 1992).	Unlikely (no records in the vicinity of the lease area and no suitable habitat)
Rattus tunneyi Pale Field-rat	–	V	Inhabiting higher rainfall area including the Top End of the NT (Menkhorst and Knight, 2011).	This species favours dense vegetation found along rivers where it occupies burrows in loose colonies (Cole and Woinarski, 2002). However, this species can be found in a variety of habitats including woodlands if a dense understorey of grasses is present (Menkhorst and Knight, 2011)	Unlikely (one record from 1999 in greater area, primary habitat absent)
Reptiles					
Acanthopis hawkei Plains Death Adder	VU	VU	In the NT this species is found in the floodplains of the Adelaide, Mary and Alligator Rivers and the Barkly Tablelands.	Found on flat cracking soils in treeless floodplains where it forages on frogs, reptiles and rats.	Unlikely (no records or suitable habitat)
Varanus Mertensi Mertens Water Monitor	–	V	Distributed throughout coastal and inland waters in northern Australia. In the NT found throughout most of the Top	Semi-aquatic species that inhabits vegetation associated with water such as Pandanus and paperbark. Seldom found far away from water (Mayes, 2006).	Unlikely*(was confirmed during previous surveys along Newcastle

Species	Conservation Status		Distribution	Habitat	Likelihood of Occurrence
	EPBC	NT			
			End. Decrease in NT population attributed to Cane Toads.		Creek, habitat unsuitable at proposed exploration lease sites)

3.5.5 Feral Animals

Feral animals known to occur within the region include:

- Pig (*Sus scrofa*)
- Wild Dog (*Canis lupus familiaris*)
- Feral Cat (*Felis catus*)
- Cane Toad (*Bufo marinus*)
- Horse (*Equus caballus*)
- Donkey (*Equus asinus*)
- Water Buffalo (*Bubalus bubalis*)
- Camel (*Camelus dromedarius*)
- Black Rat (*Rattus rattus*)
- Domestic Cattle (*Bos Taurus*)

During the August 2018 survey evidence of cattle grazing in present or 1-2 years previously was recorded and in previous surveys of the permit area cat tracks were observed as the only non-native species recorded but based on records many species, especially Dogs/Dingo, Pigs and Cane Toads will be present in permit area. The disturbance from cattle within the proposed sites were considered to have resulted in less than 5% damage or no damage at all.

The Cane Toad is known to be present in the permit area and the Commonwealth DoTEE recognises this species as a 'key threatening process' related to their impacts on biodiversity through predation, competition, land degradation and poisoning. In the Northern Territory, the Cane Toad has been implicated in the decline of several species including a large number of reptiles such as the King Brown Snake and water monitors (Smith & Phillips, 2006).

Pest predators such as the Cat are most likely common although their abundance is difficult to assess due to their cryptic nature. Introduced predators such as Cats can impact many vertebrates (e.g. Dickman, 2009 &1996). One of the primary concerns of introduced predators in the site is the impact on EPBC listed species such as reptiles, and ground-dwelling birds. Feral cats are believed to be one of factors that have led to the decline of threatened ground-dwelling bird the Partridge Pigeon (Woinarski *et al*. 2007)

Species could be attracted to the increased activities at the site potentially increasing their abundance in the landscape, and their control should be taken into consideration during the proposed activities on site. It is of key importance during all phases of the project that care is taken to ensure that rubbish is securely contained (i.e. with suitable lids) and removed from the site as soon as possible to discourage attracting any feral animals.

3.5.6 Fire

Fire is a natural occurrence in most Australian ecosystems and plays an important role in their ecology. Fire is generally excluded from Mitchell grasslands by pastoral management in order to maintain forage throughout the dry season (HLA, 2005) whereas fire is more frequent in the Sturt Plateau.

Historically, the majority of dry season fires (June to September) have occurred in the northern half of the permit area, in EP76, EP98 and EP117. At this time of year, the fires are likely to be high intensity (HLA, 2005). Wet season fires (October to May) have occurred within the permit area. These fires are likely to be patchy and of lower intensity, depending on the state of curing of the fuel load.

Bullwaddy and Lancewood communities, which are located throughout the permit area, are fire sensitive and hot fires have the ability to reduce habitat quality for both flora and fauna species. Research suggests that fauna diversity may be impacted by a hot fire, particularly for diurnal reptiles (e.g. Legge *et al*., 2008).

Based on field data, fire disturbance was determined as follows:

- Vekerri 76 S2-1 – Fire Frequency 2-3 years previous, Intensity 1 (minor scars on some trees/shrubs and Height <1m.
- Kyalla 117 N2-1 – Fire Frequency 1-2 years previous, Intensity 4 (some trees and shrubs killed) and Height 1-4 m. It was noted that site appeared to have had a hot fire go through previously with abundance of new Acacia regrowth.

All sites that showed evidence of fire disturbance were showing signs of regrowth and recovery.

3.6 Land Condition Summary

Detailed land condition description and photographs of each of the proposed lease areas (Velkerri 76 S2-1, Kyalla 117 N2-1) are provided in Table 10 and Table 11 below.

Table 10 Velkerri 76 S2 Condition Description

Site ID	Velkerri 76 S2	Habitat photos at central point of survey site (August 2018)
Location	-16°51' 20.13, 134°23' 39.85	   
Landform and soil	Plains and rises associated with deeply weathered profiles (laterite) including sand sheets and other depositional products; sandy and earth soils. Trace of cracking clay soils.	
Habitat type	*Eucalyptus/Corymbia low woodland*	
Vegetation Community	Eucalyptus low woodland/low open tussock grassland This vegetation community is considered regionally extensive and not subjected to extensive clearing.	
Dominant flora species	Canopy dominated by *Corymbia dichromophloia*, *Erythrophleum chlorostachys*. Shrub layer including *Eucalyptus sp*. Ground layer species include *Aristida latifolia, Pterocaulon sphacelatum, Triodia bitextura.*	
Habitat condition	Good condition with evidence of recent grazing. Large hollow bearing trees and logs were common in the area. The large hollows provide suitable nesting and shelter for numerous fauna species including reptiles, arboreal mammals, and nocturnal birds. The habitat contained moderate refuge opportunities in the form of dense leaf litter, dense grass cover, and woody debris. Good continuous cover adjoining adjacent woodland habitat. No evidence of weeds or feral animals.	**Additional Habitat Photos across survey site (August 2018)**  
Potential Listed Threatened Species	Grey Falcon, Northern Shrike-tit, Plains Death Adder, Gouldian Finch.	

Table 11 Kyalla 117 N2-1 Condition Description

Site ID	Kyalla 117 N2-1	Habitat photos at central point of survey site (August 2018)
Location	-16°50' 29.01, 133°39' 0.16	 
Landform and soil	Plains and rises associated with deeply weathered profiles (laterite) including sand sheets and other depositional products; sandy and earth soils	
Habitat type	*Corymbia* low woodland	
Vegetation Community	*Corymbia* low woodland/*Terminalia* (mixed) sparse shrubland/*Chrysopogon* (mixed) low tussock grassland This vegetation community is considered regionally extensive and not subjected to extensive clearing.	
Dominant flora species	Canopy dominated by *Corymbia dichromophloia, Eucalyptus setosa*. Shrub layer including *Acacia ancistrocarpa, Alphitonia pomaderroides, Brachychiton paradoxus.* Ground layer species include *Triodia bitextura*	 
Habitat condition	Good condition with evidence of recent grazing. Vegetation appeared to heavily burnt in recent years. No evidence of hollow bearing trees and logs. The habitat contained moderate to high refuge opportunities in the form of dense leaf litter, tussock grass cover, and woody debris. Good continuous cover adjoining adjacent woodland habitat and regionally extenisive. No evidence of weeds or feral animals.	**Additional Habitat Photos across survey site (August 2018)**  
Potential Listed Threatened Species	Grey Falcon, Northern Shrike-tit, Plains Death Adder, Gouldian Finch.	

4.0 Conclusion

During August 2018, AECOM undertook a land condition assessment of the two proposed exploration lease areas and access tracks to provide a baseline assessment of ecological conditions in support of Origin Energy's application to the Northern Territory Department of Environment and Natural Resources, including the preparation of an Environmental Management Plan (EMP) for various exploration activities.

The purpose of the LCA was to gather baseline information to provide an environmental condition assessment to support the proposed exploration activities to be carried out by Origin at two proposed lease sites during 2019/2020.

The LCA identified the ecological conditions and documented the site condition prior to Origin commencement of exploration within two of their Permit Areas EP76 and EP117. The information obtained during the initial LCA will assist in determining that at the end of the exploration activities that the lease areas have been rehabilitated back to its natural state.

The proposed exploration program will have a total disturbance of approximately 22.4 ha and will utilise 107 km of existing access tracks.

The desktop review and field survey assisted in identifying the potential environmental risks and impacts to the environment based on the conditions identified on site and has allowed the development of mitigation measures to minimise Origin's impact on the environment.

During the survey of the proposed exploration lease areas, as well as the areas surrounding the proposed access tracks were assessed to be in generally good condition with no to low evidence of weeds, erosion and disturbance from cattle.

The likelihood assessment concluded that no EPBC listed threatened ecological communities or threatened species are likely to be significantly impacted from the proposed exploration program activities.

Overall, the impacts of the vegetation clearing for the proposed lease areas and access tracks are considered minor from a landscape perspective. Surrounding habitat is extensive and most species are mobile and will be able to access surrounding habitat.

The mitigation measures presented in the Drilling and Stimulation EMP would assist in minimising the impacts from Origin's activities on EPBC listed species and communities.

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Appendix A

Soil Test Results

Soil Id	Photo	Soil pH	Soil Colour	Dispersion Test Observations
Kyalla N2-1		5.14	1.5YR 4/6	**Initial Observation** • Sample was fully crumbed when submerged in demineralised water. **Final Observation** • Non-dispersive, particles crumble though water remains clear.
Velkeri S2		5.02	10YR 3/4	**Initial Observation** • Sample was fully crumbed when submerged in demineralised water. **Final Observation** • Non-dispersive, particles crumble though water remains clear.
NOTE: Initial Observation - observation made when the sample was submerged in water Final Observation - observation made after 2 hours				

Appendix B

Flora Species Record, August 2018

Appendix B Flora Species Record, August 2018

Table 12 Flora Species Recorded, August 2018 Field Survey

Family	Genus	Species
Asteraceae	*Pterocaulon*	*sphacelatum*
Caesalpiniaceae	*Erythrophleum*	*chlorostachys*
Combretaceae	*Terminalia*	*canescens*
		arostrata
	Macropteranthes	*kekwickii*
Euphorbiaceae	*Petalostigma*	*pubescens*
Fabaceae	*Acacia*	*ancistrocarpa*
		shirleyi
		sp.
Myrtaceae	*Corymbia*	*dichromophloia*
		drysdalensis
		ferruginea
Poaceae	*Aristida*	*holathera*
	Chrysopogon	*fallax*
	Enneapogon	*lindleyanus*
	Eragrostis	*spartinoides*
	Eriachne	*aristidea*
		ciliata
		nervosa
		sp.
	Heteropogon	*contortus*
	Sarga	*plumosum*
	Schizachyrium	*fragile*
	Sporobolus	*australasicus*
	Themeda	*triandra*
	Triodia	*bitextura*
		sp.
Rhamnaceae	*Alphitonia*	*pomaderroides*
Sterculiaceae	*Brachychiton*	*paradoxum*

Appendix C

DotEE Protected Matters Search Report

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.

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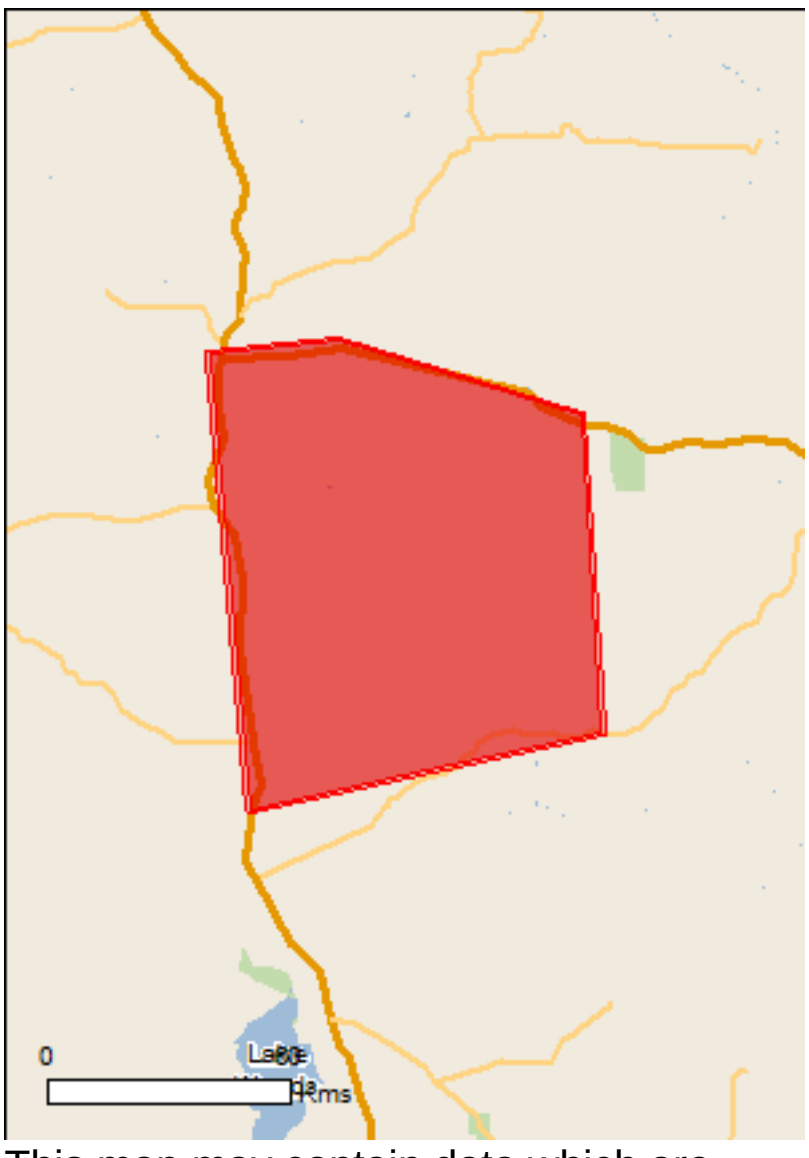

Coordinates

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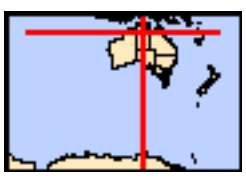

Summary

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:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	12
Listed Migratory Species:	12

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:	19
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	1
Regional Forest Agreements:	None
Invasive Species:	15
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

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 likely to occur within area
Erythrura gouldiae Gouldian Finch [413]	Endangered	Species or species habitat likely to occur within area
Falcunculus frontatus whitei Crested Shrike-tit (northern), Northern Shrike-tit [26013]	Vulnerable	Species or species habitat likely to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat known to occur within area
Rostratula australis Australian Painted-snipe, Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Tyto novaehollandiae kimberli Masked Owl (northern) [26048]	Vulnerable	Species or species habitat may occur within area
Mammals		
Macroderma gigas Ghost Bat [174]	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
Saccolaimus saccolaimus nudicluniatus Bare-rumped Sheath-tailed Bat, Bare-rumped Sheathtail Bat [66889]	Vulnerable	Species or species habitat may occur within area
Reptiles		
Acanthophis hawkei Plains Death Adder [83821]	Vulnerable	Species or species habitat likely to occur within area
Elseya lavarackorum Gulf Snapping Turtle [67197]	Endangered	Species or species habitat may 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		
Cecropis daurica Red-rumped Swallow [80610]		Species or species habitat may occur within area
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to 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

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 known to occur within area
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		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
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat known to occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat may occur within area
Hirundo daurica Red-rumped Swallow [59480]		Species or species habitat may occur within area
Hirundo rustica Barn Swallow [662]		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
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Reptiles		
Crocodylus johnstoni Freshwater Crocodile, Johnston's Crocodile, Johnston's River Crocodile [1773]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Frew Ponds	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
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat may occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Bubalus bubalis Water Buffalo, Swamp Buffalo [1]		Species or species habitat likely to occur within area
Camelus dromedarius Dromedary, Camel [7]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Equus caballus Horse [5]		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
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Plants		

Name	Status	Type of Presence
Acacia nilotica subsp. indica		
Prickly Acacia [6196]		Species or species habitat may occur within area
Cenchrus ciliaris		
Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area
Jatropha gossypifolia		
Cotton-leaved Physic-Nut, Bellyache Bush, Cotton-leaf Physic Nut, Cotton-leaf Jatropha, Black Physic Nut [7507]		Species or species habitat likely to occur within area
Parkinsonia aculeata		
Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area
Vachellia nilotica		
Prickly Acacia, Blackthorn, Prickly Mimosa, Black Piquant, Babul [84351]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus		
Asian House Gecko [1708]		Species or species habitat likely to occur within area

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

-16.305477 133.356741,-16.297568 133.356741,-16.269886 133.641013,-16.428018 134.180716,-17.098628 134.226035,-17.263941 133.447379,-16.305477 133.356741

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.

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Appendix D Heritage Report

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11 September 2018

Matthew Hanson
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Dear Matthew

Aboriginal & Historic Heritage Assessment: 2018 Exploration Lease Areas

1.0 Introduction

AECOM Australia Pty Ltd (AECOM) was commissioned by Origin Energy Resources Limited (Origin) to conduct a heritage assessment of eight proposed groundwater bore drill locations (Velkerri 98 E1-1, Kyalla 98 W1-1, Velkerri 76 S1-1, Velkerri 76 S2-1, Kyalla 117 N2-1, Velkerri 117 E1-1, Kyalla 117 W1-2 and Kyalla 117 W2-1) within the Beetaloo Basin covering exploration permit areas EP76. EP98, EP117 located west of Daly Waters, Northern Territory. This assessment included the associated access tracks.

The assessment involved a field inspection for the area of proposed works (study area).

2.0 Proposed Activities

Origin are proposing to undertake a series of low impact activities required to establish a comprehensive baseline groundwater monitoring program in preparation for its' 2019 exploration program. The groundwater monitoring program will involve the installation of up to four groundwater monitoring bores from eight (8) proposed lease sites within the Origin Beetaloo Exploration Area.

The project boundaries for the heritage assessment was defined as the area which may be affected by the groundwater monitoring bore installation program and the potential future exploration activities. Including:

- The eight (8) proposed 4 hectare lease area with an additional 500 m buffer, which encompassed the 50 x 50 m groundwater monitoring bore lease sites.
- The upgrade of approximately 205 km of existing access tracks and boundary fence tracks to allow the groundwater bore drilling rig access; and
- The installation of approximately 15km of new access tracks to connect the groundwater monitoring sites to the existing access tracks.
- Potential establishment of three 50m x 50 m gravel pits.

It is noted that the heritage assessment allowed for a 250 m buffer either side of an existing access track to allow for locating camps, gravel pits and water supply bores in the future. Where the access track is located on a property boundary, the buffer will be 500 m out into the property the road is located on.

It is noted that not all of the nominated areas for the monitoring bore lease and/or access tracks will be affected by site activities, but sufficient size has been allowed to provide flexibility in the siting of infrastructure, which in turn can be used to minimise environmental and heritage impacts (e.g. significant tree or habitat avoidance, Sacred Site/archaeological artefact avoidance).

3.0 Existing Data Sources

Information on the location of heritage sites within the study area was obtained from:

- a review of Native Title claims and Indigenous Land Use Agreements over the proposed activity areas
- a review of existing Northern Territory Heritage Register managed by the NT Heritage Branch

- a review of the Sacred Sites Register maintained by the Aboriginal Areas Protection Authority
- a review of past archaeological survey reports and assessments undertaken within the local area.

3.1 Native Title

Three Native Title claims have been determined as non-exclusive and one Indigenous Land Use Agreement (ILUA) are current over the permit areas (see Table 1).

Table 1 Native Title & ILUA Agreements

Type	Bore	Name	Summary
Native Title	Kyalla 98 W1-1	NTD21/2010 Shenandoah Pastoral Lease	Native Title exists in parts of the determination area and is held by the Kinbininggu and Bamarrngganja groups
	Kyalla 117 N2-1	NTD21/2010 Shenandoah Pastoral Lease	Native Title exists in parts of the determination area and is held by the Kinbininggu and Bamarrngganja groups
	Kyalla 117 W2-1	NTD27/2010 Beetaloo Pastoral Lease	Native Title exists in parts of the determination area and is held by the Karranjini group; the Bamarrnganja group; the Warranangku group; the Pinda (OT Downs) group; and the Lija/Muwartpi group
	Kyalla 117 W1-2	NTD27/2010 Beetaloo Pastoral Lease	Native Title exists in parts of the determination area and is held by the Karranjini group; the Bamarrnganja group; the Warranangku group; the Pinda (OT Downs) group; and the Lija/Muwartpi group
	Velkerri 98 E1-1	NTD17/2010 Amungee Mungee Pastoral Lease	Native title exists in parts of the determination area and is held by The Karranjini group; the Bamarrnganja group
	Velkerri 76 S2-1	NTD17/2010 Amungee Mungee Pastoral Lease	Native title exists in parts of the determination area and is held by The Karranjini group; the Bamarrnganja group
	Velkerri 76 S1-1	NTD27/2010 Beetaloo Pastoral Lease	Native Title exists in parts of the determination area and is held by the Karranjini group; the Bamarrnganja group; the Warranangku group; the Pinda (OT Downs) group; and the Lija/Muwartpi group
	Kyalla 117 E1-1	NTD27/2010 Beetaloo Pastoral Lease	Native Title exists in parts of the determination area and is held by the Karranjini group; the Bamarrnganja group; the Warranangku group; the Pinda (OT Downs) group; and the Lija/Muwartpi group
Indigenous Land Use Agreement	All Sites	D12004/014 Jingaloo CLA ILUA	Registered for Community Living Area and Tenure resolution

The Native Title Petroleum Exploration Agreement between Permit Holder and the NLC includes clauses for the protection of Sacred Sites, objects and sensitive areas related to Aboriginal activities in the area, including cultural, hunting and foraging activities. Site clearance will occur prior to any on ground activities. The Native Title Agreement also includes clauses for the protection of the environment and rehabilitation.

3.2 Australian Heritage Database

A search of the Australia Heritage Database identified that no statutory listed heritage places within the proposed impact areas.

3.3 NT Heritage Register

A search of the Northern Territory Heritage Register identified two artefact scatters located adjacent to the Stuart Highway (Table 2). Goochegoochena Creek Site 1 and Goochegoochena Creek Site 2 are recorded within 600 m and 350 m respectively of the proposed access track entrance. These sites will not be directly affected by the proposed works.

Table 2 NT Heritage Register - Aboriginal Heritage Sites

Site Name	Zone	Easting	Northing	Site Type
Goochegoochena Creek Site 1	[redacted]	[redacted]	[redacted]	Stone artefact scatter
Goochegoochena Creek Site 2	[redacted]	[redacted]	[redacted]	Stone artefact scatter

3.4 Aboriginal Areas Protection Authority

AAPA clearance surveys by AAPA anthropologist and traditional owners are currently being undertaken and will be finalised prior to commencement of activities. Previous clearances have previously been completed for the Origin exploration permit areas. The most current clearance certifciates issued for Origin exploration program including:

- AAPA 2014/1021 (C2014/183) – EP117 for Beetaloo W-1
- AAPA 2014/1022 (C2014/184) – EP98 for Kalala S-1 and Amungee NW-1
- AAPA 2015/550 (C2015/212) – EP98 for Kalala NE-1 and Nutwood Downs SW-1. AAPA 2015/550 was reviewed to update a change of exploration sites on EP98 for the CY2016 program.

Based on previous clearance certificates the only area restricted work area for the current clearance AAPA 2014/1021 (C2014/183) which lists AAPA #5663-45. This area is described as *open country surrounded by dense vegetation on the road to Jingaloo – no access and no work permitted on south side of Beetaloo access track within a radius of 300 m*.

Other restricted works areas are identified across the entire permit area. Refer to Appendix E for the available AAPA Clearance Certificates. Origin have committed to comply with conditions as prescribed by AAPA for the duration of the program.

3.5 Previous Archaeological Investigations

The majority of archaeological investigations near the study area have been predominately associated with either linear infrastructure in an alignment parallel to the Stuart Highway or natural gas exploration activities associated with the Beetaloo Basin. Of the assessments of relevance to the study area, the majority of sites identified are artefact scatters composed of raw material commonly found in the immediate area (quartz, silcrete and quartzite).

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

Table 3 Previous Archaeological Assessments in the Local Area

Researchers	Assessment Type	Locality	Key Findings
Smith, 1986	Excavation	Lake Woods	Insitu artefacts dated to 6,000 years.
Hermes, 1986	Survey	Amadeus Basin to Katherine	Large scale survey for a proposed natural gas pipeline targeting areas of major cultural sensitivity from Daly Waters to Katherine. Thirty-two sites were identified with the majority being artefact scatters associated with watercourses.

Researchers	Assessment Type	Locality	Key Findings
Quaternary Archaeological Surveys, 1998	Survey	Stuart Highway to Mataranka Homestead	Large scale survey for a fibre optic cable corridor. Three isolated artefacts and one historic heritage site identified.
Heritage Surveys, 1999	Survey	Daly Waters to McArthur River	Nine archaeological sites identified including rockshelters and artefact scatters.
HLA-Envirosciences Pty Ltd, 2006a, 2006b, 2006c, 2006d, 2007	Survey	Beetaloo Basin	Several archaeological sites identified across the exploration permits including artefact scatters, isolated artefacts and stone cairns.
AECOM Australia Pty Ltd, n.d., 2011, 2012a, 2012b	Survey	Beetaloo Basin	Several archaeological sites identified as part of seismic line clearance including large artefact scatters (>1 km), quarry sites and isolated artefacts.
AECOM Australia Pty Ltd, 2014	Survey	Beetaloo Basin	One isolated artefact identified as part of an exploration drilling program clearance.
AECOM Australia Pty Ltd, 2016	Survey	Beetaloo Basin	One isolated artefact identified on Newcastle Waters firebreak

4.0 Heritage Assessment

A heritage assessment involving field survey was undertaken by AECOM archaeologist, Luke Kirkwood for the proposal area on 28 to 29 August 2017. The archaeological inspection involved helicopter and pedestrian survey of the proposed water bore lease area and access tracks.

During the inspection notes were taken on landform, ground surface visibility and areas of exposure. The aim of the inspection was to identify any surface expressions of Aboriginal archaeological and cultural heritage values within the proposal area. Photographic records were taken at each proposed disturbance location.

Results of the inspection are provided in Table 4. Appendix B provides details on ground surface visibility classes and subsurface archaeological potential assessment. Plate 1 to Plate 8 present the general context shot of the proposed monitoring bore lease area.

Table 4 Monitoring Bore Inspection Results

Location	Easting (mE)[a]	Northing (mN)[a]	GSV[b]	GSI[c]	Surface Archaeology	Subsurface Potential	Impact Potential
Kyalla 98 W1-1	364955	8177458	Very good	High	None identified	Low	Low to No Impact
Kyalla 117 N2-1	356175	8137500	Fair	High	None identified	Low	Low to No Impact
Kyalla 117 W1-2	368079	8106696	Fair	Moderate	None identified	Low	Low to No Impact
Kyalla 117 W2-1	358321	8108680	Good	High	BT-18-IA1	Low	Low to No Impact
Velkerri 76 S2-1	435488	8136321	Good	High	None identified	Low	Low to No Impact
Velkerri 76 S1-1	424362	8113273	Very good	High	None identified	Low	Low to No Impact
Velkerri 98 E1-1	415515	8180683	Very poor	High	None identified	Low	Low to No Impact
Velkerri 117 E1-1	428861	8120782	Very good	High	None identified	Low	Low to No Impact

a GDA94 Zone 53; b GSV = Ground Surface Visibility; c GSI = Ground Surface Integrity

Plate 1 Kyalla 98 W1-1 general context shot

Plate 2 Kyalla 117 N2-1 general context shot

Plate 3 Kyalla 117 W1-2 general context shot

Plate 4 Kyalla 117 W2-1 general context shot

Plate 5 Velkerri 76 S1-1 general context shot

Plate 6 Velkerri 76 S2-1 general context shot

Plate 7 Velkerri 98 E1-1 general context shot

Plate 8 Velkerri 117 E1-1 general context shot

5.0 Identified Archaeological Heritage

No culturally sensitive landforms were identified during the survey of the proposed lease sites. One Aboriginal isolated artefact (BT-18-IA1, a silcrete unifacial point) was identified 100 m north west of the proposed Kyalla 117 W2-1 lease. Details of the find are provided below:

Site Name: BT-18-IA1

Co-ordinates: [redacted]

Site Description: Isolated silcrete unifacial point. Retouch is present along all margins of the artefact with the platform also removed. Extreme tip of point shows evidence of impact damage. No other obvious signs of usewear or residues. Darkening on ventral surface of tool, may be from exposure to soil.

Site is located on the boundary of two ecotones: Spinifex and laterite rich lower slopes. Soil is light grey/yellow sandy matrix typical of spinfex suitable habitats. Immediately adjacent is a very gently inclined slope composed on ironstone nodules. No evidence of archaeology was identified in the ironstone rich areas. Nearest wetland is 400m to the southeast

Ground Surface Visibility: 80%. Generally GSV is considered to be extremely good in this area due to low grass cover. Despite intensive survey of the immediate area (50m) no further archaeological finds were identified.

Ground Surface Integrity: 100%.

Site Interpretation: Site is an isolated discard event and likely represents small groups/individuals moving across the landscape for hunting purposes. Points are thought to be a late Holocene technology that was developed in response to increasingly marginal environments. The popularity of points is thought to be a response to reducing foraging risk by developing a highly maintainable technology that allowed for greater adaptation to these new conditions.

Table 5 Artefacts Identified in Disturbance Area

Archaeological Site	Artefact Type	Raw Material	Length (mm)	Width (mm)	Breadth (mm)
BT-18-IA1	Isolated unifacial point	Silcrete	38	22	5

Plate 9 **BT-18-IA1 (dorsal)**

Plate 10 **Kyalla 117 W2-1 ground cover context shot showing surface visibility. Artefact in foreground**

6.0 Key Findings and Recommendations

The key findings of this heritage assessment are:

- A review of existing heritage data and reports for the study area indicate that no previously recorded heritage sites will be impacted by the proposed works.
- One isolated artefact, BT-18-IA1, was identified. This artefact was found on the surface and has likely been moved by hydrological processes common across this area during the wet season.
- AAPA clearance surveys by AAPA anthropologist and traditional owners are currently being undertaken and will be finalised prior to commencement of activities.

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

- Heritage specialist to report site to NT Heritage Branch
- Avoid impact to the site by temporarily fencing a 10 m buffer around its location during construction works.
- If impact cannot be avoided:
    - Consult with the NT Heritage Branch and traditional owners and identify a suitable relocation area. Under law, the NT Heritage Branch are the determining body with respect to impacts to Indigenous heritage, but generally default to the wishes of community.
    - Update site details to the NT Heritage Branch. Relocation of isolated artefacts is allowed under the NT Heritage Act provided, the site is extensively documented prior to relocation.
- An unexpected heritage finds stop works procedure is to be implemented for the duration of the project.
- Induction of staff on site is to include reference to the wider area having Indigenous heritage values and the stop works procedure.

7.0 References

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Yours faithfully

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Appendix A - Legislation

Commonwealth Legislation

Environment Protection and Biodiversity Conservation Act

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

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

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

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

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

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

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

Aboriginal and Torres Strait Islander Heritage Protection Act 1984

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

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

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

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

The ATSIHP Act can override state and territory laws in situations where a state or territory has approved an activity, but the Commonwealth Minister prevents the activity from occurring by making a declaration to protect an area or object. However, the Minister can only make a decision after receiving a legally valid application under the ATSIHP Act and, in the case of long term protection, after considering a report on the matter. Before making a declaration to protect an area or object in a state or territory, the Commonwealth Minister must consult the appropriate Minister of that state or territory (section 13).

Northern Territory Legislation

Northern Territory Aboriginal Sacred Sites Act

Provides for the protection of Aboriginal sacred sites through the establishment of different categories of site based on land tenure, including sites on Aboriginal Freehold land. The Act also establishes the Aboriginal Areas Protection Authority (AAPA) as the central administering body which supports Aboriginal custodians in achieving the objectives of the Act. Consultation with the NLC and TO's required and the issue of the AAPA clearance certificates.

The Act establishes a duty-of-care to notify the AAPA of any potential disturbance to Aboriginal sacred sites. It is an offence to desecrate or disturb a site without the approval of the relevant custodians. A register of known sites exists to assist in identifying the likelihood of disturbance and potential need to obtain approval.

Heritage Act

Protects both natural and cultural heritage, including Aboriginal, historic and Macassan heritage. The Act establishes the Heritage Council (consisting of eleven members) and the NT Heritage Register. It sets the process by which places become heritage places and allows for interim protection of places.

It is an offence to remove or damage heritage places or objects or to mislead or obstruct heritage officers regarding the provision of requested information or entry to works, vehicles or premises that are likely to have been involved in an offence against the Heritage Act. Compliance with the requirements of the Act must be adhered to at all times.

Appendix B – Archaeological Assessment Criteria

Table B1 Ground Surface Visibility (GSV) Rating Scheme

GSV rating	Percentage GSV
No ground surface visibility	0%
Very poor	1-10%
Poor	11-30%
Fair	31-50%
Good	51-70%
Very good	71-90%
Excellent	91-100%

Table B2 Ground Surface Integrity (GSI) Rating Scheme

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

Table B3 Definitions for Subsurface Archaeological Potential

Subsurface Archaeological Potential	Definition
Low	Areas in which subsurface archaeological materials are unlikely to occur. This may be due to unfavourable environmental conditions and/or prior disturbance(s).
Moderate	Areas in which subsurface archaeological materials may occur. Reasonable environmental conditions exist though high artefact counts/densities are unlikely. Subsurface evidence likely to be the product of random discard events as opposed to repeated or extensive activity by Aboriginal people in antiquity.
High	Areas known or highly likely to contain subsurface archaeological materials. Presence of archaeological materials typically reflects optimal environmental conditions and little to no prior landscape disturbance. High artefact counts/densities are likely.

Table B4 Impact Potential Ranking for Aboriginal Objects

Impact Potential	Definition	Management Action
No Impact	Aboriginal objects will not be affected by the proposed activity.	No action required
Low Impact	The proposed activity is unlikely to disturb, destroy, damage or deface an Aboriginal object or objects.	No action required
Moderate Impact	The proposed activity has reasonable potential to disturb, destroy, damage or deface an Aboriginal object or objects.	Avoid area if possible. If avoidance not an option, test excavate area to determine nature and extent of potential archaeological deposits

Impact Potential	Definition	Management Action
High Impact	The proposed activity will, or is highly likely to, disturb, destroy, damage or deface an Aboriginal object or objects.	Avoid area if possible. If avoidance not an option, test excavate area to determine nature and extent of potential archaeological deposits

Appendix E AAPA Certificates

Our File: RA2019/41
In reply please quote: 201903170

Aboriginal Areas Protection Authority
protecting sacred sites across the territory

Origin Energy
PO BOX 4095
DARWIN NT 0801

ATTENTION: STEPHANIE STONIER

RE: ISSUE OF AUTHORITY CERTIFICATE FOR VARIATION TO C2019/014 - ENVIRONMENTAL MONITORING WATER BORES INSTALLATION AND DRILLING AND COMPLETIONS ON EP117, EP76 AND EP98 - 201903170

I refer to your application for Authority Certificate received on the 23rd April 2019 for the above location.

Accordingly, under the powers delegated to me under Section 19 of the *Northern Territory Aboriginal Sacred Sites Act 1989* I am pleased to issue the attached Authority Certificate.

Please read carefully the conditions outlined in the Certificate. In particular, you should note that it has been issued for an indefinite period of time, providing that the works covered by the Certificate start within the period stipulated in condition 3.

[redacted]

[redacted]

Archaeological sites and objects are protected in accordance with the *Northern Territory Heritage Act.*

There is also the possibility of burial sites being located within the subject land for the attached Certificate. Under the Northern Territory Criminal Code it in an offence to interfere with remains of a deceased person. Under the *Northern Territory Heritage Act* it is an offence to interfere with the remains of a deceased Aboriginal person without authorization under that Act.

Darwin
P: +61 (08) 8999 5511
F: +61 (08) 8999 4334
www.aapant.org.au
enquiries.aapa@nt.gov.au
4th Floor, R.C.G Centre,
47 Mitchell Street DARWIN NT
GPO Box 1890, Darwin NT 0801

Alice Springs
P: +61 (08) 8999 5511
F: +61 (08) 8952 2824
www.aapant.org.au
enquiries.aapa@nt.gov.au
Ground Floor, Belvedere House
Cnr Bath & Parsons Streets Alice Springs NT
All mail to Darwin GPO

In the event that any skeletal remains are unearthed it is your responsibility in law to stop works and report immediately such disturbance to the NT Police, and to the Director Heritage Branch, Department of Tourism and Culture, if you have reason to believe the remains are those of an Aboriginal burial. For further information on burial and archaeological sites please contact the Director Heritage Branch, Department of Tourism and Culture on (08) 8999 5039 (Darwin office) or (08) 8951 9247 (Alice Springs office) or email heritage@nt.gov.au.

You should also note that the Authority has issued you with two identical copies of digitised maps attached. One copy should be retained with your original Certificate. The second is supplied for use by contractors to avoid unnecessary photocopying of a colour coded document.

Please note that the cost of this Authority Certificate will be $15,608 inclusive of GST and an invoice will be issued to you by the Department of Corporate and Information Services. An application fee of 57 revenue units ($67) will also apply. The terms and conditions of the invoice will require you to make payment within 30 days of receipt.

Yours faithfully

DR. BEN SCAMBARY
Chief Executive Officer

9 May 2019

Information has been redacted due to confidentiality requirements

Appendix F Water Bore Drilling Program Risk Assessment and Level of Effectiveness

Ref	Activity	Aspect	Potential Impacts	Pre-Mitigation Risk Assessment			Additional Mitigation	Post-Mitigation Risk Assessment			Effectiveness of Treatment
				Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating	
1	Groundwater Monitoring Bore Design	Protection of groundwater resources	• Connectivity between aquifers resulting in change to groundwater conditions. • Uncontrolled flowing of artesian causing wastage of groundwater resource. • Contamination of groundwater from surface. • Potential for multiple aquifers to be encountered. • Cross flow of groundwater between shallow aquifers results in deterioration of water quality in utilised aquifer. • Potential that drilling method are incorrect impacting on the reliability of the data collected in the future.	3	4	M	• Minimum Construction Requirements for Water bores in Australia 3rd Edition • Monitoring bore designed and drilled as per requirements and suit the hydrogeological conditions on the site, be appropriate to protect aquifer and suitable for intended purpose as a monitoring bore. • Licensed drilling to be engaged. • A buffer of 2 km will be maintained between operations and stock water bores. • Surface water will not be used for any purpose. • No discharges to watercourses. • Agreements to be reached with land holders and/or Department of Transport for the use of groundwater resources • Sustainable use of groundwater measures will be implemented including the monitoring and recording of water use for operations.	3	1	L	E

Ref	Activity	Aspect	Potential Impacts	Pre-Mitigation Risk Assessment			Additional Mitigation	Post-Mitigation Risk Assessment			Effectiveness of Treatment
				Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating	
2	Location of monitoring bores	Damage to newly installed monitoring bores and Interaction with underground and/or above ground services.	• Impact on monitoring bore from fire, vehicle traffic, flooding, vegetation (i.e. roots) and surface water. • Although located in remote area, incorrect placement of monitoring bores could interact with utilities and infrastructure. This could include Station water, power, communication utilities.	1	4	M	• Bores should be positioned so that the headworks can be protected from damage from fire, vehicles, frequent flooding and surface water drainage. • Borehead protection should be installed around each monitoring bore. • Prior to installation of monitoring bores, ensure the area has been cleared for any potential underground and overhead services, including Pastoral Properties water supply network for homestead and stock. • Dial before your dig and consultation with land holders.	1	1	L	E

Ref	Activity	Aspect	Potential Impacts	Pre-Mitigation Risk Assessment			Additional Mitigation	Post-Mitigation Risk Assessment			Effectiveness of Treatment
				Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating	
3	Water Bore Drilling	Groundwater contamination	• Potential contamination of groundwater from drilling fluid additives. • Chemicals and other drilling fluid additives could leave residual toxicity in monitoring bore.	3	3	M	• Fluids to be used under the Australian guidelines • Chemicals or other substances that could leave a residual will not be added to drilling fluids • MSDS and manufacturer's recommendations to be made available to the DPIR and on the drill sites for all drilling fluid products • Drilling fluids considered acceptable for water bore drilling include water-based drilling fluids and air-based drilling fluids • The makeup water shall be fresh non-polluted water for all water bore drilling fluid preparations. • Mud tanks will be utilised, instead of pits. • Waste (excluding muds and cuttings) to be removed off site for appropriate disposal at licensed landfill facility. • Site to be restored, as close as reasonably practicable, to pre-drilling conditions	3	1	L	E
4	Water Bore Drilling	Drilling can inadvertently transfer microbiological organisms between sites	• Introduction of microbiological organisms (bacteria) can impact on water quality (i.e. iron bacteria cause clogging of screens and water delivery equipment).	2	2	L	• NT Licensed Driller to be used • Driller to ensure good hygiene practices are implemented • Driller to ensure drilling tools are cleaned and disinfected (as required) before commencing at each site.	2	1	L	E

Ref	Activity	Aspect	Potential Impacts	Pre-Mitigation Risk Assessment			Additional Mitigation	Post-Mitigation Risk Assessment			Effectiveness of Treatment
				Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating	
5	Water resource use	Not utilising water in accordance with ESD principles.	• Wasting of water for operations.	1	3	L	• A buffer of 2 km will be maintained between operations and stock water bores. • Surface water will not be used for activities. • Agreements to be reached with land holders and/or Department of Transport for the use of groundwater resources. • Sustainable use of groundwater measures will be implemented including recording of all groundwater use for monitoring bore installation activities .	1	1	L	E
6	Groundwater resource use and land contamination	All bores proposed are in greenfield areas that will have low potential to contain contamination. Anticipated water quality will be suitable for discharge to surface and volumes likely to be ~500-1000L per bore depending on depth.	• During the development of groundwater bores for monitoring purposes, waters will discharged to nearby surface to ensure all residual drilling muds and solids are removed from the well bore.	1	3	L	• All purged water will be discharged in a manner to minimise impacts on the environment and land users. • Water will be of good quality (i.e. low salinity) and suitable for discharge to surface. • Drilling muds will be bentonite based	1	1	L	E

Ref	Activity	Aspect	Potential Impacts	Pre-Mitigation Risk Assessment			Additional Mitigation	Post-Mitigation Risk Assessment			Effectiveness of Treatment
				Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating	
7	Civil Construction	Management of Land - Soil and Erosion	• Soil instability or movement as a result of exploration activities or vegetation loss • Soil compaction as a result of civil construction and water bore drilling • Disturbance of creek and stream banks.	2	3	M	• Erosion control measure to be implemented and maintained as per the erosion and sediment control plan. Contour drains, retention of natural vegetation, provision of buffer strips of vegetation, short slopes and low gradients help keep runoff velocities low and therefore reduce erosion. • Regular inspections will be conducted to identify erosion and repair where observed. • No off lease or off road driving. • Following completion of works, disturbed areas to be restored and/or rehabilitated. • Gravel borrow pits to have topsoil returned and re-profiled. • Avoid creating windrows. • Avoid steep terrain in dissected upland areas. • Minimise disturbance to creek banks – leave vegetation, deviate to more suitable crossing point such as a naturally clear area. Construct all crossings as per bed level crossings as provided in section 2.2 • Inspect and maintain control measures on a regular basis, particularly before and after heavy rainfall. • All compacted areas will be ripped to promote regeneration of vegetation. • Disturbed areas to be restored will be monitored for weed infestation, and progress towards specified rehabilitation goals.	2	1	L	E

Ref	Activity	Aspect	Potential Impacts	Pre-Mitigation Risk Assessment			Additional Mitigation	Post-Mitigation Risk Assessment			Effectiveness of Treatment
				Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating	
8	Water bore drilling activities, storage and transportation of wastes, sewerage treatment and disposal, disposal of drill cuttings and muds, fuel and chemical handling and storage	Localised soil contamination and impact on nearby surface water quality	• Soil contamination as a result of civil construction activities and water bore drilling	3	4	M	• Dangerous goods will be stored, handled, separated and signed as required by the Flammable and Combustible Liquids Regulations and AS1940. • Spill response measures shall be implemented for spills or leaks. Spills of dangerous goods will be collected for treatment and disposal at an approved facility. • Designated waste storage and handling area to be provided onsite. • All solid and regulated waste to be removed offsite. • Hazardous goods will be stored in bunded areas away from watercourses. • Refuelling of equipment will not occur within 100m of a water course. • Plant and equipment shall be inspected and maintained regularly to detect and prevent leakage of liquid contaminants	3	1	L	E

Ref	Activity	Aspect	Potential Impacts	Pre-Mitigation Risk Assessment			Additional Mitigation	Post-Mitigation Risk Assessment			Effectiveness of Treatment
				Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating	
9	Civil Construction	Surface Water Flow	• Access tracks and site pads altering natural surface water flow, creating ponding and or erosion	3	3	M	• Clearing and design and construction stages of earthworks should take account of seasonal site conditions (e.g. seasonally wet areas, steep slopes or nearby waterbodies). • Fit the development to the seasonal site conditions, including short-term weather forecasts. • Rely on advice of Site Operational Staff in relation to local weather and climate information to make decision regarding site operations (i.e. Cyclone on the coast that could potential increase risk of wet weather in the Basin) • Stage activities to occur during the dry season where possible. • Minimise disturbance close to natural drainage lines, whether ephemeral or permanent. Disturbance can cause changes in drainage patterns, such as sheet flow rather than channel flow. The retention of vegetation buffers, as outlined in the NTG Land Clearing Guidelines 2010, as they relate to stream order should be considered in the planning of tracks and roads. If clearing unavoidable, appropriate stabilisation to occur on creek crossings and maintained to ensure minimal interruption of surface water regimens. • Inspect and maintain control measures on a regular basis, particularly before and after heavy rainfall.	3	1	L	E

Ref	Activity	Aspect	Potential Impacts	Pre-Mitigation Risk Assessment			Additional Mitigation	Post-Mitigation Risk Assessment			Effectiveness of Treatment
				Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating	
10	Access track and drilling operations	Air Quality – Dust and Emissions	• Dust impacts on built-up areas (camp site, homesteads, Aboriginal Communities), vegetation and amenity as a result of civil construction works, drilling operations and travel to the sites. • Potential for an increase in exhaust emissions from contractors' vehicles and generators resulting in localised effect on air quality and global contribution to greenhouse gases.	2	2	L	• Reducing the speed of vehicles on dirt tracks • Monitor road conditions to ensure deterioration with possible increase in dust creation, does not occur and undertake road rehabilitation as required. • Watering of roads when appropriate and agreed with landholders. • All equipment and machinery to be in good working order to minimise vehicle exhaust emissions	2	1	L	E
11	Access track and drilling operations	Lighting, Noise, Vibration and Visual Amenity	• Noise generation causing and environmental nuisance • Interference with pastoral activities if noise, vibration and lighting affects behaviour of stock. • Light pollution impacting sensitive receptors • Visual amenity impacts on tourism	1	1	L	• Low impact water bore drilling activity surrounded by vegetated areas. • Drill sites selected to minimise noise and visual amenity impacts on sensitive receptors/ local community. • 6am to 7pm work, with no night time drilling anticipates. • Complaints shall be recorded in OCIS, investigated and responded to appropriately.	1	1	L	E

Ref	Activity	Aspect	Potential Impacts	Pre-Mitigation Risk Assessment			Additional Mitigation	Post-Mitigation Risk Assessment			Effectiveness of Treatment
				Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating	
12	Access track and drilling operations	Waste Management	• Contamination of soil or water through generation of or use of hazardous materials, domestic, industrial and drilling wastes and sewage. • Encouragement of pest species to waste sites.	2	4	M	• Designated waste storage and handling area to be provided onsite. • Consider recycling capabilities when awarding waste contract for civil construction and drilling program. • Removal and disposal of hazardous wastes to be in accordance with NT hazardous waste disposal requirements. • Undertake inspection of waste storage areas regularly, or after significant rainfall event (greater than 20 mm in 24-hour period). • All waste bins should be covered. • Grey water from kitchen and showering facilities will be managed in accordance with Part 6 of the DoH Code of Practice for Small On-site Sewage and Sullage Treatment Systems and the Disposal or Reuse of Sewage Effluent, 2014. • Domestic refuse to be disposed of in accordance with NT waste guidelines. No incineration of wastes on site. • Identify and remediate the affected area where applicable in accordance with the National Environmental Protection Measure (NEPM) requirements. • Waste Contractors to be used to be listed on the NT EPA waste handling contractors register (http://www.ntepa.nt.gov.au/waste-pollution/approvals-licences/ep-licences).	2	1	L	E

Ref	Activity	Aspect	Potential Impacts	Pre-Mitigation Risk Assessment			Additional Mitigation	Post-Mitigation Risk Assessment			Effectiveness of Treatment
				Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating	
13	Vehicle and water bore Rig movements, Clearing of vegetation and Rehabilitation	Natural Environment – Vegetation, Flora, Fauna and Habitat	• Disturbance to environmentally sensitive areas and/or flora and fauna species • Loss or endangerment of Threatened species • Loss of habitat • Vehicle collisions with fauna – fauna mortality	1	4	M	• Ecological assessment to be undertaken to identify environmentally sensitive areas (flora and fauna habitat). • Clearing to avoid large habitat trees. • Spotter catcher or equivalent to be present when clearing vegetation. • No off lease driving, stay to approved access tracks. • Personnel will be prohibited from bringing firearms or traps into the lease areas. • Water bore leases will be fenced. • Personnel will be prohibited from interfering with wildlife. • Personnel will be prohibited from bringing domestic pets onto the Program area. • Adequate fire breaks shall be maintained around Monitoring bores to protect asset • Appropriate fuel and chemical handling and storage measures will be implemented • Fire extinguishers and firefighting equipment will be provided at each site and for vehicles. • Fire bans will be complied with. • Driving at dawn and dusk to be avoided in accordance with Origin Travel Management Plan • Rehabilitate back to sites natural state once activities are completed (if required). Monitoring post-disturbance.	1	2	L	E

Ref	Activity	Aspect	Potential Impacts	Pre-Mitigation Risk Assessment			Additional Mitigation	Post-Mitigation Risk Assessment			Effectiveness of Treatment
				Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating	
14	Civil construction activities, vehicle and water bore Rig movements	Introduction and Spread of Weeds	• Transport of weeds or other exotic species and plant diseases between regions through transport operations that may compromise existing habitats or vegetation and impact on pastoral or cultural activities in the area. If possible locally sourced machinery and Transport will be used to reduce the risk of pests being transported and introduced from other regions • Biosecurity impacts causing harmful effects of some weed species on livestock or native fauna	3	4	H	• Activities will adhere to the guidelines within the NT Weed Management Handbook (2018). • Weed desktop and field based surveys to be undertaken to identify existing weed areas. • Weed management and control measures to be implemented in alignment with existing landholder biosecurity procedures. • All equipment will have certified equipment wash-down completed prior to entry to the field. • Activities will be planned to address prevention of weed or non-indigenous plant spread. • Machinery to be preferentially sourced locally, with machinery sourced from surrounding areas or Queensland being the 2nd and 3rd preferred option respectively. • Pre and post wet (February to May) inspections and periodic audits will be conducted to identify and report weed outbreaks. • Weeds will be actively controlled in cleared/ hardstand areas. • Major equipment moves will be planned from weed-free areas to infested areas and not the other way around. • Staff members responsible for preventing, identifying and managing weeds to be appropriately trained. • Ensuring all material imported to or between sites is free of weeds.	3	3	M	E

Ref	Activity	Aspect	Potential Impacts	Pre-Mitigation Risk Assessment			Additional Mitigation	Post-Mitigation Risk Assessment			Effectiveness of Treatment
				Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating	
15	Operations	Feral Animals and other Pest Species	• Introduction of feral and pest species may impact upon livestock • Introduction of feral animals and pest species may compromise existing habitats, vegetation or native fauna through predatory behaviour or competition • Biosecurity impacts from introduction of diseases associated with feral and pest species may impact upon existing habitats, vegetation, native fauna and livestock	2	4	M	• No domestic animals brought to site. • No rubbish (i.e. food packaging) to be left on drill sites. all refuse should be taken back to camp where It will be disposed of appropriately. • Solid domestic waste storage areas will need lids or protective barriers installed that effectively Restrict Access to pest species, including those species able to dig under or climb over barriers. in general though, removal of wastes is recommended	2	1	L	E
16	Access track construction and drilling operations	Bushfire	• Increased incident and intensity of bushfires can lead to vegetation degradation and habitat modification • Damage to or loss of public infrastructure, private infrastructure and equipment or community lands • Damage to or loss of culturally significant sites	4	4	H	• Fire extinguishers to be fitted to all vehicles. • Fire trailer to be on hand to respond to fire. • Emergency response plan developed and implemented to deal with fire. • Establish firebreaks around water bore infrastructure (4 m fire break in accordance with NT requirements. • Firebreaks around production wells must be maintained for life of the lease area. • Access tracks and roads will serve as firebreaks to limit the spread of fire and the availability of water and firefighting equipment on site will assist in fire control.	3	3	M	E

Ref	Activity	Aspect	Potential Impacts	Pre-Mitigation Risk Assessment			Additional Mitigation	Post-Mitigation Risk Assessment			Effectiveness of Treatment
				Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating	
17	Access track construction and drilling operations	Cultural Heritage and Sacred Sites	• Disturbance to cultural heritage sites	2	1	L	• Cultural Heritage Clearance (and identification of sites of Aboriginal significance in conjunction with NLC and AAPA) will be conducted prior to commencement of disturbance activities or operations • Activities will be conducted in accordance with the NLC Agreement. • Prepare a Code of Conduct for employees and contractors to assist in the prevention of any possible anti-social behaviour that will affect the local residents. • Identify location of culturally sensitive areas and ensure design avoids these areas where applicable. • Where avoidance is not possible, such as in the case of existing access tracks, an artefact collection protocol is to be implemented in collaboration with traditional owners and NLC. • An unexpected heritage finds stops related work activities within the vicinity of the find (within a 500 m radius) for assessment and direction by an NLC representative. • Ensuring appropriate behaviours are employed outside of work hours. • Site inductions are to ensure that all personnel are aware of the Code of Conduct prepared for social interactions with the community.	1	1	L	E

Ref	Activity	Aspect	Potential Impacts	Pre-Mitigation Risk Assessment			Additional Mitigation	Post-Mitigation Risk Assessment			Effectiveness of Treatment
				Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating	
18	Access track construction and drilling operations	Livelihood and well-being of local communities and towns	• Loss of visual amenity- landholder and tourists • Possible danger to health and safety of the community. • Possible increase in traffic from activity	1	1	L	• All areas to be located away from sensitive receptors with lease layouts designed to minimise visual amenity impacts. • Emergency response systems will be in place. • All personnel and site visitors will complete the appropriate inductions. • All activities to be undertaken in accordance with Code of Practice: Onshore Petroleum Activities in the Northern Territory (and any land access agreement negotiated between Origin and a landholder at later date). • An approved DIPL Traffic Management Plan or exemption to be provided to DPIR prior to commencement of activities.	1	1	L	E

Effectiveness Rating

Rating	Explanation
Effective (E)	• Controls are well designed and address the root cause/s of the risk • Controls are recognised industry best practice • All controls operate at the required level • All controls are within the power of Origin, with few external factors beyond control • Ongoing monitoring required
Can Be Improved (C)	• Majority of controls are well designed and address the root cause/s of the risk • Majority of controls operate at the required level • Some controls are outside the power of Origin, with multiple external factors beyond control

	• Ongoing monitoring required • Certain controls can be improved or have elements below industry best practice.
Must Be Improved (M)	• Most controls are not well designed and do not address the root cause/s of the risk. • Most controls are not operating to the required level. • A large number of controls are outside the power of Origin, with multiple external factors • The majority of controls require improvement and are well below industry best practice.

Appendix G Environmental Commitment Register

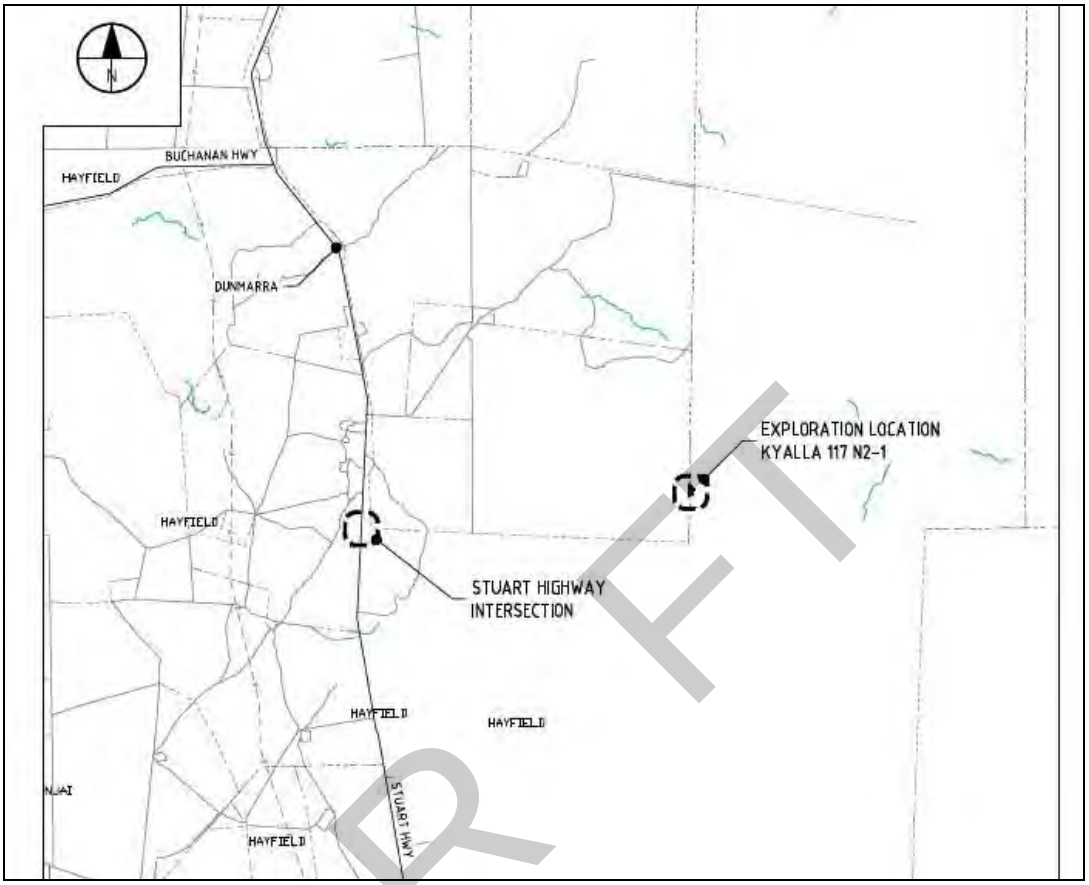
Obligation Details	Track Construction, Maintenance and Access	Water Bore Drilling
Layout of the site and exact siting of infrastructure will be informed by the environmental sensitivities and mitigation measures identified in this EMP.	x	x
Land clearance will be minimised to avoid disturbance of soils, vegetation and wildlife habitats and avoid interference or blockage of natural drainage patterns.	x	
The tracks are designed to minimise their environmental footprint, with standards allowing only sufficient width to enable the safe ingress/egress of the rig and associated equipment, materials and service vehicles.	x	
An erosion and sediment control plan shall be developed prior to the commencement of activities. The ESCP shall outline all relevant control measures to minimise the effect of rainfall runoff or overland flow on areas of disturbance	x	
Crossing of waterways and drainage lines will be minimised wherever possible and efforts made to find crossing points with the lowest risk of environmental harm.	x	
Existing gravel borrow pits will be used where possible	x	
All bores will be drilled and constructed by an appropriately NT licensed water bore driller and in accordance with the Minimum Construction Requirements for Water bores in Australia 3rd Edition (National Uniform Drillers Licensing Committee, 2012)		x
Location of the lease areas has considered the minimum offset distance of at least 2 km between site activities and pastoral water supply bores.		x
Each aquifer intersected will be isolated from overlying aquifers with a cemented casing string.		x
Drilling will be undertaken with air or mud rotary techniques. If mud rotary techniques are employed, the circulation fluid will be water based and will utilise standard water bore drilling polymer or bentonite-based density and viscosity modifying additives.		x
Within 28 days of bore completion, a statement of bore (Form 21), with it registered number, will need to be submitted to the Water Resource branch of the Department of Environment and Natural Resources (DENR).		x
All cuttings and drilling mud will be disposed of on site in accordance with normal water bore drilling practices. Any contaminated material not suited for onsite disposal will be removed from site and transferred to a licenced waste management facility.		x
Permission from land holders to utilise the existing water bores in the area of the proposed lease areas or a permit to work within a road reserve would be obtained to gain access	x	x
Surface water will not be used for any activities proposed in this EMP or future operations	x	x
Stormwater flooding across the cleared site will be managed to minimise impacts from erosion and sedimentation.	x	x
Creek and stream crossing to be designed to minimise changes to drainage patterns in accordance with NTG Land Clearing Guidelines 2010		
Origin will implement appropriate controls to prevent the spread of weeds, feral pests and diseases, and ensure biosecurity.	x	x
Records of weed distribution will be maintained within Origin's GIS and if required provided to the Weeds Officer at DENR.	x	x
Origin have committed to comply with conditions as prescribed by AAPA for the duration of the program.	x	x
Cultural Heritage Clearance (and identification of sites of Aboriginal significance in conjunction with NLC) will be conducted prior to commencement of disturbance activities or operations in any area	x	x
Origin has committed resources and time to allow competent and experienced personnel to participate in educational and community information sessions from Darwin in the North, to Alice Springs in the South and across to Borroloola in the East.	x	x

Obligation Details	Track Construction, Maintenance and Access	Water Bore Drilling
Appropriate housekeeping standards will be maintained, and the site will be maintained free of rubbish	x	x
All civil contractors performing work will be housed in local hotel accommodation avoiding the need for permanent camps.	x	x
Wastewater, sewage and sullage generated by the domestic camp activities will be managed by a Department of Health (DoH) approved sewage treatment system or captured and removed from site.	x	x
For the size of the proposed program, all waste (other than drill cuttings) produced will be backloaded with the crew for appropriate disposal and or recycling.	x	x
At completion, Origin will implement natural regeneration to rehabilitate disturbance areas and monitor annually to assess rehabilitation success.	x	x
Monitor road conditions to ensure deterioration with possible increase in dust creation, does not occur and undertake road rehabilitation as required.	x	x

Appendix H Trafficwerx NT Traffic Management Plan

TRAFFICWERX NT

building the future together



TRAFFIC MANAGEMENT PLAN

origin

I Chris Boyer (WZ1 #18444) declare that I have designed this Traffic Management Plan on 17/02/2019. The Traffic Management Plan prepared, subject to the variations approved, is in accordance with DIPL Provisions for traffic works within the NT Government Road Reserve and AS 1742.3—2009.

Signature: C. Boyer Date: 17/02/2019

TMP No.	Revision	Date	Author	Description
TWX190066	0	17/02/2019	CB	For submission

TABLE OF CONTENTS

GLOSSARY

AS	Australian Standard
AS/NZS	Australian and New Zealand Standard
DIPL	Department of Infrastructure, Planning & Logistics
NTG	Northern Territory Government
PCBU	Person Conducting a Business or Undertaking
PWC	Power and Water Corporation
SWMS	Safe Work Method Statement
TGS	Traffic Guidance Scheme
TMP	Traffic Management Plan
WHS	Work Health Safety

1 PURPOSE AND SCOPE

This Traffic Management Plan (TMP) has been developed for Origin Energy to carry out works associated with the Beetaloo Basin Exploration Project.

The works comprise construction of a temporary, site access road to allow project construction and support service vehicles access to the basin exploration drill sites. The access road works are located on the Stuart Highway, 64.5km South of the Hi-Way Inn, Daly Waters. The access road is on the Eastern side of the Stuart Highway, perpendicular to the road. Origin are planning to utilise and upgrade the existing access track which runs along the southern boundary of Hayfield/Shenandoah Station and northern boundary of Beetaloo Station.

The Contractor and Subcontractors shall complete the project with the least possible disruption to the flow of traffic. All reasonable attempts shall be made to reduce the impact on road users. The convenience of the public and of residents adjacent to any work site and the protection of persons and property shall be provided at all times. This document is designed to establish efficiencies, consistencies and good understanding of the commitment to safety.

This TMP provides the traffic management procedures to be implemented by Trafficwerx NT during the project. It has been prepared for routine construction and maintenance activities. This document addresses the minimum traffic management requirements for work activities using the diagrams attached at Appendix C. The document has been prepared in accordance with current versions of DIPL Provisions for Traffic and Australian Standard 1742.3—2009 - Manual of Uniform Traffic Control Devices.

1.1 Objectives and Strategies

The objectives of the TMP are to:

- provide for a safe environment for road workers
- provide for a safe environment for all road users
- minimise the disruption, congestion and delays to all road users.

To assist in meeting these objectives the TMP provides information on:

- the Scope of Works
- site conditions
- permissible working times
- procedures and responsibilities
- the traffic management schemes
- the Traffic Guidance Scheme (TGSs).

1.2 Project Overview

ITEM	DESCRIPTION
Project	Beetaloo Basin Exploration Project
Classification	Long – Term Works
Road Authority	DIPL – Road Operations
Local Government	Roper Gulf Regional Council and Barkly Regional Council
Client	Origin Energy
Prime Contractor	TBA
Traffic Management Subcontractor	Trafficwerx NT Pty Ltd
Scope of Works	Works Origin Energy are to carry out works associated with the Beetaloo Basin Exploration Project. The works comprise construction of a temporary, site access road to allow project construction and support service vehicles access to the basin exploration drill sites. The access road works are located on the Stuart Highway, 64.5km South of the Hi-Way Inn, Daly Waters. The access road is on the Eastern side of the Stuart Highway, perpendicular to the road. The new access track runs to the southern boundary of Hayfield/Shenandoah Station and northern boundary of Beetaloo Station. Traffic Management Proposed traffic management for the work activities includes installation of Advance warning signage, temporary speed limit restriction and lane closure with work area delineated. Select signage and delineation of work area to remain installed as Aftercare treatment out of work hours and when the site is unattended. Variable Message Signs to be installed prior to works commencement and during the works. **TGS1 – Stuart Hwy, Beetaloo Basin Access Road, Works within 1.2m** **TGS2 – Stuart Hwy, Beetaloo Basin Access Road, Works 1.2 to 3m** **TGS3 – Stuart Hwy, Beetaloo Basin Access Road, Works greater than 3m** **TGS4 – Stuart Hwy, Beetaloo Basin Access Road, Trucks Entering** **TGS5 – Stuart Hwy, Beetaloo Basin Access Road, Works within 1.2m Aftercare** **TGS6 – Stuart Hwy, Beetaloo Basin Access Road, Works 1.2 to 3m Aftercare** **TGS7 – Stuart Hwy, Beetaloo Basin Access Road, Works greater than 3m Aftercare** Refer to the TGSs at Appendix C for details regarding traffic management to be implemented. Specific activities not covered by the attached TGSs (Appendix C) shall be addressed separately. Traffic management design and implementation is by Trafficwerx NT Pty Ltd. Suitability and/or Compliance Audits of this TMP shall not be conducted using an independent Consultant unless so directed by the Road Authority.
Staging of Work	Access road construction works to be undertaken as a single stage of the project

ITEM	DESCRIPTION
Project Date	April to October 2019
Hours/Days of Work	0600 – 1800 Monday–Sunday including Public Holidays
Duration of Work	6 months
Other Constraints	As per DIPL Provisions for Traffic and AS 1742.3—2009.

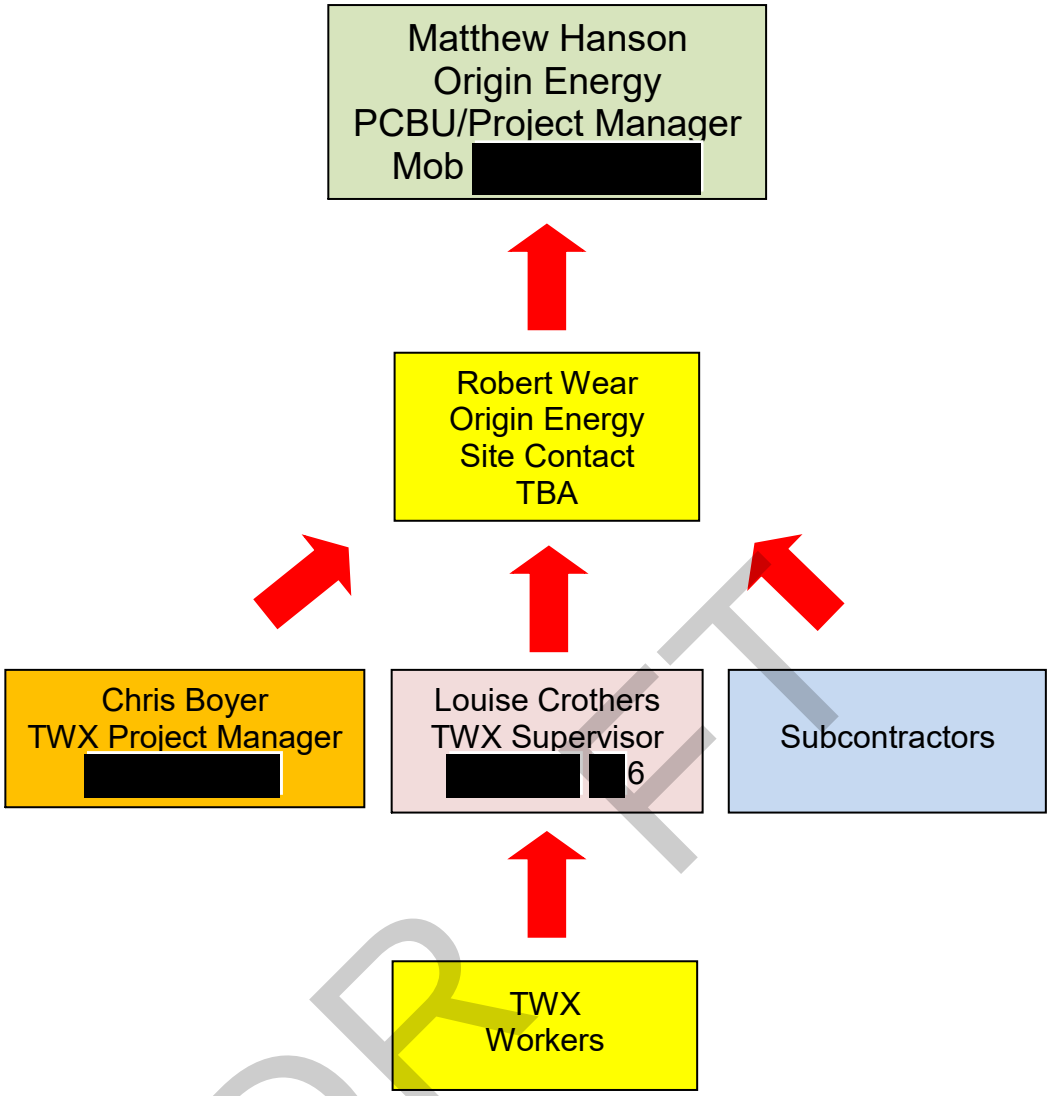
2 Project Representatives

NT Road Authority	DIPL – Road Operations
Stakeholders	NT Government Department of Infrastructure, Planning & Logistics Roper Gulf Regional Council and Barkly Regional Council
Client	Origin Energy Resources Ltd 180 Anne St, Brisbane City, QLD 4000 Ph: 13 24 61
Origin Energy ***Project Manager***	Matthew Hanson Mob: [redacted]
Origin Energy ***Construction Supervisor/Site Contact***	Robert Wear Email: [redacted].w[redacted].origin[redacted]
Subcontractor	TBA
Subcontractor ***Project Manager/Site Contact***	TBA
Traffic Management Subcontractor	Trafficwerx NT Traffic Management PO Box 2587, Parap, NT 0804 Ph: 08 8942 2228 Fax: 08 8941 3528 Email: chris@[redacted]
Trafficwerx NT ***Project Manager***	Chris Boyer Mob: [redacted] Email: [redacted]
Trafficwerx NT WZ1 ***Traffic management designer***	Chris Boyer WZTM 1 Reg. # 18444, exp. 21 DEC 2021 WZTM 2/3 Reg. # 12596/12597, exp. 22 MAR 2020 Mob: [redacted] Email: c[redacted]

2.1 Traffic Management Administration

TMP Design	Trafficwerx NT Traffic Management PO Box 2587, Parap, NT 0804 Ph: 08 8942 2228 Fax: 08 8941 3528 Email: c[redacted]
Contact Details	Chris Boyer Mob: [redacted] Email:[redacted]
Traffic Management by	Trafficwerx NT Traffic Management PO Box 2587, Parap, NT 0804 Ph: 08 8942 2228 Fax: 08 8941 3528 Email:[redacted].au
TMP Site Inspection by	Chris Boyer Mob: [redacted] [redacted]au Inspection completed 14 February 2019
Site Contacts	Chris Boyer WZTM 1 Reg. # 18444, exp. 21-DEC-2021 WZTM 2/3 Reg. # 12596/12597, exp. 22-MAR 2020 Mob: 0420 416 776 Louise Crothers WZTM 1 Reg. # 22878, exp. 17-JUL-2021 WZ2/3 # 14093/14094, exp. 30-JAN-2021 Mob: 0407 060 476 Cody Dyet WZ2/3 # 21416/21417 exp 1 NOV 2020 Troy McGregor WZ2/3 # 23667/23668 exp 05 DEC 2021 Stephanie May Packwood WZ2/3 # 18738/18739 exp 15 NOV 2021

2.2 Responsibility Hierarchy



2.3 Competencies

Origin Energy have engaged Trafficwerx NT to prepare this Traffic Management Plan and associated controls for the works.

The Contractor shall ensure that at all times during working hours a competent person shall be available at the site to ensure that the TMP requirements are met.

2.4 Responsibilities

All personnel engaged in the traffic management field activities shall follow the correct work practices as required by AS1742.3.

All personnel shall not commence or continue work until all signs, devices and barricades are in place and operational in accordance with the requirements of the TMP.

All personnel responsible for traffic control shall ensure that the number, type and location of signs, devices and barricades are to a standard not less than the TGS of this plan (refer Appendix C) and AS1742.3 (except where specifically detailed in this TMP with reasons for the variations). Should a situation arise that is not covered by this TMP or AS1742.3, the Road Authority Representative shall be notified.

The Road Authority Representative may direct erection, relocation or removal of signs or devices, which, in the opinion of the Road Authority Representative, are not in accordance with the TMP and do not provide sufficient safety for road users.

A Trafficwerx NT WZ2 & WZ3 holder is responsible for completion of the daily traffic diary.

2.5 Senior Management Commitments

Senior Management shall provide evidence of its commitment to the development and implementation of quality Traffic Management by the following:

- Establishing a good Quality Policy through the application of the Trafficwerx NT Quality Management System.
- Ensuring the availability of resources through Toolbox Talks and daily auditing by Trafficwerx NT personnel with WZ2 & WZ3 accreditation.
- Communicating to workers the importance of meeting statutory and regulatory requirements.

Matthew Hanson	Origin Energy PCBU/Project Manager	
Robert Wear	Origin Energy Supervisor/Site Contact	TBA
TBA	Subcontractor Site Supervisor	TBA
Chris Boyer	TWX Project Manager	
Louise Crothers	TWX Supervisor	
Cody Dyet	TWX	
Troy McGregor	TWX	
Stephanie Packwood	TWX	

2.6 Responsibility for Safety at Work Sites.

Supervisory personnel carrying out construction, maintenance or other works that require the use of a traffic guidance scheme should give attention to the following:

- Be mindful of their responsibility to provide, as far as practicable, a safe work place for personnel and plant under their control, and safe and convenient travelling conditions for road users.
- Ensure that all personnel at the work area are aware of their responsibilities and that traffic controllers are appropriately trained and informed of their duties.
- Ensure that personnel under their control are at all times courteous to road users.
- Personel should not allow themselves to become distractedby provocation from menbers of the public.

2.7 Traffic Controller Training Requirements

All traffic control personnel entering a work area are required to have the minimum mandatory training requirements:

- Level 1 – Traffic Management Plan designer (WZ1) for personnel engaged in developing work zone traffic management plans
- Level 2 – Work zone traffic controller (WZ2) with stop/slow bat
- Level 3 – Work zone traffic supervisor (WZ3) for on site road work supervisors engaged in setting up and supervision of work zone traffic
- Level 4 – Escorting mobile road marking operations (WZ4)
- Current drivers licence.

2.8 Adequate Facilites

A person conducting a business or undertaking at a work place must ensure, so far as is practicable, the following:

- An adequate supply of clean drinking water to be provided for all workers - Trafficwerx NT provides as part of PPE bottled drinking water and ice.
- Access to clean toilets must be provided for all workers while at the work place - Trafficwerx NT provides staff breaks and where toilets are not in an accessible location, portaloos are provided.
- Hand washing facilities must be provided to enable workers to maintain good standards of personal hygiene - Trafficwerx NT provides staff breaks and staff are given time to access amenities and toilets. Where these facilities are not in an easily accessible location, crib and portaloos are supplied.
- Workers should be provided with access to hygienic dining facilities for eating meals and for preparing and storing food - Trafficwerx NT provides staff breaks and staff are given time to access amenities and toilets. Where these facilities are not in an easily accessible location, crib and portaloos are supplied.

3 SAFETY PLAN

All persons and organisations undertaking these works or using the roadwork site have a duty of care under statute and common law to themselves, their employees and all site users, lawfully using the site, to take all reasonable measures to prevent accident or injury.

This TMP forms part of the overall project Safety Management Plan, and provides details on how all road users considered likely to pass through, past, or around the worksite shall be safely and efficiently managed for the full duration of the site occupancy and works.

All traffic management works and control devices shall be in accordance with DIPL technical requirements for Works within the NT Government Road Reserve AND Australian Standard AS 1742.3—2009; Manual of uniform traffic control devices.

3.1 Personal Protective Equipment

All personnel entering the work site shall wear high-visibility clothing meeting the requirements of AS/NZS 4602 for Types D, N or D/N. Garments shall be worn by all personnel working in or adjacent to traffic, including traffic at work sites, in quarries and on construction haul roads. The clothing is designed to make the personnel more conspicuous and to warn road users of their presence.

The clothing shall be used as follows:

- For general use by all personnel at a works site – a Type D/N (day/night) garment.

Note: This requirement covers the contingency that a worker may be required to work in darkness or partial darkness at the beginning or end of a day shift or may be called out unexpectedly at night.

- Where the garment is to be worn during daylight hours only – a Type D (day only) garment.
- Where the garment is to be worn during hours of darkness only – a Type N (night only) garment.

Clothing shall be properly fastened when being worn at a works site so that the entire available area of high-visibility material for each direction of observation can be seen.

3.2 Other PPE

All personnel entering the work site shall correctly wear other personal protective equipment required on a site-by-site basis (e.g. protective footwear, eye protection, safety helmet, sun protection, respiratory devices, safety harnesses, etc.) at all times whilst on the work site.

3.3 First Aid Equipment

The contractor has the primary duty under the WHS act to ensure, so far as is reasonably practicable, that workers and other persons are not exposed to health and safety risks. When undertaking a task the contractor is required to:

- Provide first aid equipment and ensure each worker at the work place has access to the equipment
- Ensure access to facilities for the administration of first aid
- Ensure that an adequate number of workers are trained to administer first aid at the work place or that workers have access to an adequate number of other people who have been trained to administer first aid.

3.4 Fatique Management Controls

The guiding principals for fatigue management include, but are not limited to, the below.

Workers should be in a fit state to undertake work by all of the following:

- Being given appropriate time to plan and prepare for a working period involving long shifts
- Presenting in a fit state for work and must be free from alcohol and drugs
- Being adequately rested before starting work
- Avoiding unfamiliar or irregular work rosters
- Being medically fit and should have regular assessments by medical practitioners
- Having access to lifestyle information and councelling where necessary to assist in presenting in a fit state for work.

3.5 STOP/SLOW Bat

A STOP/SLOW bat (R6-8/T7-1) shall be used by traffic controllers to control traffic at any temporary obstruction or hazard. For night-time operations, an illuminated wand should be used in conjunction with the bat.

3.6 Radio Communications

Portable two-way radios shall be used for communication between traffic management personnel.

Any personnel controlling construction traffic shall do so with the aid of portable two-way radios.

3.7 Mobile Phones

Traffic controllers shall not, under any circumstance, use mobile phones whilst actively controlling traffic.

Contractors and subcontractors shall observe their own company policy with regards to the use/possession of mobile phones at work sites.

3.8 Facilities Required to Prevent Slips, Trips and Falls

The worksite and its immediate surroundings shall be suitably protected and free of hazards which could result in slipping, tripping or falling by non-motorised road users. Hazards which cannot be removed shall be suitably protected to prevent injury to road users, including those with sight impairment. Where level differences are significant, suitable barriers which prevent access shall be used.

The worksite shall be kept tidy to reduce the risk to workers. Where level differences are significant, suitable barriers which prevent falls shall be installed.

3.9 End of Queue Collisions

End of queue protection shall be provided whenever a stationary queue is likely to extend to a point less than 'D' beyond the Prepare To Stop associated with the active traffic control by applying the following:

- Where the maximum queue length can be predicted in advance, the primary Prepare to Stop sign shall be located so that the distance from this sign to the end of the queue is never likely to be less than 'D'.
- A second traffic controller can be employed to shift the Prepare to Stop sign and the Roadwork Ahead sign as necessary to maintain its minimum required distance in advance of the end of queue.
- Advance warning using variable message signs should also be implemented where practicable.
- All other advance and position signs required for the work site shall be located at the distance otherwise specified from the start of the work area.

3.10 Incident/Accident Procedures

In the event of an incident or accident, whether or not involving traffic or road users, all work shall cease and traffic shall be stopped as necessary to avoid further deterioration of the situation. First Aid shall be administered as necessary, and medical assistance shall be called for if required. For life threatening injuries an ambulance shall be called on 000. A Site Accident Action Checklist is provided at Appendix A to assist the site traffic management Team Leader to record initial details and report to the WZ1 Manager.

Details of all incidents and accidents shall be reported to the site supervisor and project manager and Trafficwerx NT using the Incident/Accident Report Form at Appendix A.

Any traffic crash resulting in injury shall immediately be reported to the NT Police Service, Ambulance (Appendix B) and NT Work safe on 1800 019 115.

Any traffic crash resulting in injury shall immediately be reported to the NT Police Service, Ambulance and NT Work safe on 1800 019 115.

Notifiable accidents and incidents shall be reported to NT Work Safe by calling 1800 019 115.

Contact details for emergency services are as follows:

Emergencies	000
Police	131 444
Fire	000
Ambulance	000

Emergency Services have been notified of proposed works and have been provided with contact details for relevant personnel:

Origin Energy Site Supervisor – Robert Wear, Mob: TBA

3.10.1 Vehicle Breakdown within Site

Broken down vehicles and vehicles involved in minor non-injury causing crashes shall be temporarily moved to the verge as soon as possible after details of the crash locations have been gathered and noted. Where necessary to maintain traffic flow, vehicles shall be temporarily moved into the closed section of the work area behind the cones, providing there is no risk to vehicles and their occupants or workers. Suitable recovery systems shall be notified to facilitate prompt removal of broken down or crashed vehicles. Assistance shall be rendered to ensure the impact of the incident on the network is minimised.

Details of all incidents and accidents shall be reported to the site supervisor, project manager and Trafficwerx NT using the Incident/Accident Report Form at Appendix A.

Notifiable accidents and incidents shall be reported to NT Work Safe by calling 1800 019 115.

3.10.2 Remote and Isolated Workers

The contractor must ensure that systems are in place to eliminate or minimse WHS risks to workers engaged in remote or isolated work by implementing the following measures:

- Providing effective communication tools and devices for workers performing remote or isolated work
- Providing safe systems of work, including developing Safe Work Method Satetments, travel itineries, emergency procedures and training in the use of emergency equipment
- Providing advice, information, training, instruction or supervision that is necessary to protect all persons from risk to their health and safety, arising from isolated or remote work
- Ensuring the conditions at the workplace are monitored for the purpose of preventing illness or injury to workers.

3.10.3 Serious Injury or Fatality

In the case of serious injury or fatality occurring within the traffic control zone all work shall cease immediately, machinery and vehicles turned off and the area cleared of personnel as soon as possible. Traffic Controllers (and other personnel if necessary) shall be deployed immediately to ensure no traffic or other road users approach the area.

Emergency services shall be notified of the incident and all road workers and traffic management personnel shall preserve the scene leaving everything in situ, until direction is given by Police or NT WorkSafe.

A site specific detour route and/or road closure point shall be determined, signed and controlled by traffic management personnel and advised to Police, who shall take charge of the site upon arrival. Detour routes shall be determined so as to cater for all types of vehicles required to use them.

All site personnel shall be briefed on control procedures covering incidents and crashes that result in serious injury or fatalities.

3.10.4 Procedures for Reporting to NT WorkSafe

Under the Work Health and Safety (National Uniform Legislation) Act 2011, it is a requirement to notify NT WorkSafe if certain incidents occur at the work place.

A person conducting a business or undertaking (PCBU) is required to contact NT WorkSafe immediately after becoming aware of a notifiable incident at their workplace.

Refer to Appendix A for Trafficwerx NT Incident/Accident Form.

Notification to NT WorkSafe must be carried out by the fastest means by either:

- Calling 1800 019 112
- Completing the appropriate Incident Notification Form and:
    - Faxing it to 8999 5141
    - Emailing it to ntworksafe@nt.gov.au

3.10.5 Record of Site

Digital images that are date and time stamped are to be taken of the site prior to the commencement of works. The images are to be stored by the applicant for 6 months after the completion of works and are to be available to DIPL upon request if required.

3.10.6 High Risk Construction Work

Any persons or organisation undertaking high risk work must ensure that the SWMS are developed for all high risk construction work prior to work commencing, and that any works are carried out in accordance with the SWMS.

3.10.7 Traffic Management Review

The principal contractor for a construction project must review and as necessary revise the Traffic Management Plan to ensure that it remains up to date.

They must ensure, so as is reasonably practicable, that each person carrying out works in connection with the project is made aware of any revisions in connection with the Traffic Management Plan.

Once a revision of the TMP has been made a copy shall be sent to relevant authorities for appraisal.

3.11 Notification

The key to safe and successful traffic management planning is communication. This includes communicating with major stakeholders and other parties that may be directly affected by the works.

In accordance with the Permit to Work within the NT Government Road Reserve and Relevant Local Government Authority, all stakeholders affected by the works shall be notified prior to the commencement of operations.

Origin has made contact with affected Station Managers in the area of operations, and has been granted permission to access the site.

The traffic management subcontractor may need to notify the following agencies of any significant traffic disruption as the works require:

- Department of Infrastructure, Planning & Logistics (DIPL)
- Local Council
- Local Emergency Services
- Local Police
- Public Transport Division
- Any other agency as the work site location requires.

Other affected parties may include:

- the general public
- local residents and/or businesses.

Notification may take the form of any of the following:

- NT News advertisement
- Community notices
- Local area letter drop
- Direct contact
- Group letter/fax
- Variable Message Signs.

Variable Message Signs (VMS) shall be installed on the Stuart Hwy at both approaches to the work area, 3 days prior to works commencing and a minimum of 2 days before any changes are made to existing traffic conditions during the works.

VMS messaging shall be implemented in accordance with DIPL advice for pre works and during works.

4 GENERAL ENVIRONMENTAL CONTROLS

4.1 Site Control

The contractors shall not form any new tracks, alter any existing tracks, erect any camps, remove any trees or shrubs, cut any fences or water, sewer, power or telecommunications lines or perform other activities not specified or indicated in this TMP or the project drawings without the prior approval of the Site Supervisor.

4.2 Site Clearing

The contractors and subcontractors shall not destroy, damage, remove or clear vegetation to an extent greater than is necessary for the execution of the works. Clearing shall not be carried out without the prior written approval from the relevant authority.

4.3 Fires

The contractors and subcontractors shall not light fires under any circumstances whatsoever without the prior written approval of the relevant authority. Where fires are accidentally started, it is the responsibility of the contractor to extinguish the fire.

4.4 Waste Material

The contractors and subcontractors shall comply with the requirements of the Waste Management and Pollution Control Act. All waste materials, including green waste, food scraps and the like, construction waste, chemicals and effluent shall be removed from site and disposed of in an appropriate manner at a place that can legally accept the waste.

All refuse and waste materials shall be handled in a manner so as to confine the material completely and prevent dust emission.

4.5 Solid, Liquid and Gaseous Contaminants

The contractors and subcontractors shall take responsibility for the proper disposal of all solid, liquid and gaseous contaminants in accordance with statutory and contractual requirements, including the provisions of this section.

Liquid paint materials or other hazardous materials shall not be disposed of by flushing down any sewer, storm water system or natural waterway.

4.6 Volatile Substance Abuse Prevention Controls

Under the Volatile Substance Abuse Prevention Act, contractors must ensure the safe and responsible use of volatile substances:

- Use low aromatic fuel when and where available
- If low aromatic fuel is not available use a lockable fuel cap or diesel powered equipment
- Secure inhalants and fuel-powered equipment
- Lock up areosols, glue and other substances that may be abused
- Remove or safely dispose of all glues, paints aerosols and other inhalants when leaving the community.

4.7 Fumes

The Prime Contractor expects that vehicles shall comply with emissions regulations and shall not generate excessive fumes. Conditions shall be monitored and appropriate recovery breaks, away from the effects of the fumes, shall be provided if necessary.

4.8 Noise Control

All practical precautions shall be taken to minimise noise resulting from the work activities. Construction equipment shall be fitted with noise suppressing devices, where possible, so that noise is minimised.

4.9 Preservation of Visual Values

The visual amenity of adjacent land owners shall be maintained at all times during the works. The work site shall be kept neat and tidy at all times.

4.10 Air Quality

All emissions of smoke, dust, and other substances into the atmosphere shall be minimised in accordance with the Waste management and Pollution Control Act.

5 MANAGING ENVIRONMENTAL CONDITIONS

5.1 Weather

Works are being conducted during the day. Generally, weather is extremely hot during the day and workers need to ensure they drink enough fluids throughout the shift.

Should adverse weather conditions be encountered during the works, the following contingency plans should be activated. Any adjustments to this TMP shall be risk assessed and approved by the WZ1 planner.

5.2 Rain

In the event of rain, an on-site assessment shall be made and sign spacing and tapers may be extended by 25% to account for increased stopping distances.

All changes shall be recorded in the Daily Diary for Roadworks (Appendix A).

5.3 Flooding

In the event of the road flooding due to heavy rain and the situation is deemed unsafe, it shall be necessary to cease works and install road condition signage until conditions return to normal.

All changes shall be recorded in the Daily Diary for Roadworks (Appendix A).

5.4 Fog/Dust/Smoke

Where sight distances are significantly reduced below 1.5D by fog, dust, smoke or similar and it is deemed unsafe by the client, it may be necessary to cease works until conditions return to normal.

All changes shall be recorded in the Daily Diary for Roadworks (Appendix A).

5.5 Wind

Signage and delineation may require additional weighting, placement of sandbags or similar, for stabilisation during periods of high wind.

5.6 Lightning

Lightning strikes are a common occurrence in the Northern Territory during the wet season.

Contractors and subcontractors shall be aware of approaching storms with the potential for lightning and shall take appropriate action in preparation to cease work and stand down traffic management personnel temporarily from their duties to seek appropriate protection.

5.7 Heat and Humidity

Extremes of heat and humidity are experienced in the Northern Territory especially during the “Wet Season” between the months of October and April however there is no single factor such as a “maximum allowable temperature” which should be applied in a workplace as a “cease work” limit.

Excessive heat is expected as works are performed throughout the shift during the transition from the wet to dry/dry to wet season. Employees need to ensure that they are drinking enough fluids.

Should temperatures rise and become excessive whilst traffic management personnel are conducting operations, they should be relieved more frequently than when operating under normal conditions.

5.8 Sunglare

The visibility of a sign, vehicle mounted warning device, delineation devices, traffic controller position, etc., can be affected by the direction of the sunlight, including background conditions. Traffic control personnel shall consider the prevailing sunlight conditions when positioning traffic control devices and themselves, to minimise the adverse effects of sunglare.

All changes shall be recorded in the Daily Diary for Roadworks (Appendix A).

5.9 Shadows

Trees along the verge may cast shadows. All signs shall be regularly inspected and re-positioned as required to reduce the effects of shadows.

All changes shall be recorded in the Daily Diary for Roadworks (Appendix A).

5.10 Structures

There are no existing structures affecting sight lines or access, or which shall affect works processes.

5.11 Terrain

The road geometry of the surrounding road network at the work site location is generally straight and relatively even and does not present any impediment to traffic management requirements. There are no grades that affect deceleration or acceleration of vehicles.

5.12 Vegetation

There is existing vegetation along the roadway in the vicinity of the work area however the vegetation is well back from the road verge and should not affect sight lines of road users.

Traffic control personnel shall consider the existing vegetation when positioning traffic control devices and themselves, to ensure sight lines of road users are not obscured.

All changes shall be recorded in the Daily Diary for Roadworks (Appendix A).

5.13 Existing Traffic and Advertising Signage

There is no existing traffic and advertising signage on the road verge or near the work area that affects the works or traffic management requirements.

6 TRAFFIC ENVIRONMENT

6.1 Traffic Volume and Composition

Northern Territory Government Department of Infrastructure, Planning and Logistics, Transport and Civil Services Division Annual Traffic Report (2017) indicates that traffic volume is 551 vpd travelling on the Stuart Hwy at a point 20km North of Elliott (Refer to Appendix H).

Traffic is considered Low-volume and consequently no significant congestion is expected under normal operating circumstances.

Traffic Control and works personnel shall monitor traffic conditions throughout the works and adjust traffic control measures and works methodology where required to ensure minimal disruption to road users. All changes shall be recorded in the Daily Diary (Appendix A).

Traffic management measures have been developed with consideration of the volume of vehicles through the area including heavy vehicles, to ensure disruption to road users is minimised during the works.

6.2 Existing Speed Restrictions

The existing speed limit on the Stuart Hwy at the area of works is 130km/h.

The operating speed (85th percentile) has been estimated to be no greater than the original posted speed limit.

7 PROVISION FOR TRAFFIC

7.1 Proposed Speed Restrictions

Proposed traffic management treatment includes lane closure with active traffic control requiring temporary speed restriction to 60km/h on the Stuart Hwy (workers within 1.2m of traffic) during the works.

7.2 Lane Widths

Minimum traffic lane widths of 3.5m shall be maintained at all times.

7.3 High/Wide Loads

Traffic/Works personnel are to aid high/wide loads passing through the work area when required. This may include stopping work and moving delineation as required for safe passage through the work area.

7.4 Impact on Adjoining Network

Road users travelling on side roads in the immediate vicinity of works being conducted may experience minor delays. Works and traffic management in these areas shall be conducted so as to ensure minimal delays and congestion is experienced.

7.5 Motorised Traffic

Advance warning signage, temporary speed restriction and lane closure with active traffic control to direct road users safely past the worksite to be installed as per the TGSs and work related task (refer to Appendix C).

7.6 Non-Motorised Road Users

Consideration of other road users such as cyclists, pedestrians and the disabled shall be made at all times during the implementation of this TMP. Onsite personnel shall be instructed to watch for non-motorised road users and to render assistance as and where required to ensure their safe passage around/through the site.

The worksite and its immediate surroundings shall be suitably protected and free of hazards which could result in slipping, tripping or falling by non-motorised road users. Hazards which cannot be removed shall be suitably protected to prevent injury to road users, including those with sight impairment. Where level differences are significant, suitable barriers which prevent access shall be used.

7.7 Public Transport

Public transport is not affected by the works. The Public Transport Network Supervisor shall not require notification.

7.8 School Crossings

There is no school crossing in the vicinity of the works and as such there is no impact on the traffic management requirements or the works.

7.9 Worksite Access

All traffic control personnel shall complete site specific work induction prior to having worksite access.

Works vehicles, plant and personnel entering and leaving the worksite shall do so at designated locations to be determined on site in accordance with project procedures and safe work practices. Observers shall be used for any personnel crossing roads. Site access requirements shall be discussed with all site personnel at the daily project Tool Box Talk meeting (Appendix A).

Works personnel are to give way to all road users and proceed with extreme caution whilst entering/exiting the worksite or crossing active traffic lanes (Appendix F).

Traffic controllers are to assist safe passage of works vehicles, plant and personnel entering and leaving the work area where required.

7.10 Existing Parking Facilities

All construction traffic not in use is to be parked out of road work zones. Parking is permitted only in designated areas on site to be outlined in the Toolbox Talk meeting prior to works commencing (Appendix A).

7.11 Access to Adjoining Developments/Properties

Access to adjoining properties shall be provided at all times during the implementation of this TMP.

7.12 Contingencies

All contractors and subcontractors are to return the roadway to normal condition in the event of inclement weather from cyclonic conditions. All work personnel are to be informed of evacuation procedures and muster points in the case of an emergency (Toolbox Talk Appendix A).

7.13 Special Events and Other Works

Whilst traffic management signage and equipment to be installed for this project is considered adequate to cater for safe guidance of road users during most special events, Traffic Controllers may be required to assist traffic flow at these times.

Other works underway in the vicinity of the site of works to be conducted under this project may impede the set-out of the proposed traffic management treatment.

If this TMP is considered inadequate or unsafe for implementation during an identified special event or in the vicinity of other works, the nominated WZ1 plan designer must be contacted. The WZ1 plan designer shall reassess the proposed traffic management and advise adjustments if required. Any variation to the TMP shall be recorded in the Daily Diary (Appendix A).

7.14 Night Work Provisions

Work is to be completed during daylight hours from 0600-1800.

7.15 Railway Sites

Work is not being conducted within a railway site location.

7.16 Unattended Worksite

Roadway aftercare treatment shall be installed out of work hours and when the site is unattended. Refer to TGSs at Appendix C regarding aftercare treatment details.

8 EMERGENCY ARRANGEMENTS

8.1 Emergency Services

Regulations require full and uninterrupted access to the site by emergency services for emergency situations. Emergency services shall have continual access to all properties and the worksite, hence no specific facilities are required.

Works personnel shall assist emergency vehicles requiring entry and/or travelling through the worksite.

Emergency services shall not be affected by the works, but shall be notified in writing as a courtesy (Appendix G).

8.2 Emergency Planning

Regulations require full and uninterrupted access to the site by emergency services for emergency situations. Emergency services shall have continual access to all properties and the worksite, hence no specific facilities are required.

Works personnel shall assist emergency vehicles requiring entry and/or travelling through the worksite.

8.3 Emergency/Hazardous Conditions

Emergency Services are to be notified where a hazard occurs that may affect road users travelling through the area. Traffic controllers may be required to reduce speed and actively control traffic until emergency services arrive, if a hazard occurs in the path of traffic.

8.4 Dangerous Goods

NT legislative requirements to be complied with when carrying dangerous goods. Records of dangerous goods carried to be kept. NTPFES (Northern Territory Police Fire & Emergency Services) informed about the movement of dangerous goods. Contractors are to provide a list of all dangerous goods to be moved to emergency services, which is to be updated on a regular basis.

For any work site that is located directly adjacent to a facility containing dangerous goods (i.e. a fuel service station), the regulations require full and un-interrupted access to the site by emergency services for emergency situations.

8.5 Damage to Services

In the event that any utilities (i.e. gas, water, electricity) services are damaged, all work shall cease immediately, machinery and vehicles turned off and the area cleared of personnel as soon as possible. Traffic Controllers (and other personnel if necessary) shall be deployed immediately to ensure no traffic or other road users approach the area. The Police Service and relevant supply authority shall be called immediately. Damage to any other services shall be treated in a similar manner except that machinery may remain operational and access may be maintained where it is safe to do so.

All site personnel shall be briefed on evacuation plans and muster area location prior to any works commencing (Toolbox Talk, Appendix A).

8.6 Failure of Services

8.6.1 Failure of Street Lighting

Not applicable to this TMP.

8.6.2 Failure of Power

Not applicable to this TMP.

8.6.3 Failure of Traffic Signals

Not applicable to this TMP.

8.6.4 Failure of Rail Crossing Signals

Not applicable to this TMP.

9 TRAFFIC CONTROL DEVICES

9.1 General

The location of all existing services, utilities and infrastructure of DIPL and other Authorities in the vicinity of the works shall be undertaken prior to any signage being installed taking steps to protect personnel, equipment, infrastructure, utilities and services that are located in the area. Report immediately any damage caused to any existing services, utilities or infrastructure to DIPL and the relevant Authority (Appendix A).

9.2 Devices in Use

Traffic Control devices shall be in accordance with the TGSs submitted for the works.

Should the use of additional or a reduced number of devices be required (not shown on the TGS) due to unforseen needs, they shall be recorded within the Daily Diary for Roadworks as a variation to the TMP, following prior approval from the WZ1 plan designer (Appendix A).

9.3 Equipment Standards

All signs shall be selected and installed in accordance with AS 1742.3—2009 and manufactured in accordance with AS 1743. Signs shall be installed with 1m lateral clearance from the travelled path with a minimum of 200mm from the lower edge of the sign to the ground. Posted signs (i.e. speed signs) shall be installed with 1m lateral clearance from the travelled path with a minimum of 1.5m from the lower edge of the sign to the ground.

All road signs are to be used with approved stands or erected on posts set into the ground, where permitted by the relevant authorities.

All signs are placed in the most advantageous position, having regard for the nature of the hazard and the warning being conveyed, to provide the maximum visual impact for approaching drivers. The Symbolic Worker sign shall also be fluorescent.

Prior to installation, all signs shall be checked for damage and cleanliness and repaired, replaced or cleaned as necessary.

Cones and bollards shall be used in accordance with the TGSs to delineate traffic flow and to provide clearance between the traffic stream and work areas. Traffic Cones shall be at least 700mm high, fluorescent red and fitted with a Class 1 retroreflective band. Alternatively fluorescent red Bollards with a Class 1 retroreflective band may be used.

All works vehicles shall be fitted with rotating flashing yellow lights in accordance with AS 1742.3–2009 clause 3.12.1.

9.4 Approach Speed

The operating speed (85th percentile) on Stuart Hwy has been estimated to be no greater than the original posted speed limit, consequently distance ‘D’ is derived from the posted speed limit at the location of the work area which is 130km/h.

9.5 Device Spacing

Spacing is set out in accordance with the requirements of AS1742.3–2009 and DIPL Provision for Traffic unless an identified impediment exists at the location of the works to be conducted.

Adjustments to sign and device positioning and spacing may be implemented on site as required to ensure appropriate visibility to road users. All treatment positioning adjustments that vary from those depicted in the TGSs must be approved by the project WZ1 plan designer and then recorded in the Daily Diary for Roadworks (Appendix A).

9.6 Protection of Excavations

The table below indicates AS 1742.3—2009 requirements for protection of excavations.

Protection/Delineation Adjacent to Excavations					
Speed of Traffic (km/h)	Traffic Volume (vpd)	Clearance to Excavation (m)	Protection Required (Standard delineation = 12m device spacings, Close delineation = 4m device spacings)		
			Depth of Excavation (mm)		
			50 to 250	260 to 500	>500
<70	All	<2.5	Standard delineation	Close delineation	Safety barrier
		2.5 to 5.0	Standard delineation	Standard delineation	Close delineation
		>5.0	None	None	None
≥70	≤1500	≤5.0	Standard delineation	Close delineation	Safety barrier
		>5.0	None	None	None
	>1500	≤6.0	Standard delineation	Close delineation	Safety barrier
		>6.0	None	None	None

All excavations are to be backfilled on completion of the days works or steel plated and/or temporary fenced whilst left unattended.

9.7 Setting Up and Dismantling

Setting up of the traffic management signage and equipment shall be carried out starting at the sign furthest from the work area moving progressively toward the work site before installing delineation devices. Dismantling shall be carried out in the reverse order. A 'shadow vehicle' with twin rotating flashing yellow lamps, in accordance with AS 1742.3—2009 clause 3.12.1, shall be used at all times to protect workers setting up and dismantling the traffic management equipment.

> *Note*: Vehicle-mounted warning devices are approved under the Northern Territory Traffic Regulations. These devices shall not be used outside the limits of the road works.

Devices no longer required shall be promptly and completely removed from road users lines of sight in the reverse order to installation.

10 TMP DOCUMENTATION REQUIREMENTS

10.1 Approvals

This Traffic Management Plan shall comply with the necessary approvals as required:

Road Authority

This TMP shall be submitted with the road authority DIPL – Road Operations pending approval.

10.2 Legal and Other Requirements

The Contractor recognises that the traffic management plan has been developed and shall be implemented with due consideration and in accordance with the following legislative, environment and industry standards where applicable:

- Work Health and Safety (National Uniform Legislation) Act and Regulations
- Traffic Act and Regulations
- Control of Roads Act
- Local Government Act
- DIPL Permit to Work
- AS 1428; Mobility and access standard for people with disabilities
- AS 1742.3; Traffic control for works on roads
- NT Environmental Protection Authority (EPA)
- Utility Providers Code of Practice (where required).

The Contractor shall ensure that the requirements of these documents and other relevant information shall be monitored and the Traffic Management Plan adjusted to meet changing requirements where necessary.

10.3 Variations to Standards and Plans

There are no variations in this TMP to the DIPL Provision for Traffic and AS 1742.3—2009 (except where expressly overridden by the Provision for Traffic).

On-site variations, if required, shall generally only be made following approval by the NT Road Authority and recorded in the Daily Diary for Roadworks (Appendix A).

Significant variations to this TMP shall not be carried out without prior consultation with the designer. However, minor adjustment to suit site and work requirements are recommended, with the changes recorded in the appropriate documentation.

In emergency situations, on-site variations shall be made and recorded in the Daily Diary, and the NT Road Authority Contact notified as soon as practicable.

Any future variations to be documented in the Daily Diary for Roadworks, TMP designer to be notified and revised Traffic Management Plan to be submitted to the NT Road Authority Contact as soon as practicable.

10.4 Audit Provisions

This TMP is in accordance with DIPL Provision for Traffic, and it should normally be subjected to a suitability audit by an independent Senior Road Safety Auditor.

Due to the nature of the works, one compliance audit shall be conducted following installation of the traffic management devices and prior to commencement of the works, in accordance with DIPL and Local Government Authority specifications.

Audit findings, recommendations and actions taken shall be documented and copies forwarded to the Project Manager.

10.5 Records

This TMP shall be discussed with all parties involved before implementation. Regular debriefs and feedback shall be encouraged by functional managers to be carried out to ensure the relevance of this TMP document to the contractor's current activities.

The Daily Diary for Roadworks and Daily Inspection Sheet shall be completed by the site Traffic Management Supervisor. All variations to the TMP/TGS, non-conformances, incidents and accidents shall be recorded. Copies of the completed report shall be forwarded to the Project Manager by the Site Supervisor.

Inspections may be carried out periodically throughout the duration of the works.

All activities on site in relation to the implementation and maintenance of this TMP shall be recorded in the Daily Dairy for Roadworks (Appendix A).

The Daily Inspection Sheet is provided at Appendix A. One sheet per report/inspection should be used, with the relevant sections completed.

11 RISK MANAGEMENT

In order to clearly understand the risks associated with the traffic environment and determine the manner in which identified hazards shall be managed, the following schedule outlines the risk management process undertaken for traffic issues associated with the work activities. The risk assessment process has been undertaken in accordance with Australian Standard AS/NZS ISO 31000—2009, Risk Management.

The risk assessment assumes the worst most likely outcome should the risk event occur. Assessment of likelihood is based on the assumption that no risk control is in place - that is, it defines the risk that would be expected to be associated with the project should no traffic management be undertaken. This is known as pure risk.

The Risk Treatments proposed are based on evaluation of the risks associated with specified events and application of the appropriate control measures necessary to bring risk levels to a point that is “As low as is reasonably practicable” (ALARP).

Risk Treatments shall be based on the Hierarchy of Control. The Hierarchy of Control forms a tiered approach to the management of workplace hazards. Each control principle is listed in descending order according to its effectiveness:

- **Elimination of the hazard** e.g. divert traffic away from the work area or for hazards associated with high volumes, undertake work at times of low volumes.
- **Substitution of the hazard** e.g. undertaking drainage/service works using trenchless technology.
- **Management of the risk by Engineering Controls** e.g. placement of safety barriers, the use of physical devices that reduce speed, temporary traffic signals, reverse alarms, flashing lights, delineators, etc.
- **Management of the risk by Administrative Controls** e.g. signage, variable message boards, safe work procedures for workers around mobile plant, procedures for placement of signage under traffic, induction and communication procedures.
- **Personal Protective Equipment** e.g. use of high visibility vests.

This TMP meets the ‘minimum’ requirements of the DIPL Standard Specifications, Provision for Traffic; meaning there is no requirement for an external Risk Assessment to be undertaken by an independent consultant unless so directed by the NT Road Authority.

Risk analysis of the proposed works has identified a number of risk events/items that shall be managed by effective traffic management planning and the implementation of this TMP. A risk analysis table is attached at Appendix B.

All identified risks have been treated by development of this TMP. Unforseen risks arising during the works shall be treated in accordance with standard work practices and procedures where appropriate.

The highest priority risk item has been determined as contractor to conduct works within 1.2m of the traffic travel path leading to unsafe conditions for workers and road users. Proposed traffic management measures to manage this risk include installation of Advance warning signage, temporary speed limit restriction and lane closure with active traffic control. Refer to TGSs at Appendix C for traffic management scheme to be implemented to manage this risk item.

Traffic management design is by Trafficwerx NT Pty Ltd. Compliance Audits of this TMP shall not be conducted using an independent Consultant unless so directed by the Road Authority.

12 REFERENCED DOCUMENTS

- NT Traffic Act
- NT Control of Roads Act
- Workplace Health and Safety (National Uniform Legislation) Act
- Workplace Health and Safety (National Uniform Legislation) Regulations
- DIPL Technical Requirements for Works Within the NT Government Road Reserve
- Australian Standard AS 1742.3—2009; Manual of uniform traffic control devices – Traffic control for works on roads
- Australian Standard AS/NZS 4192; Illuminated flashing arrow signs
- Australian Standard AS/NZS 4602; High visibility safety garments
- Australian Standard AS/NZS ISO; 31000-2009; Risk management
- Australian Standard AS/NZS 1906.1; Retroreflective materials
- Australian Standard AS 4191; Portable traffic signals
- NT WorkSafe; All relevant bulletins
- Northern Territory Government Department of Infrastructure, Planning and Logistics, Transport and Civil Services Division Annual Traffic Report (2017)
- Traffic Guidance Scheme's (Appendix C).

13 APPENDICES

Appendix A	**Trafficwerx NT Jobcard**
Appendix B	**Risk Analysis Table**
Appendix C	**Traffic Guidance Schemes**
Appendix D	**Sign and Equipment Manifest**
Appendix E	**Certificate of Currency of Public Liability Insurance**
Appendix F	**Procedure for Entering/Exiting Traffic**
Appendix G	**Agency Notification**
Appendix H	**Traffic Volume/Composition Count Data**
Appendix I	**DIPL - Permit to Work Application and Approval**
Appendix J	**Temporary Speed Limit Authorisation**
Appendix K	**Project Documentation**
Appendix L	**Safe Work Method Statement**
Appendix M	**Traffic Control Licenses**
Appendix N	**TMP Completion Checklist**

13.1 APPENDIX A Trafficwerx NT Jobcard

TEAM LEAD IS RESPONIBLE TO ENSURE THAT THE CLIENT UNDERSTANDS WHAT THEY ARE SIGNING FOR

Trafficwerx NT Jobcard

Time is charged from departure at Trafficwerx NT depot to return at Trafficwerx NT depot

Client Name: _____ Day: _____

Job Location: _____ Date: _____

Road Authority: _____

Client Start: _____ Client finish: _____

Client MUST SIGN: _____ Client MUST SIGN: _____

Client MUST PRINT NAME: _____

Permit / Approval		*Temporary Speed Limit Authorisation (TSLA)*	
Traffic Guidance Scheme's (TCD's)		*Personal Protective Equipment (PPE)*	

VEHICLE RECORDS

REGO	DRIVER	START KM	FINISH KM
TWX	To:		
	From:		

Ring name below (if any issues on site)

TEAM LEADER:	*WZ MANAGER:*

			OFFICE USE ONLY		
Traffic Controllers	**Start**	**Break**	**Finish**	**Total**	**Office Use**
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

Notes:	**Government/Council/Visitor on site:** **Name of person:** **Company name:** **Phone Number:**

This is not a Tax Invoice

**PLEASE FILL IN ALL RELEVANT SECTIONS & DATE & INTIAL NON/RELEVANT SECTIONS N/A

Tool Box Talk Items

- Where implemented, all Traffic Management (TM) staff MUST attend Prime Contractor and/or site Stakeholder daily meeting/toolbox talk and/or site induction.
- All Traffic Management (TM) staff are to familiarise themselves with the Prime Contractor project/site evacuation plan and muster area location where available. Where this information is unavailable the TM Team Leader SHALL advise all site TM staff of the proposed evacuation plan and muster area location for the work site.
- TM staff SHALL have a pre-planned escape route at all times during the works and be aware of their surroundings in the work environment.
- TMP and Traffic Guidance Scheme (TGS) requirements are explained clearly to all TM staff and any TMP or TGS changes during the works are communicated to TM staff and acknowledged.
- Expected TM staff and works personnel responsibilities/duties whilst works are in place are communicated.
- Concerns over safety of the implementation of the TMP/TGS requirements during installation and pull-down of signage, devices and delineation MUST be directed to the Team Leader immediately.
- Any personal heat stress or other safety concerns MUST be directed to the Team Leader immediately.
- Any Outsider communication regarding the works or the site is to be referred to the Team Leader in the first instance and then the WZ1 Manager.
- Employees SHALL conduct themselves in a professional manner at all times - do not allow the public to provoke you.
- Employees are required to correctly wear/use required Personal Protective Equipment (PPE), i.e. steel capped footwear, high visibility day/night vests, hard hats (if required), wide-brimmed hats, radios & night wands when directing traffic during periods of poor visibility or night works, etc.

By signing the following Toolbox/Prestart Register personnel working at site acknowledge that they have read and understand the requirements of the attached TMP and were present at the Tool Box Talk meeting

****PLEASE FILL IN ALL RELEVANT SECTIONS & DATE & INTIAL NON/RELEVANT SECTIONS N/A**

DAILY PRESTART / TOOLBOX / VEHICLE PRESTART

building the future together

Date		Client	
Team Leader		Signed	
Work Site Location		Weather Conditions	☐ Dry Season ☐ Wet Season
Road Surface ☐ Dry ☐ Wet ☐ Rough		Principal Daily Prestart attended	☐ Yes ☐ No
Issues or Comments TWNT or from Principal Prestart			

Attendance Names (Note traffic cards to be readily available)

By signing below, I am fit for duty, free from alcohol and or drugs, and will abide by all TWNT, and client requirements for this project.

Name	Reason onsite	Wz 1	Wz 2	Wz 3	Signature

Vehicle Registration / ID			Kms	
Item / Vehicle Checklist	**Ok proceed- Fault seek team leader advise**			**Comments**
Vehicle fuel	☐ OK ☐ Fault ☐ N/A			
UHF (Two-way radios)	☐ OK ☐ Fault ☐ N/A			
Any vehicle exterior damage	☐ OK ☐ Fault ☐ N/A			
Horn working	☐ OK ☐ Fault ☐ N/A			
Windshield wipers / washers working	☐ OK ☐ Fault ☐ N/A			
Signal lights / lights / tail lights working	☐ OK ☐ Fault ☐ N/A			
Mirrors ok, adjustments made to suit	☐ OK ☐ Fault ☐ N/A			
First aid kit in vehicle	☐ OK ☐ Fault ☐ N/A			
Fire Extinguisher in vehicle - tested	☐ OK ☐ Fault ☐ N/A			
Flashing lights working	☐ OK ☐ Fault ☐ N/A			
Cones / Bollards on board	☐ OK ☐ Fault ☐ N/A			
Appropriate signage on board for works	☐ OK ☐ Fault ☐ N/A			

All major faults which may affect the safe operations of the equipment MUST be reported immediately to you supervisor. Equipment must NOT be operated until these faults are rectified and repair has been authorised.

****PLEASE FILL IN ALL RELEVANT SECTIONS & DATE & INTIAL NON/RELEVANT SECTIONS N/A**

TRAFFIC MANAGEMENT-DAILY INSPECTION SHEET		**Date:**	
Inspection Prior to Commencement of Work		**Day time Inspection During Work Hours**	
Time of Inspection:		**Time of Inspection:**	
Signs & devices appropriate for the day's activities and conditions	Satisfactory ☐ Modifications/ Repairs required ☐	Sign's & devices operating satisfactorily and seen by motorists	Satisfactory ☐ Modifications/ Repairs required ☐
Signs & devices positioned and mounted correctly	Satisfactory ☐ Modifications/ Repairs required ☐	Sign's & devices positioned and mounted correctly	Satisfactory ☐ Modifications/ Repairs required ☐
Signs & devices clean and clearly visible	Satisfactory ☐ Modifications/ Repairs required ☐	Signs & devices clean and clearly visible	Satisfactory ☐ Modifications/ Repairs required ☐
Traffic controllers correctly attired and operating correctly	Satisfactory ☐ Modifications/ Repairs required ☐	Traffic controllers correctly attired and operating correctly	Satisfactory ☐ Modifications/ Repairs required ☐
Modifications and/ or repairs completed	Yes (give details) ☐ No (if no, give reason) ☐ Not Applicable ☐	Modifications and/ or repairs completed	Yes (give details) ☐ No (if no, give reason) ☐
Notes:			

****PLEASE FILL IN ALL RELEVANT SECTIONS & DATE & INTIAL NON/RELEVANT SECTIONS N/A**

Closing Down Inspection		**Night Time Inspection During Working Hours**	
Time of Inspection:		**Time of Inspection:**	
Signs removed	Satisfactory ☐ Modifications/ Repairs required ☐	Yellow lamps operating	Satisfactory ☐ Modifications/ Repairs required ☐
Excavations correctly backfilled. If excavation backfilling is unsealed, are ROUGH SURFACE signs and cones in place	Satisfactory ☐ Modifications/ Repairs required ☐	Signs & devices positioned & mounted correctly	Satisfactory ☐ Modifications/ Repairs required ☐
Driving surfaces adequate	Satisfactory ☐ Modifications/ Repairs required ☐	Signs & devices clean and reflective	Satisfactory ☐ Modifications/ Repairs required ☐
All materials removed from medians	Satisfactory ☐ Modifications/ Repairs required ☐	Modifications and/or repairs completed	Yes (Give Details) ☐ No/Not Applicable (Give Reason) ☐
Modifications and/ or repairs completed	Yes (Give Details) ☐ No/Not Applicable (Give Reason) ☐		
Notes:			

Notes:

1. Indicate by **placing a tick in the appropriate box** for each item.
2. Items requiring **modification and/or repair are to be described** on the back of this form.
3. For all modifications that are different to the basic traffic management plan layout give details of **who authorised the changes.**
4. Sheets to be given to supervisor/manager at completion of shift.
5. If copying, ensure any notes on back of sheet are copied as well.

Signed _____ (Team lead/Supervisor) **Date** _____

**PLEASE FILL IN ALL RELEVANT SECTIONS & DATE & INTIAL NON/RELEVANT SECTIONS N/A

Daily Diary for Roadworks

Record the details of any changes made to the approved Traffic Management Plan, also state who directed/made the changes and who authorised the changes (WZ1 Accredited).

PROJECT DETAILS: _____

LOCATIONS: _____

TGS No.: _____

DATE	DETAILS OF CHANGES	CHANGE MADE BY	INSPECTION OF CHANGES (WZ1)

**PLEASE FILL IN ALL RELEVANT SECTIONS & DATE & INTIAL NON/RELEVANT SECTIONS N/A

DATE	DETAILS OF CHANGES	CHANGE MADE BY	INSPECTION OF CHANGES (WZ1)

**PLEASE FILL IN ALL RELEVANT SECTIONS & DATE & INTIAL NON/RELEVANT SECTIONS N/A

Speeding Vehicles Report Form

Record the details of any speeding vehicles sighted, also state who witnessed the event.

PROJECT DETAILS: _____

LOCATIONS: _____

TMP/TGS No.: _____ **PROJECT/JOB No.:** _____

DATE	TIME	VEHICLE DETAILS (Rego, Make, Model, Colour, etc)	WITNESSED BY	INITIALS

**PLEASE FILL IN ALL RELEVANT SECTIONS & DATE & INTIAL NON/RELEVANT SECTIONS N/A

Traffic Section Checklist

TIME DIPL CONTACTED:

Start of Shift: _____

End of Shift: _____

NAME OF DIPL CONTACT SPOKEN TO:

Start of Shift: _____

End of Shift: _____

REMAPPING REQUIRED: Yes / No

RED LIGHT CAMERA ACTION REQUIRED: Yes / No

If Yes, provide details of action taken in the space below

_____

_____

_____

_____

_____

_____

_____

_____

**PLEASE FILL IN ALL RELEVANT SECTIONS & DATE & INTIAL NON/RELEVANT SECTIONS N/A

Speed Restriction Installation Form

DATE: _____

JOB LOCATION: _____

CONTRACTOR: _____

DIPL TRACKING NUMBER:_____

SPEED REDUCED FROM _____ TO _____

SPEED RESTRICTION INSTALLED AT _____HRS

INSTALLED BY _____ WZ2/3 NUMBER: _____

TGS DESIGNER: _____ WZ1 NUMBER: _____

WORK ZONE MANAGER: _____

SPEED RESTRICTION REMOVED AT _____HRS

REMOVED BY _____ WZ2/3 NUMBER: _____

POLICE SPEED CHECK ON SITE _____ TIME: _____

****PLEASE FILL IN ALL RELEVANT SECTIONS & DATE & INTIAL NON/RELEVANT SECTIONS N/A**

Incident/Accident Report Form

To be completed by employee

Surname:		Other name(s):	
Address:		Phone no.:	
Company/Contractor:			
Date and time of hazard:			
Location of hazard:			

Indicate what part of the body was injured and the nature and cause of the injury

Part of body injured				Nature of Injury		Cause of injury			
Head	☐	Elbow L/R	☐	Abrasion	☐	Aggression	☐	Plant/Equipment	☐
Neck	☐	Lower arm L/R	☐	Anxiety	☐	Allergy	☐	Push/Pull	☐
Shoulder L/R	☐	Hand L/R	☐	Bite	☐	Animals	☐	Repetitive	☐
Chest	☐	Fingers	☐	Break	☐	Bump	☐	Slip	☐
Abdomen	☐	Upper leg L/R	☐	Bruise/Crush	☐	Chemical	☐	Splashed	☐
Upper back	☐	Knee L/R	☐	Burn	☐	Disease	☐	Trip	☐
Lower back	☐	Lower leg L/R	☐	Cut	☐	Electrical	☐	Vegetation	☐
Eye L/R	☐	Foot L/R	☐	Infection	☐	Fall	☐	Vehicle/Transport	☐
Nose	☐	Toe L/R	☐	Soft tissue	☐	Insects/Spiders	☐	Visitor	
Ear L/R	☐	Nervous System	☐	Strain		Lifting	☐		
Upper Arm L/R		Whole of body				Other Staff			
Other (please specify)				Other (please specify)		Other (please specify)			

Was any time lost as a result of this injury? ☐ Yes ☐ No

If Yes please indicate the number of hours/days lost? _____

****PLEASE FILL IN ALL RELEVANT SECTIONS & DATE & INTIAL NON/RELEVANT SECTIONS N/A**

Description of Hazard/Accident/Injury/Disease (attach further information where necessary)

_____

_____

_____

_____

_____

_____

_____

_____

_____

Registration of vehicle and make/model if required: _____

Name of Supervisor: _____ Phone: _____

Name of Witness: _____ Phone: _____

Was first aid required? Yes ☐ No ☐

If yes who was the first aider? _____

Was medical treatment required? Yes ☐ No ☐

If yes who was the treating doctor? _____

Was hospital treatment required Yes ☐ No ☐

If yes who was the treating doctor? _____

FOR STATUTORY PURPOSES PLEASE ENSURE THIS FORM IS FULLY COMPLETED AND SIGNED

Employee Signature: _____ Date: _____

EMERGENCY CONTACT NUMBERS

CONTACTS	PHONE NUMBER
POLICE	131 444
FIRE	000
AMBULANCE St John Ambulance	 000
HOSPITAL Elliott Community Health Centre	 8969 2060
POWER & WATER Power Water	 1800 245 090
WORKSAFE NT	1800 019 115
DEPARTMENT OF INFRASTRUCTURE, PLANNING & LOGISTICS (DIPL) (Business Hours Only)**	8999 4402
BARKLY REGIONAL COUNCIL	8962 0000
ROPER GULF REGIONAL COUNCIL	8972 9000
DIPL TRAFFIC SECTION (Business Hours Only)**	8999 4402
BUREAU OF METEROLOGY Forecasts & Warnings Cyclone Warnings & Info	 8920 3826 1300 659 211
DIGITAL MOBILE SERVICE Out of area Mobile Phone Emergency Service	 112
TELSTRA Cable Damage	 132 203
DIAL BEFORE YOU DIG	1100
GAS APA Group - Emergencies & Gas Leaks	 1800 017 000

**PLEASE FILL IN ALL RELEVANT SECTIONS & DATE & INTIAL NON/RELEVANT SECTIONS N/A

Site Accident Action Checklist

When an accident occurs at a job site, the team leader must use the procedure checklist following to deal with the matter appropriately.

Date _____ Time _____

Action Required	Done
Check for any injuries and record the number of people injured.- • No. of people injured _____	☐
Take pictures and send to WZ1 Manager.	☐
Contact WZ1 Manager and report:	☐
1. No. of people injured _____ Is additional Traffic Controller required to assist to allow Team Leader to complete accident report? Y / N	☐
2. No. of vehicles involved _____	☐
3. Did accident take place in our site? Y / N	☐
4. Is accident affecting traffic management in place Y / N	☐
5. Is traffic flow affected by the accident? Y / N	☐
6. Complete Incident/Accident Report in full.	☐

ENSURE MOTOR VEHICLE ACCIDENT SITE IS PRESERVED

13.2 APPENDIX B Risk Analysis Table

L = Likelihood **C** = Consequences **RR** = Risk Rating

Refer to notes following the table for table criteria explanation.

RISK	ROOT CAUSE	PURE RISK			RISK RESPONSE	RESIDUAL RISK		
		L	C	PR		L	C	RR
Contractor to conduct works within 1.2m of traffic travel path.	≈ Traffic speed ≈ Traffic volume ≈ Inadequate workers protection ≈ Inadequate separation from traffic	C	IV	High	Advance warning signage, temporary speed restriction and lane closure with work area delineation installed. Refer to TGSs (Appendix C)	C	III	Med
Contractor to conduct works 1.2 to 3m from nearest traffic travelled path.	≈ Traffic Speed ≈ Traffic Volume ≈ Inadequate worker protection ≈ Inadequate separation from traffic	C	IV	High	Advance warning signage and temporary speed restriction with work area delineation installed. Refer to TGSs (Appendix C)	C	II	Low
Contractor to conduct works greater than 3m from nearest traffic travelled path.	≈ Traffic Speed ≈ Traffic Volume ≈ Inadequate worker protection ≈ Inadequate separation from traffic	C	IV	High	Vehicle mounted warning device operating, Advance warning signage installed. Refer to TGSs (Appendix C)	C	II	Low
Aftercare Treatment	≈ Traffic Speed ≈ Loose Stones/Gravel	C	IV	High	Advance warning and road condition signage with delineation to be installed out of work hours and when the site is unattended as aftercare treatment. TGS (Appendix C)	C	III	Med
Plant and work vehicles accessing the work site from the roadway creating unsafe conditions leading to crashes	≈ Unclear delineation at access point ≈ Work personnel not following correct access procedure ≈ Traffic speed ≈ Poor direcrion from construction traffic ≈ Vehicles follow traffic into work zone	C	IV	High	Determine safe access points to the work site and outline safe entry/exit procedures for all personnel All truck drivers and persons requiring vehicular access/egree to/from site to abide by access and entry procedure Plant to stop and give way to all approaching traffic before proceding to enter traffic stream Suitable clearance zones provided for protection of works.	C	II	Low

RISK	ROOT CAUSE	PURE RISK			RISK RESPONSE	RESIDUAL RISK		
		L	C	PR		L	C	RR
Installation and removal of Traffic Control Devices leading to worker injury and crashes.	≈ Inadequate worker protection ≈ Traffic speed ≈ Inadequate separation from traffic	C	IV	High	Before work commences, signs and devices at the approaches to and within the work area should be set out in accordance with the traffic guidance scheme in the following sequence: (a) Advance warning signs. (b) Delineation of the work area. (e) All other required warning and regulatory signs. This operation shall be carried out, where practicable, as a frequently changing work area in accordance with Clause 4.3.4 for locations in open road areas (AS 1742.3-2009). Recovery of devices at the conclusion of work shall be done in the reverse order using the same work method as for setting out. A traffic control vehicle fitted with a vehicle mounted warning device shall "shadow" (protect) personnel whilst installing traffic control devices on the roadway. All site personnel to remain clear of the travelled path of vehicles at all times and clear of the roadway where possible.	C	III	Med
Excavations	≈ Traffic Speed ≈ Traffic volume ≈ Inadequate separation from traffic	C	IV	High	Excavations limited to between 50-250mm depth located less than 5m from traffic in >70km/h speed zone with <1500 vpd volume requires standard delineation - 12m bollard spacings. Excavations limited to between 260-500mm depth located less than 5m from traffic in >70km/h speed zone with <1500 vpd volume requires Close Delineation - 4m bollard spacings. Excavations greater than 500mm depth located less than 5m from traffic in >70km/hr speed zone with <1500 vpd volume requires Safety Barrier. Excavations greater than 50mm depth located greater than 5m from traffic in >70km/h speed zone with <1500 vpd volume requires No Delineation. All excavations to be backfilled on completion of days works or steel plated and or temporarily fenced whilst left unattended.	C	II	Low

RISK	ROOT CAUSE	PURE RISK			RISK RESPONSE	RESIDUAL RISK		
		L	C	PR		L	C	RR
Traffic flows along the road creating a hazardous work site leading to worker injury.	≈ Unclear delineation of access point. ≈ Traffic Speed ≈ Poor direction from construction traffic ≈ Vehicles follow traffic in to work zone	C	IV	High	Determine safe access points to the work site and outline safe entry and exit procedures for all personnel. All truck drivers and persons requiring vehicular access/egress to/from the site to abide by access entry procedure. Plant to stop and giveway to all approaching traffic before proceeding to enter traffic stream. Suitable clearance zones provided for protection of workers.	C	II	Low
Workers accessing road worksites leading to injury or crashes.	≈ Workers enter road areas ≈ Inadequate access provided to workers	C	IV	High	Workers to cross the road to enter a work space from the job side of the road. Workers to be instructed of this in site induction at toolbox talk.	C	II	Low
Inappropriate placement and use of temporary signs leads to confusion and crashes.	≈ Incompetent persons. ≈ Not applying approved Plans ≈ Changes to work situations	C	IV	High	Installation and removal of temporary signs shall be managed by competent personnel as required by DIPL. Site monitoring procedures to identify changes to signage requirements	C	II	Low
Pedestrians and Cyclists accessing through or across a worksite resulting in injury to pedestrians/ cyclists or workers.	≈ No separation of pedestrians or cyclists from worksite. ≈ Cyclist speeds ≈ Delineation of worksite	D	IV	High	Traffic controllers and workers onsite to assist safe passage of pedestrians and cyclists through/past the site.	D	II	Low
Parking of construction plant leading to traffic hazards.	≈ No clear procedure for parking of vehicles. ≈ No designated parking areas	C	III	Med	All construction traffic not in use to be parked out of road work zones. Parking only in designated areas on or near the site of works.	C	II	Low
Vehicle breakdown/crash causing obstruction to traffic.	≈ Operator or vehicle error ≈ Poor roadway conditions	D	IV	High	Contractor to assist where practical for access by emergency vehicles or removal and storage of affected vehicle. Contact with breakdown contractors	D	II	Low
Effects of weather.	≈ Water filling site ≈ Increases chance of accidents, reduced visibility	C	IV	High	Weather is hot, workers need to ensure that they drink enough fluids throughout the shift. Work to cease if weather prevents clear line of sight or restricts visibility and to resume when visibility is regained. Work to cease during periods of lightning.	C	II	Low

RISK	ROOT CAUSE	PURE RISK			RISK RESPONSE	RESIDUAL RISK		
		L	C	PR		L	C	RR
Working around plant and equipment.	≈ Staff not wearing correct PPE ≈ Operator not seeing staff and other plant and equipment.	C	IV	High	Ensure staff are wearing correct PPE. Site induction to reinforce safe operating procedures in Toolbox Talk prior to commencement of works (Appendix A)	C	III	Med
Signs dirty and difficult to read.	≈ Dust caused by traffic ≈ Signs muddied	C	III	Med	Daily inspections to address cleanliness of the traffic control devices. Must be cleaned as required.	C	II	Low

RISK CRITERIA

Each hazard/hazardous situation shall be assigned a risk rating which is used for prioritising hazards and quantifying the degree of risk. The risk rating is determined by using the risk assessment matrix below.

LIKELIHOOD	CONSEQUENCES				
	Insignificant **I**	Minor **II**	Moderate **III**	Major **IV**	Catastrophic **V**
A (almost certain)	L	M	H	E	E
B (likely)	L	M	H	H	E
C (possible)	A	L	M	H	E
D (unlikely)	A	L	M	H	H
E (rare)	A	A	L	M	M

Likelihood

Likelihood refers to the possibility or frequency of a hazard occurring. The organisation undertakes many routine activities that have potential to cause a WHS incident on a daily or relatively frequent basis. Other activities are conducted less routinely, and WHS incidents can also occur. The following table lists criteria that explain the five qualitative measures of likelihood.

	Likelihood	Likelihood Measures Description
A	Almost certain	The event or hazard is expected to occur in most circumstances – shall probably occur with a frequency in excess of 10 times per year.
B	Likely	The event or hazard shall probably occur in most circumstances – shall probably occur with a frequency of between 1 and 10 times per year.
C	Possible	The event or hazard might occur at some time – shall probably occur with a frequency of 0.1 to 1 times per year (i.e. once in 1 to 10 years).
D	Unlikely	The event or hazard could occur at some time – shall probably occur with a frequency of 0.01 to 0.1 times per year (i.e. once in 10 to 100 years).
E	Rare	The event or hazard may occur only in exceptional circumstances – shall probably occur with a frequency of less than 0.01 times per year (i.e. less than once in 100 years).

Note: The likelihood of an event or hazard occurring shall first be assessed over the duration of the activity (i.e. "period of exposure"). For risk assessment purposes the assessed likelihood shall then be proportioned for a "period of exposure" of one year.

Example: An activity has a duration of 6 weeks (i.e. "period of exposure" = 6 weeks). The event or hazard being considered is assessed as likely to occur once every 20 times the activity occurs (i.e. likelihood or frequency = 1 event/20 times activity occurs = 0.05 times per activity). Assessed annual likelihood or frequency = 0.05 times per activity x 52 weeks/6 weeks = 0.4 times per year. Assessed likelihood = C (i.e. Possible).

Consequence

The following table provides criteria for determining consequence to individuals or the company and its operations as a result of a WHS incident occurring.

Level	Consequence	Personal Injury/ Equipment Damage	Cost	Traffic/Network Performance	Company Reputation/ Business Relationships
I	Insignificant	First Aid required / immediate return to work. Negligible damage requiring no further action.	Nil	Short term delays. Some minor reduction in level of service (loss) at non-peak periods.	Unsubstantiated issue unnoticed by customer or regulatory authority. Process check required. Low impact, low profile. No news item.
II	Minor	Minor medical treatment, attendance by doctor. No lost time injury. Minor damage requiring minor plant or equipment repair.	Less than $5K	Delays occur during peak periods. Minor reduction in level of service. Localised impact <1 day.	Minor substantiated issue requiring customer reassurance only. Low impact, and internal inquiry only.
III	Moderate	Medical treatment required, hospitalisation. Work Safe Report. Lost time injury. Moderate damage requiring plant or equipment repair	$5K to $10K	Moderate reduction in level of service. Impacts up to a week. Impacts in immediate adjacent streets also. Some short term impact on property access (< 1hr).	Substantiated issue, short-term impact, public embarrassment, moderate news profile. Loss of customer(s) confidence requiring rectification/explanation. Query from Regulatory authority. Company internal investigation required.
IV	Major	Significant injuries, hospitalisation, temporary disability. Work Safe Report. Major damage requiring extensive plant or equipment repair	$10K to $20K	Significant reduction in level of service. Impacts up to a month. Some “rat running” during peak periods. Impact on local property access.	Substantiated issues, non-compliance with Regulatory Authority policy, high news profile, long term impact. Loss of customer(s) with short to medium-term impact. Third party inquiry.
V	Catastrophic	Death, permanent disability. Work Safe investigation. Severe damage requiring plant or equipment replacement.	Over $20K	Major reduction of loss of service over several weeks. Adverse impacts on surrounding residential/ commercial areas due to traffic overflow. May result in loss of access for extended periods.	Substantiated multiple impacts, widespread multiple news profile, long-term impact. Substantial non-compliance with Regulatory Authority requirements. Loss of customer(s) with long-term impact. Third party actions.

Risk Rating

Conducting a risk assessment results in allocation of a risk rating of extreme, high, moderate, low or accept for each hazard. Hazards with an extreme or high risk are considered to be significant, that is, they have or can have a significant impact.

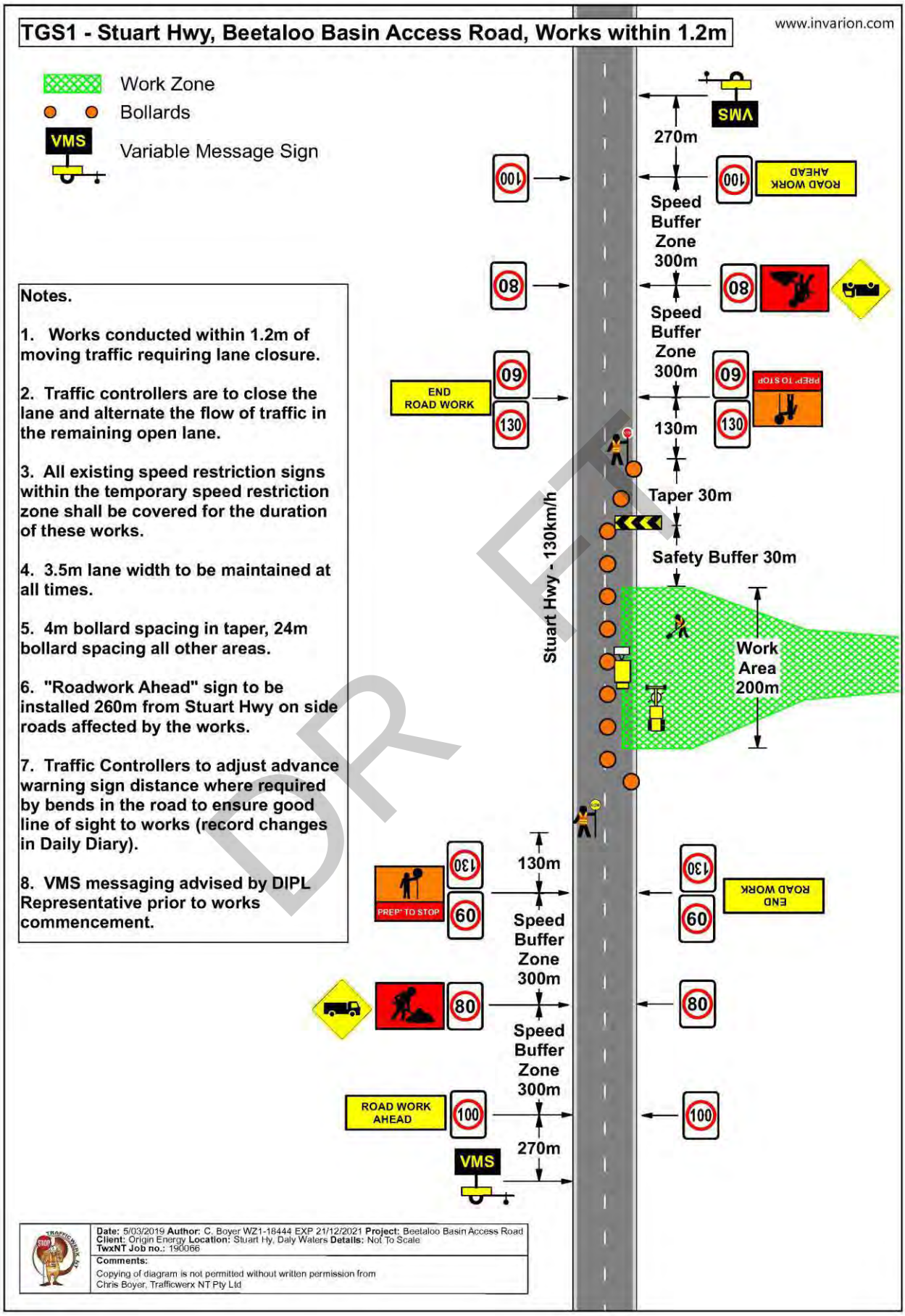
Hazards associated with a regulatory or legal requirement are also considered to be significant, regardless of the outcome of the risk analysis.

The risk rating allocated as a result of the risk assessment is described in the table following, including the required treatment to ensure they are managed appropriately.

	Risk Rating	Required Treatment
E	Extreme	Unacceptable risk. HOLD POINT. Work cannot proceed. Avoidance or elimination of risk preferred. Managing Director must review and sign-off treatment.
H	High	High priority. Treatment may look to reduce consequence or likelihood. If both are impracticable, WHS Officer/WZ1 Planner/Quality Representative approves treatment and signs off when effectively implemented.
M	Medium	Documented management procedure and prescribed risk treatment subject to review by experienced business area management staff and signed off at implementation.
L	Low	Managed in accordance with standard informal and formal work practices and monitored by affected business area staff.
A	Accept	Managed through standard informal and formal work practices.

13.3 APPENDIX C Traffic Guidance Schemes

TGS1 – Stuart Hwy, Beetaloo Basin Access Road, Works within 1.2m
TGS2 – Stuart Hwy, Beetaloo Basin Access Road, Works 1.2 to 3m
TGS3 – Stuart Hwy, Beetaloo Basin Access Road, Works greater than 3m
TGS4 – Stuart Hwy, Beetaloo Basin Access Road, Trucks Entering
TGS5 – Stuart Hwy, Beetaloo Basin Access Road, Works within 1.2m Aftercare
TGS6 – Stuart Hwy, Beetaloo Basin Access Road, Works 1.2 to 3m Aftercare
TGS7 – Stuart Hwy, Beetaloo Basin Access Road, Works greater than 3m Aftercare


TGS1 - Stuart Hwy, Beetaloo Basin Access Road, Works within 1.2m
www.invarion.com
Work Zone
Bollards
VMS
Variable Message Sign
Notes.
1. Works conducted within 1.2m of moving traffic requiring lane closure.
2. Traffic controllers are to close the lane and alternate the flow of traffic in the remaining open lane.
3. All existing speed restriction signs within the temporary speed restriction zone shall be covered for the duration of these works.
4. 3.5m lane width to be maintained at all times.
5. 4m bollard spacing in taper, 24m bollard spacing all other areas.
6. "Roadwork Ahead" sign to be installed 260m from Stuart Hwy on side roads affected by the works.
7. Traffic Controllers to adjust advance warning sign distance where required by bends in the road to ensure good line of sight to works (record changes in Daily Diary).
8. VMS messaging advised by DIPL Representative prior to works commencement.
Stuart Hwy - 130km/h
270m
Speed Buffer Zone 300m
130m
Taper 30m
Safety Buffer 30m
Work Area 200m
ROAD WORK AHEAD
END ROAD WORK
PREP' TO STOP
ROAD WORK AHEAD
VMS
Date: 5/03/2019 Author: C. Boyer WZ1-18444 EXP 21/12/2021 Project: Beetaloo Basin Access Road
Client: Origin Energy Location: Stuart Hy, Daly Waters Details: Not To Scale
TwxNT Job no.: 190066
Comments:
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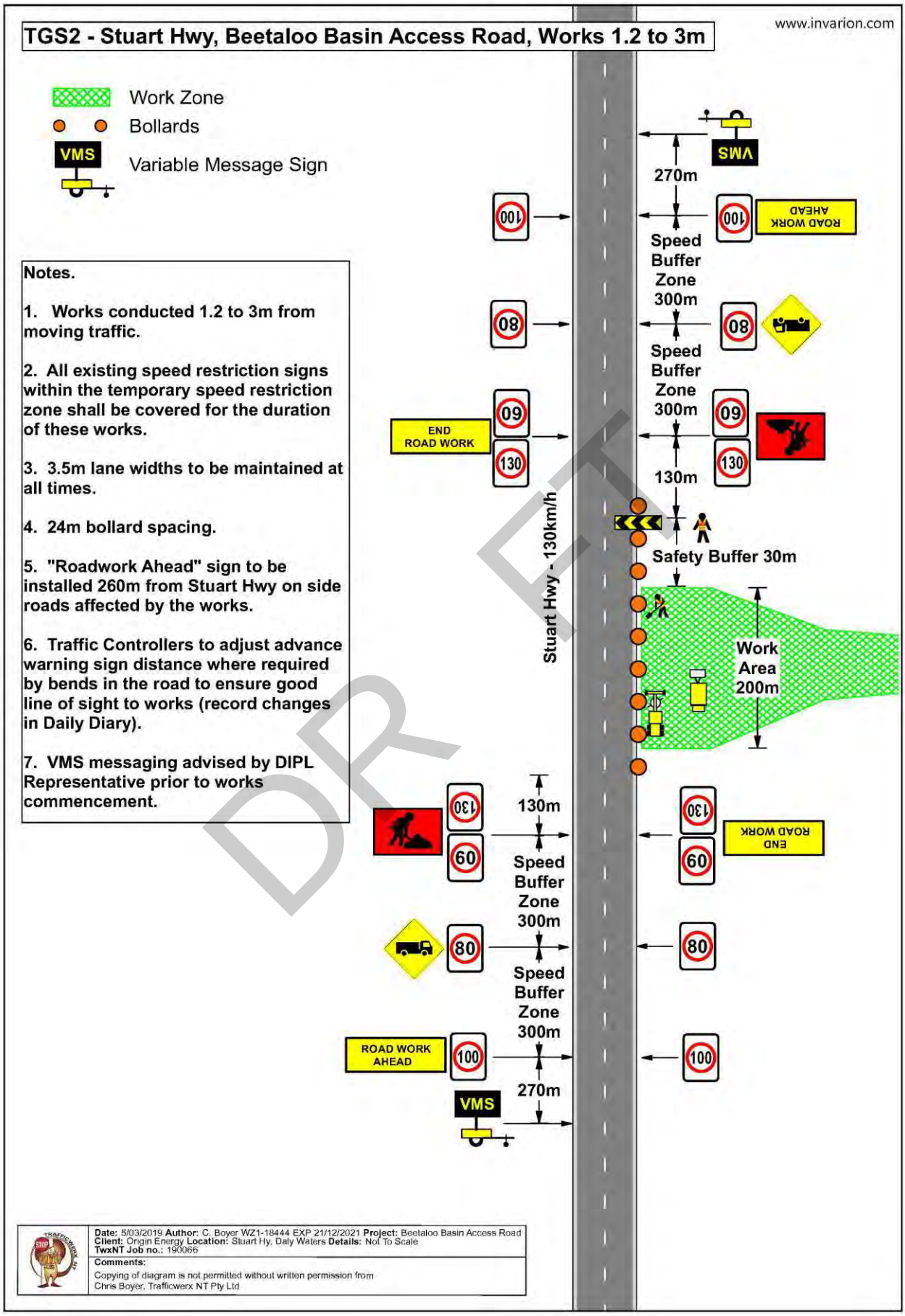
TGS2 - Stuart Hwy, Beetaloo Basin Access Road, Works 1.2 to 3m
www.invarion.com
Work Zone
Bollards
VMS
Variable Message Sign
Notes.
1. Works conducted 1.2 to 3m from moving traffic.
2. All existing speed restriction signs within the temporary speed restriction zone shall be covered for the duration of these works.
3. 3.5m lane widths to be maintained at all times.
4. 24m bollard spacing.
5. "Roadwork Ahead" sign to be installed 260m from Stuart Hwy on side roads affected by the works.
6. Traffic Controllers to adjust advance warning sign distance where required by bends in the road to ensure good line of sight to works (record changes in Daily Diary).
7. VMS messaging advised by DIPL Representative prior to works commencement.
Stuart Hwy - 130km/h
270m
Speed Buffer Zone 300m
Speed Buffer Zone 300m
END ROAD WORK
130m
Safety Buffer 30m
Work Area 200m
130m
Speed Buffer Zone 300m
Speed Buffer Zone 300m
ROAD WORK AHEAD
270m
END ROAD WORK
ROAD WORK AHEAD
Date: 5/03/2019 Author: C. Boyer WZ1-18444 EXP 21/12/2021 Project: Beetaloo Basin Access Road
Client: Origin Energy Location: Stuart Hy, Daly Waters Details: Not To Scale
TwxNT Job no.: 190066
Comments:
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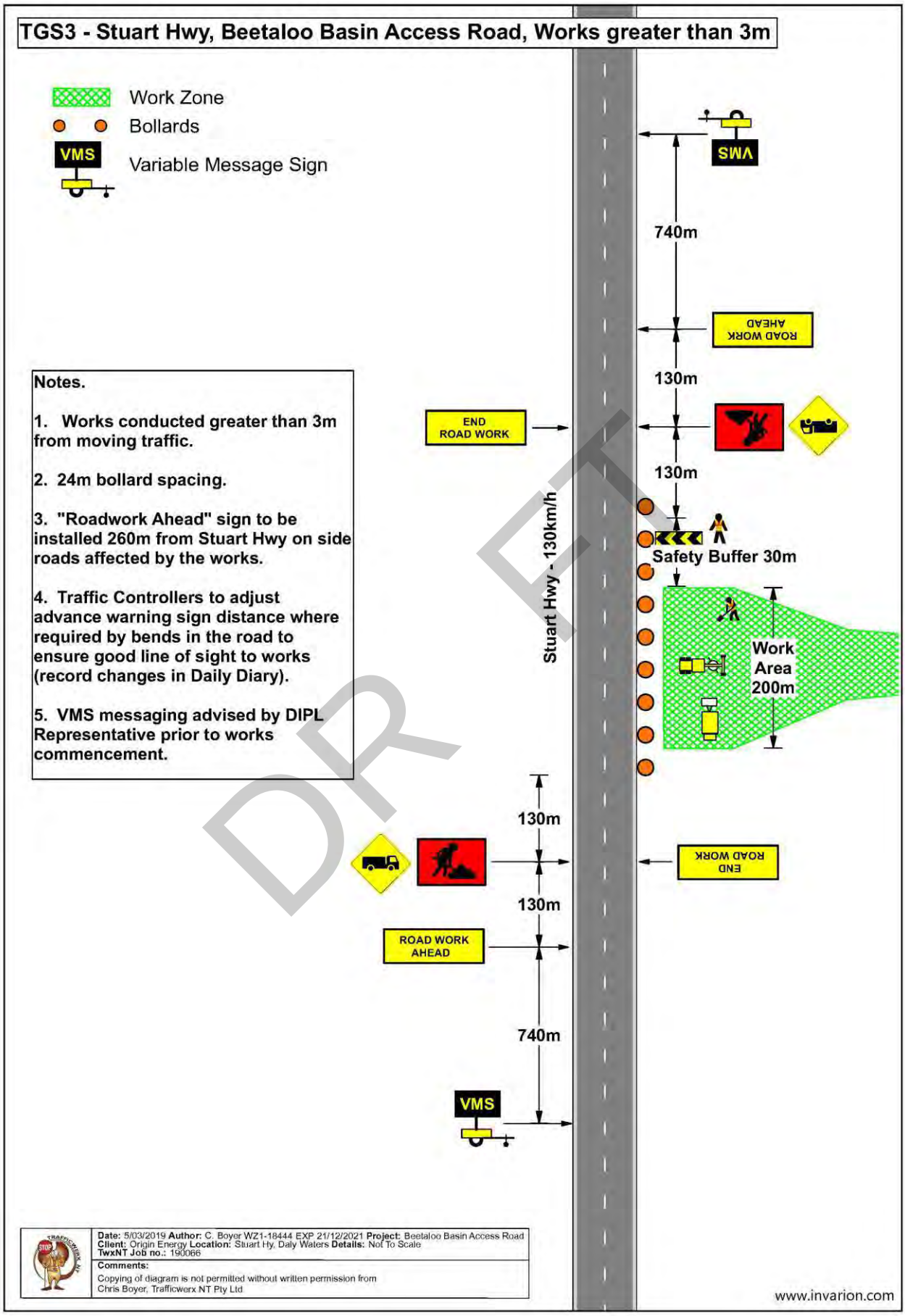
TGS3 - Stuart Hwy, Beetaloo Basin Access Road, Works greater than 3m
Work Zone
Bollards
VMS
Variable Message Sign
Notes.
1. Works conducted greater than 3m from moving traffic.
2. 24m bollard spacing.
3. "Roadwork Ahead" sign to be installed 260m from Stuart Hwy on side roads affected by the works.
4. Traffic Controllers to adjust advance warning sign distance where required by bends in the road to ensure good line of sight to works (record changes in Daily Diary).
5. VMS messaging advised by DIPL Representative prior to works commencement.
VMS
740m
ROAD WORK AHEAD
130m
END ROAD WORK
130m
Safety Buffer 30m
Stuart Hwy - 130km/h
Work Area 200m
130m
END ROAD WORK
130m
ROAD WORK AHEAD
740m
VMS
Date: 5/03/2019 Author: C. Boyer WZ1-18444 EXP 21/12/2021 Project: Beetaloo Basin Access Road
Client: Origin Energy Location: Stuart Hy, Daly Waters Details: Not To Scale
TwxNT Job no.: 190066
Comments:
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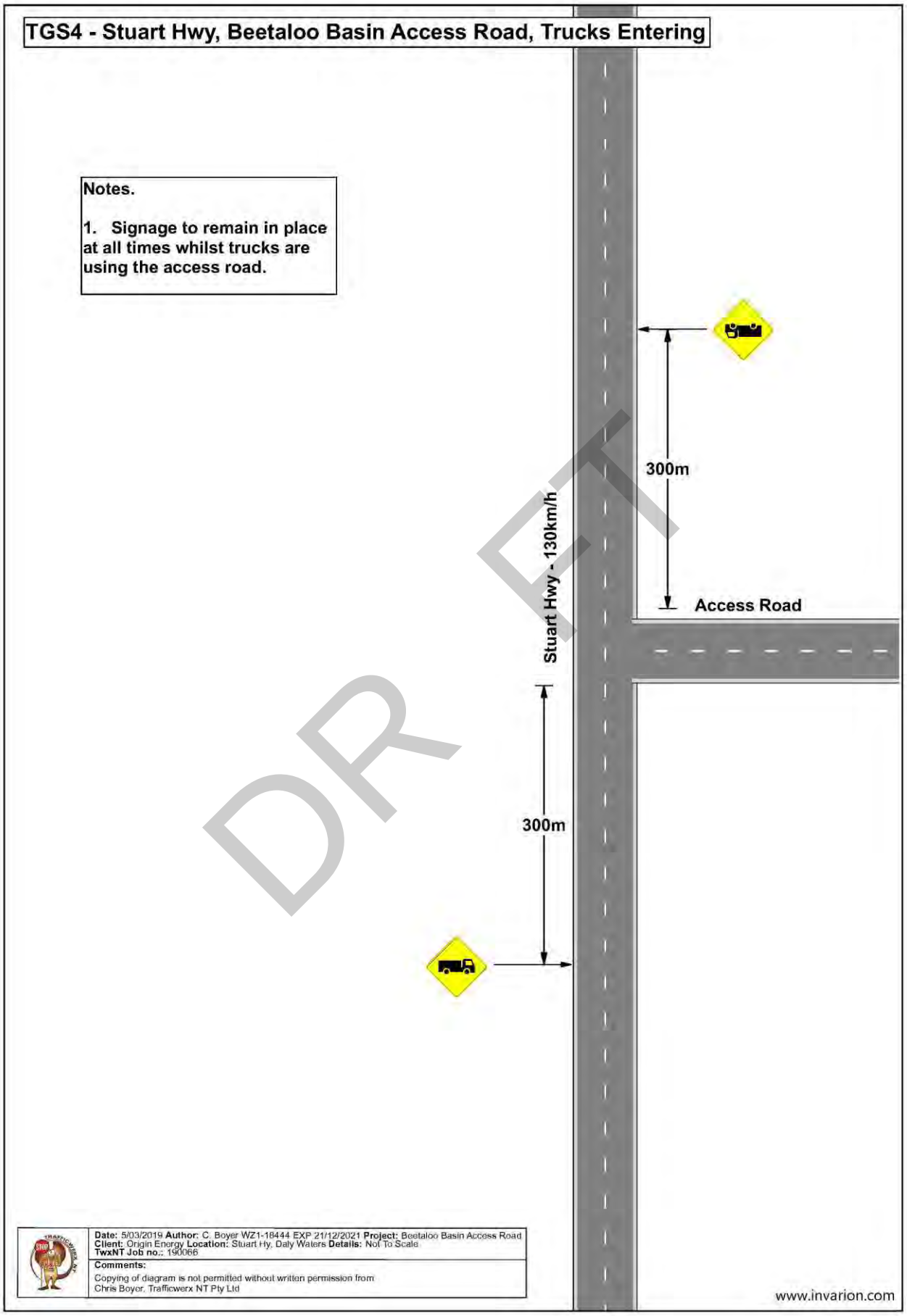
TGS4 - Stuart Hwy, Beetaloo Basin Access Road, Trucks Entering
Notes.
1. Signage to remain in place at all times whilst trucks are using the access road.
300m
Stuart Hwy - 130km/h
Access Road
300m
DRAFT
Date: 5/03/2019 Author: C. Boyer WZ1-18444 EXP 21/12/2021 Project: Beetaloo Basin Access Road
Client: Origin Energy Location: Stuart Hy, Daly Waters Details: Not To Scale
TwxNT Job no.: 190066
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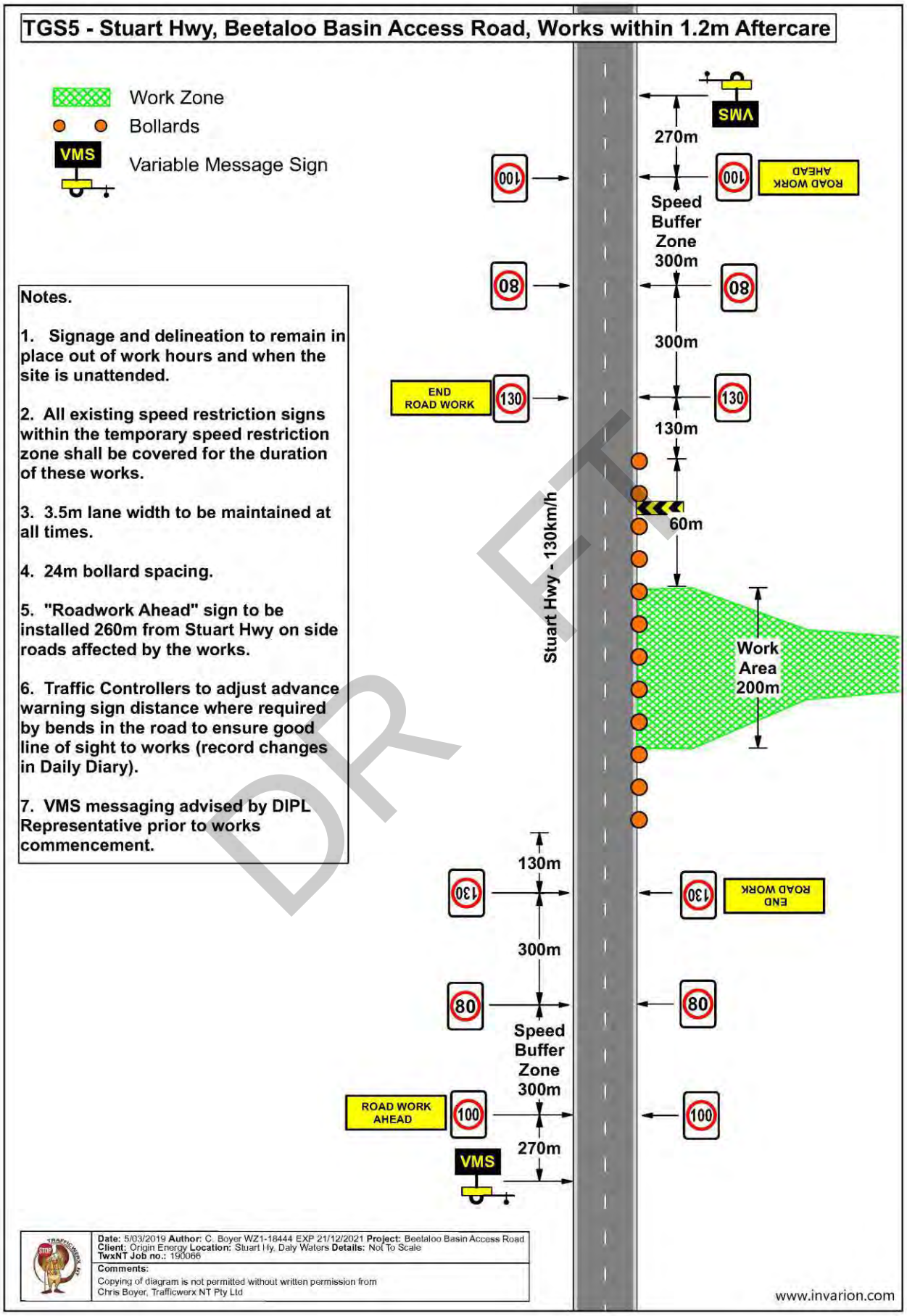
TGS5 - Stuart Hwy, Beetaloo Basin Access Road, Works within 1.2m Aftercare
Work Zone
Bollards
VMS
Variable Message Sign
Notes.
1. Signage and delineation to remain in place out of work hours and when the site is unattended.
2. All existing speed restriction signs within the temporary speed restriction zone shall be covered for the duration of these works.
3. 3.5m lane width to be maintained at all times.
4. 24m bollard spacing.
5. "Roadwork Ahead" sign to be installed 260m from Stuart Hwy on side roads affected by the works.
6. Traffic Controllers to adjust advance warning sign distance where required by bends in the road to ensure good line of sight to works (record changes in Daily Diary).
7. VMS messaging advised by DIPL Representative prior to works commencement.
VMS
270m
100
ROAD WORK AHEAD
Speed Buffer Zone 300m
08
300m
END ROAD WORK
130
130m
60m
Stuart Hwy - 130km/h
Work Area 200m
130m
END ROAD WORK
300m
80
Speed Buffer Zone 300m
ROAD WORK AHEAD
270m
VMS
DRAFT
Date: 5/03/2019 Author: C. Boyer WZ1-18444 EXP 21/12/2021 Project: Beetaloo Basin Access Road
Client: Origin Energy Location: Stuart Hy, Daly Waters Details: Not To Scale
TwxNT Job no.: 190066
Comments:
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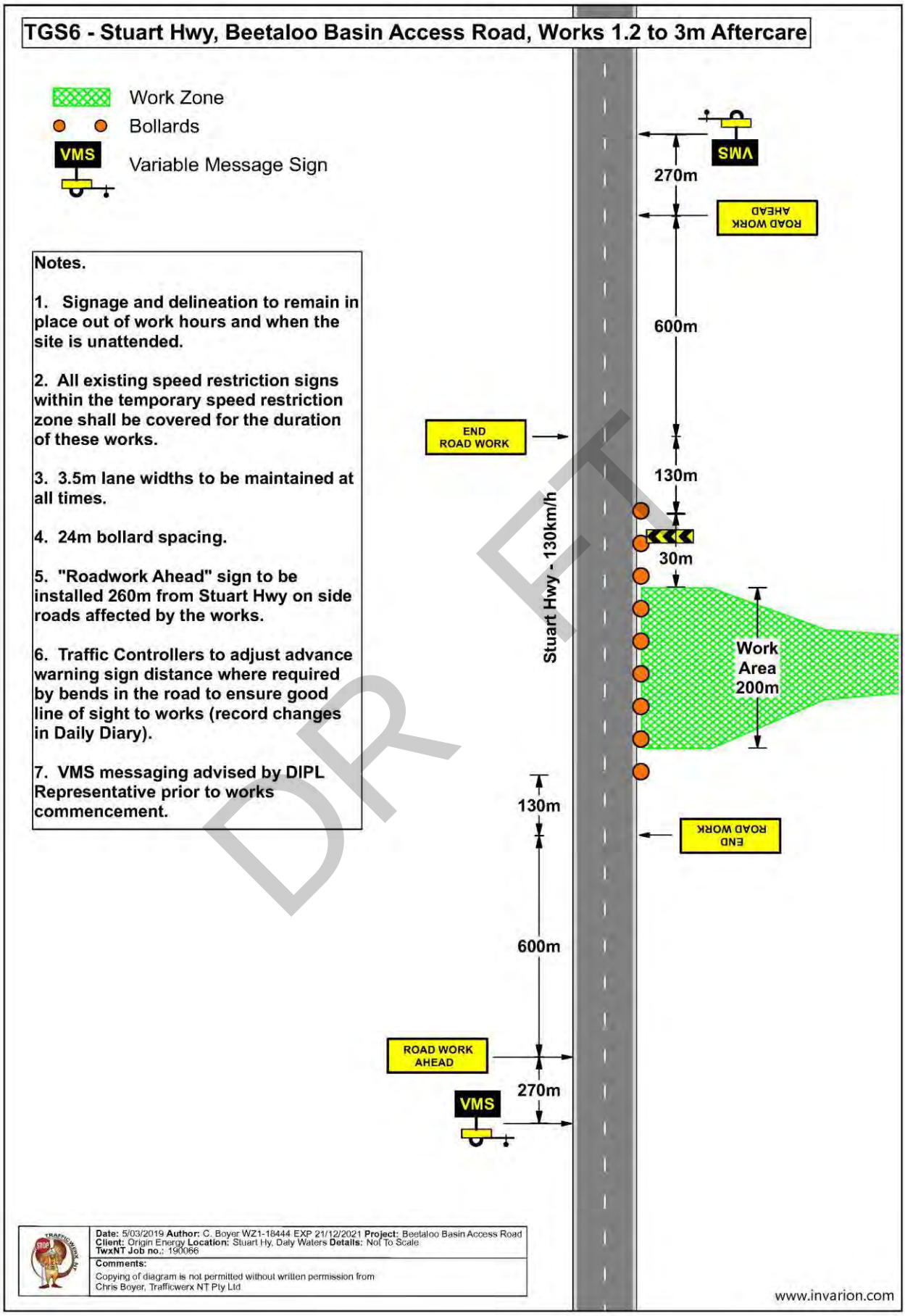
TGS6 - Stuart Hwy, Beetaloo Basin Access Road, Works 1.2 to 3m Aftercare
Work Zone
Bollards
VMS
Variable Message Sign
Notes.
1. Signage and delineation to remain in place out of work hours and when the site is unattended.
2. All existing speed restriction signs within the temporary speed restriction zone shall be covered for the duration of these works.
3. 3.5m lane widths to be maintained at all times.
4. 24m bollard spacing.
5. "Roadwork Ahead" sign to be installed 260m from Stuart Hwy on side roads affected by the works.
6. Traffic Controllers to adjust advance warning sign distance where required by bends in the road to ensure good line of sight to works (record changes in Daily Diary).
7. VMS messaging advised by DIPL Representative prior to works commencement.
VMS
270m
ROAD WORK AHEAD
600m
END ROAD WORK
130m
30m
Stuart Hwy - 130km/h
Work Area 200m
130m
END ROAD WORK
600m
ROAD WORK AHEAD
270m
VMS
DRAFT
Date: 5/03/2019 Author: C. Boyer WZ1-18444 EXP 21/12/2021 Project: Beetaloo Basin Access Road
Client: Origin Energy Location: Stuart Hy, Daly Waters Details: Not To Scale
TwxNT Job no.: 190066
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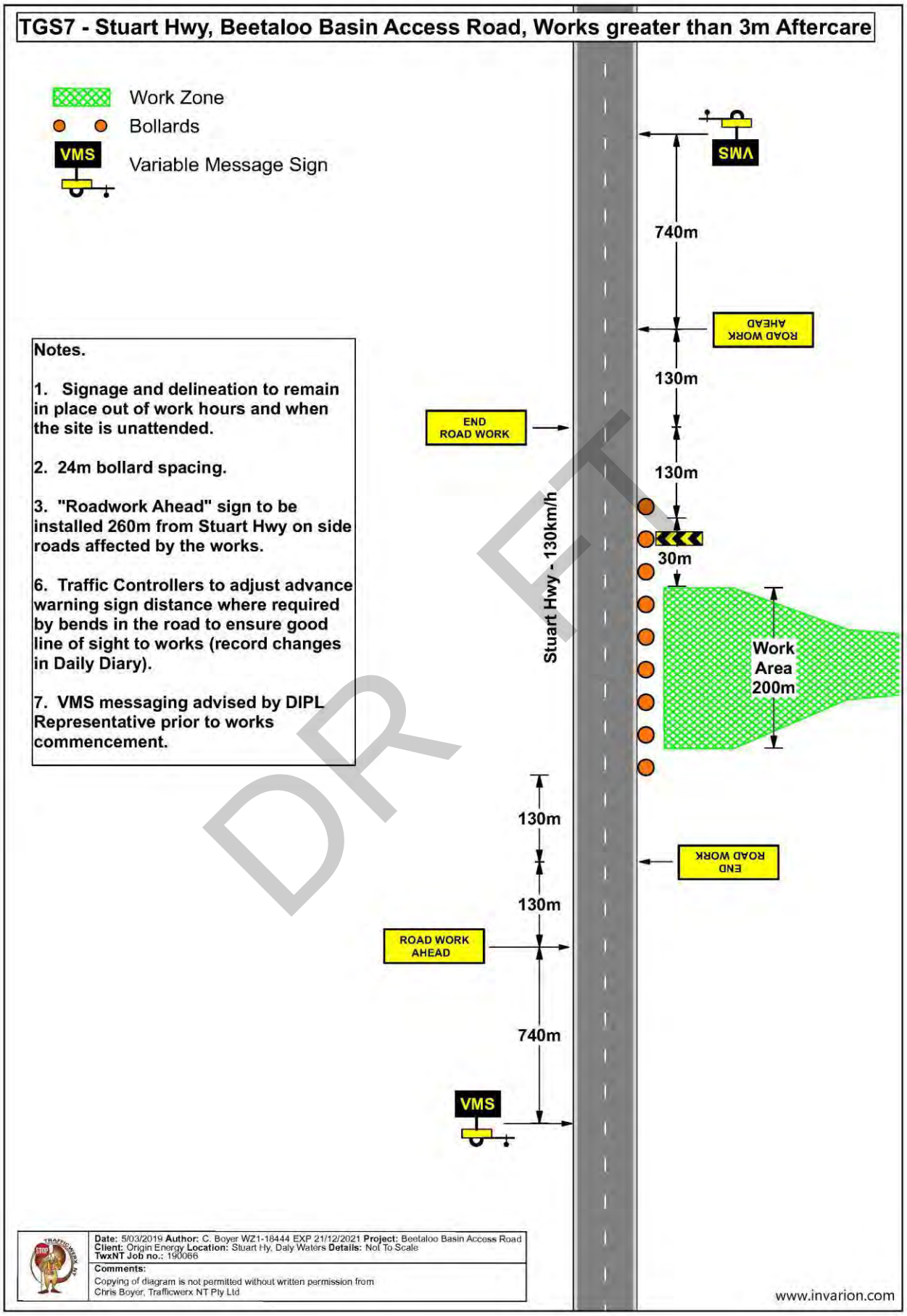
TGS7 - Stuart Hwy, Beetaloo Basin Access Road, Works greater than 3m Aftercare
Work Zone
Bollards
VMS
Variable Message Sign
Notes.
1. Signage and delineation to remain in place out of work hours and when the site is unattended.
2. 24m bollard spacing.
3. "Roadwork Ahead" sign to be installed 260m from Stuart Hwy on side roads affected by the works.
6. Traffic Controllers to adjust advance warning sign distance where required by bends in the road to ensure good line of sight to works (record changes in Daily Diary).
7. VMS messaging advised by DIPL Representative prior to works commencement.
VMS
740m
ROAD WORK AHEAD
130m
END ROAD WORK
130m
30m
Stuart Hwy - 130km/h
Work Area 200m
130m
END ROAD WORK
130m
ROAD WORK AHEAD
740m
VMS
Date: 5/03/2019 Author: C. Boyer WZ1-18444 EXP 21/12/2021 Project: Beetaloo Basin Access Road
Client: Origin Energy Location: Stuart Hy, Daly Waters Details: Not To Scale
TwxNT Job no.: 190066
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13.4 APPENDIX D Sign and Equipment Manifest

TGS1 – Stuart Hwy, Beetaloo Basin Access Road, Works within 1.2m

Approach / Departure Signage	Sign Number	Size (mm)		Quantity
Roadwork Ahead	T1-1A	1800	600	2
Road Plant Ahead	T1-3-2A	1800	600	
Grader Ahead	T1-4A	900	600	
Worker (symbolic)	T1-5-1A	900	600	
Worker (symbolic)	T1-5-1B	1200	900	2
Roadwork 1km Ahead	T1-16A	1800	600	
Roadwork Next 2km	T1-24A	1800	600	
Roadwork On Side Road	T1-25A	1800	600	
Next 2km	T1-28A	600	600	
End Roadwork	T2-16A	1800	600	2
Side Road Closed	T1-25	1800	600	
Worker (symbolic) Next 2km				

Regulatory Traffic Control Signage	Sign Number	Size (mm)		Quantity
Stop / Slow Bat	R6-8 / T7-1 A	450		2
Reduce Speed	G9-9A	1500	750	
Prepare To Stop Traffic Controller Symbolic	T1-18B	1200	900	2
Give Way	R1-2B	900	900	
No Overtaking Or Passing	R6-1A	750	900	
Signals Ahead (symbolic)	T1-30A	900	600	
Stop Here On Red Signal	R6-6A	450	750	
Traffic Controller (symbolic)	T1-4-A	900	600	
Traffic Controller (symbolic)	T1-4B	1200	900	
Blasting Area, Switch off Radio Transmitters and Mobile Phones	T4-7-A	1200	900	
End Blasting Area	T4-3-A	1800	600	

Detour Signage	Sign Number	Size (mm)		Quantity
All Traffic Turn (left arrow)	R2-14A L	600	800	
All Traffic Turn (right arrow)	R2-14A R	600	800	
Local Traffic Only	G9-40-2A	900	600	
Detour Ahead	T1-6A	1200	600	
End Detour	T2-23A	1200	600	
Two-way Traffic (symbolic)	T2-24A	900	600	
Detour (left arrow)	T5-1A L	1200	300	
Detour (right arrow)	T5-1A R	1200	300	
No Left Turn	R2-6A L	450	900	
No Right Turn	R2-6A R	450	900	

Road Condition Signage	Sign Number	Size (mm)		Quantity
Slippery (symbolic)	T3-3A	900	600	
Soft Edges	T3-6A	900	600	
Rough Surface	T3-7A	900	600	
Loose Stones (symbolic)	T3-9A	900	600	
New Work No Lines Marked	T3-11	1500	900	
No Lines Do Not Overtake Unless Safe	T3-12	1500	900	

Lane / Road Closure Signage	Sign Number	Size (mm)		Quantity
Road Closed	T2-4A	1800	300	
Road Closed Ahead		1800	600	
Road Closed 1km Ahead	T2-Q02	1800	600	
Lane Status (2 lane) (open arrows)	T2-6-1A	1200	900	
Lane Status (3 lane) (open arrows)	T2-6-2A	1800	900	
Lane Status Magnetic Overlay (T-shaped)				
Lane Status Magnetic Overlay (left arrow)				
Lane Status Magnetic Overlay (right arrow)				

Delineation / Miscellaneous Signage	Sign Number	Size (mm)		Quantity
Traffic Cone with Reflective Sleeve		700		
Temporary Hazard Marker	T5-4A	1500	450	1
Temporary Hazard Marker	T5-5A	600	600	
Highway Bollard				20
Caution Tape				

Pedestrian Control Signage	Sign Number	Size (mm)		Quantity
Pedestrians Watch Your Step	T8-1A	900	600	
Use Other Footpath	T8-3	900	600	
Pedestrians (left arrow)	T8-2A L	1200	300	
Pedestrians (right arrow)	T8-2A R	1200	300	
Footpath Closed	T8-4	900	600	

Other Roadworks Signage	Sign Number	Size (mm)		Quantity
Traffic Hazard Ahead	T1-10A	1200	900	
Traffic Accident Ahead	T1-11A	1200	900	
Water Over Road	T2-13B	1200	900	
Trucks Entering (symbolic) (left)	T2-25A L	900	600	2
Trucks Entering (symbolic) (right)	T2-25A R	900	600	
Trucks (diamond)	W5-22B	750	750	
Trucks (diamond)	W5-22C	750	750	
Side Road Junction (L/R)	W2-4	750	750	

Speed Restriction Signs	Sign Number	Size (mm)		Quantity
20 km/h	R4-80B	600	800	
40 km/h	R4-80B	600	800	
50 km/h	R4-80B	600	800	
60 km/h	R4-80B	600	800	4
70 km/h	R4-80B	600	800	
80 km/h	R4-80B	600	800	4
90 km/h	R4-80B	600	800	
100 km/h	R4-80B	600	800	4
110 km/h	R4-80B	600	800	
130 km/h	R4-80B	600	800	4
End 60 km/h	R4-12B	600	800	

Miscellaneous Equipment	Quantity
Radios (UHF)	2
Vests (High Visibility)	2
Vests (Retro-reflective Night)	
Hard Hats (Wide Brimmed)	
Traffic Control Vehicles	
Arrow Boards	
Sign Legs	18
Speed Restriction Trailers	
Speed Restriction Spikes	12
Spike Drivers	2
Fuel Cans	
Lighting Towers	
Variable Message Boards	2

13.5 APPENDIX E Certificate of Currency of Public Liability Insurance

Empower Results®

Contact Ross Hoy
t 02 9253 8265
e ross.hoy@aon.com

Origin Energy Limited
Tower 1, 100 Barangaroo Avenue
SYDNEY 2000
NEW SOUTH WALES
AUSTRALIA

Certificate of Currency

Date of Issue 27 June 2018

In our capacity as Insurance Brokers to Origin Energy Limited we hereby certify that the under mentioned insurance policy is current.

Policy Type	Public and Products Liability
Insured	1. Origin Energy Limited 2. Subsidiary and/ or controlled companies of 1. above; 3. Joint Venture Partners and/ or other companies of 1 and/ or 2. above for whom the insured has contractual responsibility to insure; and/ or 4. Other parties (including those acquired during the currency of the insurance) and as provided for herein and others as defined in the policy conditions.
Insurer	AIG Australia Limited (primary lead insurer)
Policy Number(s)	300018358
Period of Insurance	30/06/2018 - 30/06/2019
Interest Insured	Legal Liability for (a) Injury to any person; (b) Property Damage; (c) Advertising Injury, (d) Financial Loss occurring within the Territorial Limits during the Period of Insurance as a result of an Occurrence happening in connection with the Insured's Business.
Limits of Liability	Not less than AUD$20,000,000 any one Occurrence and in the annual aggregate in respect of each of Products and Pollution Liability.
Geographical Limit	Anywhere in the World excluding the United States of America (with the exception of American Samoa) and Canada where this Policy will only apply in respect of Products sent into those countries and/or travelling directors or Employees who are non resident in such countries.
Conditions	Subject to the terms and conditions of the policy

Further Information
Should you have any queries, please contact us. Our details are set out in the top right side of this document.
This certificate is a summary of cover only. Please refer to the Policy Wording and Schedule for its full terms and conditions.

Important notes

- Aon does not guarantee that the insurance outlined in this Certificate will continue to remain in force for the period referred to as the Policy may be cancelled or altered by either party to the contract, at any time, in accordance with the terms of the Policy and the Insurance Contracts act 1984 (Cth).
- Aon accepts no responsibility or liability to advise any party who may be relying on this Certificate of such alteration to or cancellation of the Policy.
- This certificate does not:
  - represent an insurance contract or confer rights to the recipient; or
  - amend, extend or alter the Policy.

Office use only: A2TO7976 1

Aon Risk Solutions Sydney
17 0004 347 20 241141

SUBCONTRACTOR PL INS TBA

13.6 APPENDIX F Procedure for Entering/Exiting Traffic

TRAFFICWERX NT Pty Ltd

Trafficwerx NT Document TXD081

building the future together

Procedure for Entering/Exiting Traffic from/to the Worksite

Purpose:	To define the process for personnel operating vehicles or plant at a worksite to safely enter or exit the traffic stream from or into the worksite.
Staff Affected:	All staff All contractors and subcontractors accessing the worksite
Expected Outcomes:	Common understanding by all personnel accessing the worksite regarding the procedure for entering or exiting the worksite from or into the traffic stream. Safe movement of vehicles and plant into and out of the worksite leading to no incidents or accidents.
Definitions:	Nil
References:	Nil

Vehicles entering and exiting the traffic stream do so in an environment that is different from normal situations and as such drivers need to be mindful of the conditions that may affect the safety of these movements.

All entry and exit movements will be conducted in accordance with the Traffic Act and shall be undertaken in the manner described following.

Worksite Entry

Vehicles and plant may be required to enter the worksite at different points of access and shall do so as described following:

- At the start of the merge traffic by manoeuvring behind the delineations and by utilising the closed lanes to traverse the worksite.
- At the end of the worksite by entering the closed lanes in the prescribed manner.
- At the designated entry point established at the Tool Box Talk meeting.

As 'following' drivers would not commonly expect 'leading' vehicles to leave the roadway, their attention may be reduced. In recognition of this behaviour, drivers leaving the carriageway shall be required to undertake the following safe work practice:

1. Decelerate slowly and signal their intention by indicator to leave the traffic stream well in advance of their departure point.
2. Activate their vehicle's rotating yellow lamp(s) once a speed of 40km/h has been reached and at least 50m prior to the entry location.

Worksite Exit

Vehicles and plant entering the traffic stream from the worksite shall have the vehicle's rotating yellow lamp(s) activated prior to entering the traffic stream and must undertake the following:

1. Indicate their intention to enter the traffic stream using direction indicators.
2. Ensure there is a suitable gap from oncoming traffic to allow for a safe entry manoeuvre.
3. Accelerate while still in the delineated lane of the worksite.
4. Enter the traffic flow.
5. Turn OFF the vehicle's rotating yellow lamp(s) once a speed of 40km/h is reached.

13.7 APPENDIX G Agency Notification

Emergency Services

TRAFFICWERX NT Pty Ltd

building the future together

To: **Northern Territory Police, Fire & Emergency Services** **St John's Ambulance Service**	**From:** **Chris Boyer** **Trafficwerx NT**
Attention:	**Fax No.: 8941 3528**
Email: police.assistance@pfes.nt.gov.au feedback@stjohnnt.asn.au	**Date: 29/03/2019**
No of Pages (incl): 1	
Subject: Works within Road Reserve – Stuart Hwy, Daly Waters	

To whom it may concern,

Origin Energy are to carry out works associated with the Beetaloo Basin Exploration Project.on the Stuart Hwy, 64.5km South of the Hi-Way Inn, Daly Waters.

The works comprise construction of a temporary, site access road to allow project construction and support service vehicles access to the basin exploration drill sites. The access road is on the Eastern side of the Stuart Highway, perpendicular to the road.

The works are expected to be carried out between April to October 2019, Monday to Sunday including Public Holidays 0600 – 1800.

Traffic management for the works includes installation of Advance warning signage, temporary speed limit restriction and lane closure with work area delineated. Select signage and delineation of work area to remain installed as Aftercare treatment out of work hours and when the site is unattended. Variable Message Signs to be installed prior to works commencement and during the works.

The Site Supervisor responsible for the work zones is Robert Wear (Origin Energy). Robert shall be available to be contacted on Mob TBA in the event of an emergency.

We apologise for any inconvenience and imposition and require your co-operation and patience whilst these works are being conducted.

Should you have any queries or concerns regarding the above or wish to discuss any other matter, please do not hesitate to contact me on 8942 2228.

Thank you and Regards,

Chris Boyer
Trafficwerx NT

13.8 APPENDIX H Traffic Volume/Composition Count Data

Traffic Volume Data

Rural Coverage Count Stations — **Year: 2017**

Table: 4.1 AADT For Coverage Stations - 10 Year Period — **Region: Tennant Creek**

Road Name / Location	ADT Station	Direction	Units	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Stuart Highway	RTVDC020	Inbound	Veh			225	211	210	225	222	229	223	280
20km North of Elliott		Outbound	Veh			221	195	197	205	213	213	222	271
SITE NOT SURVEYED IN 2008 and 2009		Both	Veh			446	406	407	430	435	442	445	551

13.9 APPENDIX I DIPL - Permit to Work Application and Approval

NORTHERN TERRITORY GOVERNMENT

DEPARTMENT OF INFRASTRUCTURE, PLANNING AND LOGISTICS

APPLICATION FOR PERMIT TO WORK WITHIN THE NT GOVERNMENT ROAD RESERVE

PROPOSED WORK DETAILS			
Applicant's Name			
Business/Company Name			
ABN			
Road Name/s			
Location of works			
Description of works			
Dates of Proposed Works			

DEVELOPMENT/SERVICE & ROAD AGENCY APPROVALS	
DEVELOPMENT/SERVICE APPROVAL DETAILS: N/A	ROAD AGENCY APPROVAL DETAILS: N/A
APPROVAL NUMBER:	APPROVAL NUMBER:
APPROVED BY.	APPROVED BY:

WORK ZONE TRAFFIC MANAGEMENT PLAN (TMP)		
The TMP shall be in accordance with the current AS1742.3, Provisions for Traffic and designed by a Northern Territory accredited Traffic Management Plan Designer. (WZ1)		
TMP Designed By: Chris Boyer	Accreditation No.	18444

INDEMNITY			
Public Liability Insurance minimum $10 million			
Policy No.			
Policy holder			
Insurer		Expiry Date	
Copy attached		If No, permit will not be approved	

APPLICANT'S DECLARATION

- I/We understand that the permit is granted under the terms and conditions set out on the attached Conditions and Specifications and have read and understand those conditions and agree to comply with them accordingly.
- I/We agree to pay all fees and charges as assessed and estimated by DIPL prior to approval. (non-refundable).

Applicant's Name			
Signature			
RTM Receipt No:		Date:	28/11/2018

DIPL Office Use Only - if all items below have **not** been met, the permit approval will **not** be granted

TMP sufficient for use & attached.	RTM Receipt attached	Insurance details attached & compliant	Conditions of Approval signed, dated & attached.	Development approval confirmed with R/A or Database	WZTM Accreditation numbers supplied & registered at MVR
Yes	**Yes**	**Yes**		**Yes**	**Yes**

Permit approval Number:	Permit expiry date: / /20	Processed By:	/ /20
		Delegated Officer:	/ /20

Special Conditions:

Extension of time: (Refer to Clause 1.5)
Extended permit expiry date: / /20 . Approval officer: / /20

Information collected on this permit application form may be made available under the *Information Act.*

PERMIT TO WORK WITHIN THE NTG ROAD RESERVE – 31 May 2017

CONDITIONS OF APPROVAL

1.1 NON-COMPLIANCE

If the Permit holder fails to comply with this permit, then DIPL reserves the right to suspend all works if deemed to be non-compliant. This includes works sites identified hazardous or causing significant inconvenience to the public. DIPL officers may rectify these issues if the Permit Holder fails to do so by the nominated timeframe as instructed by DIPL officer. The Permit Holder shall pay all associated costs for the remedial works.

1.2 FEES AND CHARGES

Fees and charges shall be determined by DIPL permits staff following receipt of an application and fall into the following 2 categories.

Tier 1 - standard, non-complex work - $200 per permit application. This includes projects that would typically be completed in a single work shift with minor traffic control requirements such as one-off surveying work, repairing a private advertising sign or installing a swimming pool requiring a crane to be parked on a trafficked lane.

Tier 2 - non-program, complex works - A cost estimate shall be provided after lodgement of a permit application or where the scope of the project changes based on an estimate of costs e.g. covering expert pre-project assessments including traffic control plan evaluations and formal technical advice. This includes projects that are conducted over an extended period of time, such as private housing estate developments with a new intersection and drainage works to be constructed to link into the existing road network.

1.3 TRAFFIC CONTROL STATEMENT

A signed statement developed by the author of the TMP for this application is to be co-signed by the Permit applicant. The statement is to confirm that the Standards and Provision for Traffic have been met and shall include the following:

- An explanation as to how compliance has been achieved.
- That the traffic control featured within the TCDs are compliant for day and night use (if applicable).
- An explanation where the Standards and Provision for Traffic have **not** been met and provide details within the risk assessment what treatments will be implemented to mitigate the risk to an acceptable level.
- Confirm site visit/s have occurred collectively with the permit applicant, contractor conducting the works and the WZ Level 1 author of the TMP. Has the staging of works been identified and provided within the TMP and meets the requirements specified within the Provision for Traffic.

1.4 DECLARATION

Signing this document certifies that the applicant has read and understands all of the requirements and conditions contained herein and hereby undertakes to carry out all works in compliance with the requirements of this PTW.

Approval of a permit does not constitute approval of any TMPs or TCDs. The applicant hereby accepts full responsibility and liability for any omissions or any non-conformances with the relevant Australian Standards for the proposed works.

Signed:		Date:	
Printed Name:		Position:	
Company Name		Email details:	
Witnessed by		Date	
Witness Name:	Chris Boyer	Witness Position:	TWX WZ1 designer

NORTHERN TERRITORY GOVERNMENT

DEPARTMENT OF
INFRASTRUCTURE, PLANNING
AND LOGISTICS

Level 3, Highway House,
Palmerston Circuit,
Palmerston NT 0831

Postal Address
PO Box 61,
Palmerston NT 0831

T 08 8924 7104
F 08 8924 7211
E DevRoads.NTG@nt.gov.au

Our ref: DDPI2005/4572-02-0062~0009
Your ref: N/A
TCSD Project No: 2018-0186

Robert Wear
Construction Superintendent
Beetaloo Exploration
Daly Waters,
Northern Territory 0852

Robert.wear@upstream.originenery.com.au

Dear Robert,

Re: BARKLY REGION - NT PORTION 7027, 1079 & 702 - 4500, 8240 & 16965 CARPENTARIA HIGHWAY - USE EXISTING TRACKS OFF STUART HWY & CARPENTARIA HWY TO ACCESS AND CONSTRUCT GROUND WATER MONITORING BORES - AECOM - DPIR

ROAD AGENCY APPROVAL – 2018-0186-D1

I refer to your email correspondence of 28/09/2018 concerning coordinates and location maps detailing existing access tracks to NT portion 7027, 1079 and 702, 4500, 8240 and 16965 along the Stuart Highway and Carpentaria Highway.

The Transport and Civil Services Division, Department of Infrastructure, Planning and Logistics grants approval to use existing tracks (locations identified as below) for water bore drilling and monitoring activities only, in the locations identified as below and subject to the following comments and conditions:

- Existing track to Kyalla 117 N2: -16.861166°; 133.426613°
- Beetaloo Access Track: -17.115562°; 133.456416°
- Existing Track to Kayalla 98 W-1: -16.307348°; 133.747246°
- Existing Track to Velkerri 98 N1-2: -16.338620°; 133.884436°
- Existing Track to Velkerri 98 E1-1: -16.448133°; 134.241456°

1. Approval to use existing tracks off Stuart Highway and Carpentaria Highway until 10/04/2019. If required, the Stuart Highway and Carpentaria Highway Road reserves and edge of seal are to be rehabilitated and revegetated in accordance with the Department's *Roadworks Master Specification*.

2. Application to extend the period of the approval must be made in writing at least 10 business days prior to the expiry of the approval.

3. If works within the road reserves are required, the contractor will need to obtain a "Permit to Work within NT Government Road Reserves" prior to the commencement of any works within the Stuart Highway and Carpentaria Highway road reserves.

   The Application Procedure for a Permit to Work within NT Government Road Reserves is available at https://nt.gov.au/driving/management/apply-for-permit-to-work-on-a-road.

   On application for a "Permit to Work within NT Government Road Reserves" the Developer will have to provide:

   (i) A copy of Transport and Civil Services Division, Department of Infrastructure, Planning and Logistics Approval (this letter).
   (ii) An appropriate "Work Zone Traffic Management Plan" prepared by a competent and accredited agent, and endorsed as in accordance with "AS1742.3".

4. AECOM is required to obtain all necessary Clearances (Environmental, Sacred Sites, Heritage, Services, etc.) for the construction of infrastructure beyond the existing Stuart Highway and Carpentaria Highway road pavement and provide copies for verification on request.

5. The loads of all trucks entering and leaving the site of works are to be constrained in such a manner as to prevent the dropping or tracking of materials onto Stuart Highway and Carpentaria Highway. This includes ensuring that all wheels, tracks and body surfaces are free of mud and other contaminants before entering onto the sealed road network. Where tracked material on the road pavement becomes a potential safety issue, the Developer will be obliged to sweep and clean material off the road.

Should you wish to discuss the above mentioned further, please contact Corridor Access Group at the Transport and Civil Services Division, Department of Infrastructure, Planning and Logistics on telephone 8924 7280.

Please quote the TCSD Project No 2018-0186 in all correspondence.

Yours sincerely

Digitally signed by Mike Tait
Date: 2018.11.06 07:54:19
+09'30'

Mike Tait
A/Director, Corridor Management

cc: Manager Operations & Traffic – Ian Smith
Project Director, Civil Assets Management – David Kerslake
Regional Director Barkly, Tennant Creek – Darcy Dunbar
Regional Manager Barkly, Tennant Creek – Glen Ivor Jones

13.10 APPENDIX J Temporary Speed Limit Authorisation

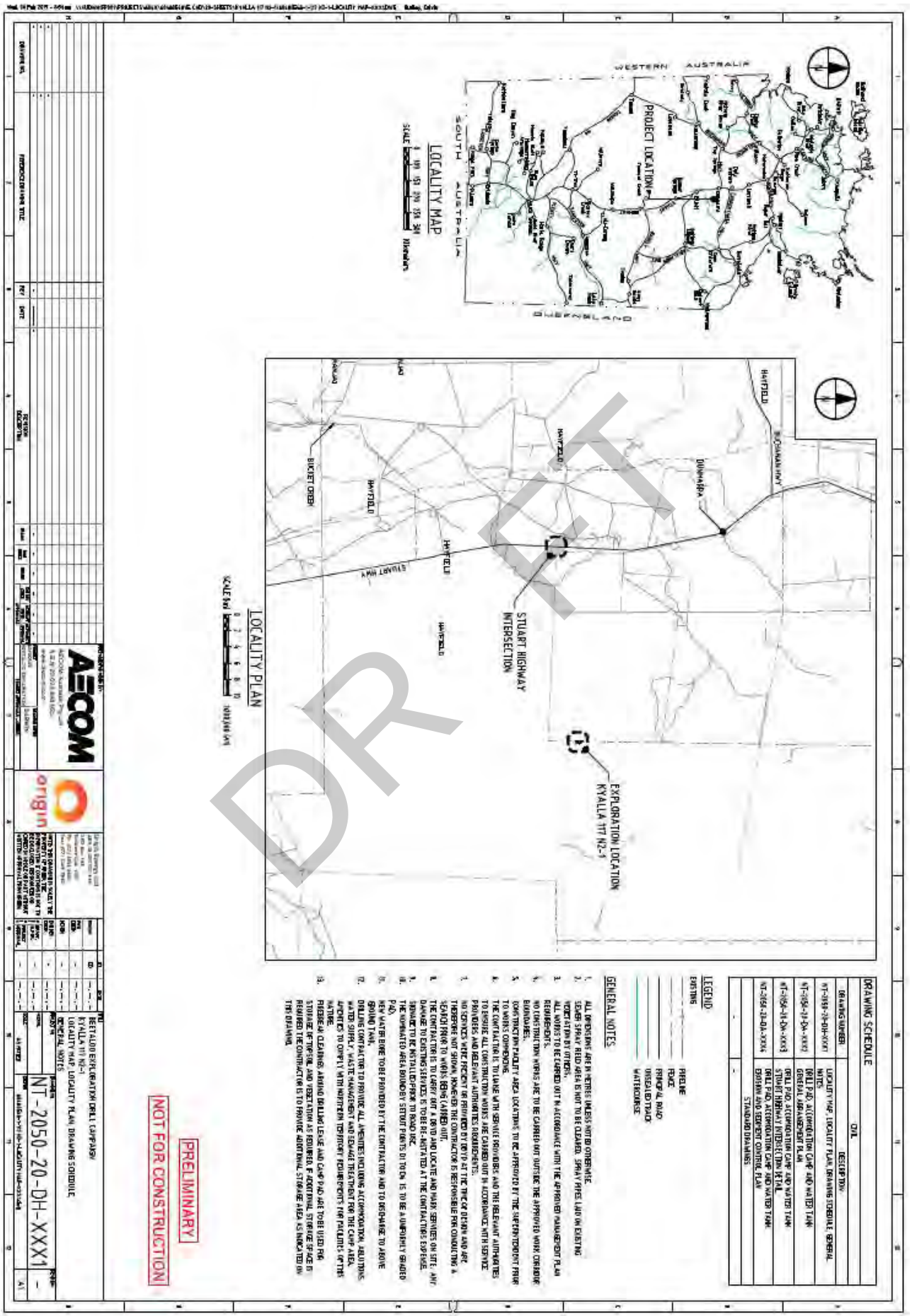
NORTHERN TERRITORY GOVERNMENT

DEPARTMENT OF INFRASTRUCTURE, PLANNING AND LOGISTICS

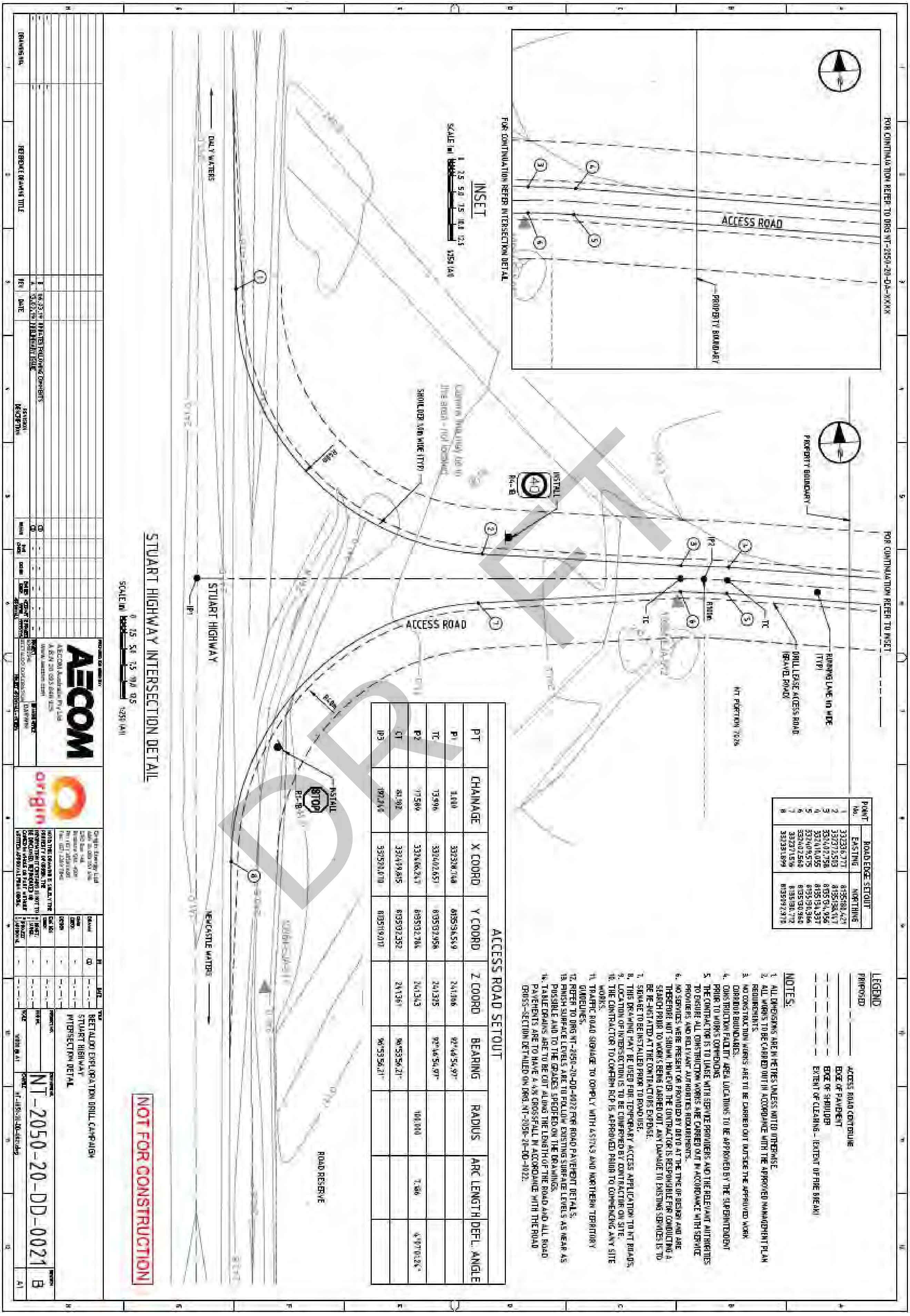
TEMPORARY SPEED LIMIT AUTHORISATION

LOCATION	Stuart Hwy		
FROM CH:		TO CH:	
LOCATION DESCRIPTION	Stuart Hwy 64.5km South of the Hi-Way Inn, Daly Waters		
TYPE OF WORK	Access road construction		
DURATION	**6 months**		
DATE FROM:	April 2019	DATE TO:	October 2019
Including Weekends (circle one)			
TIME	Start Shift: 0600 Hrs		Finish Shift: 1800 Hrs
	Start Shift: Hrs		Finish Shift: Hrs
ASSOCIATED PROJECT No/Name:	Beetaloo Basin Exploration Project		
EXISTING SPEED LIMIT/s	130 KM/H	KM/H	KM/H
REQUESTED SPEED LIMIT/s	110 KM/H	80 KM/H	60 KM/H
REQUESTING PERSON	Chris Boyer WZ1 18444 Exp 21/12/2021		
REQUESTING ORGANISATION	Trafficwerx NT P/L		
DIPL AUTHORISATION (Print Name, Sign & Date)			
Name:	Signature:		Date: / /20
Comments:			
DIPL Approving Officer to forward authorised document to: NT Police.			

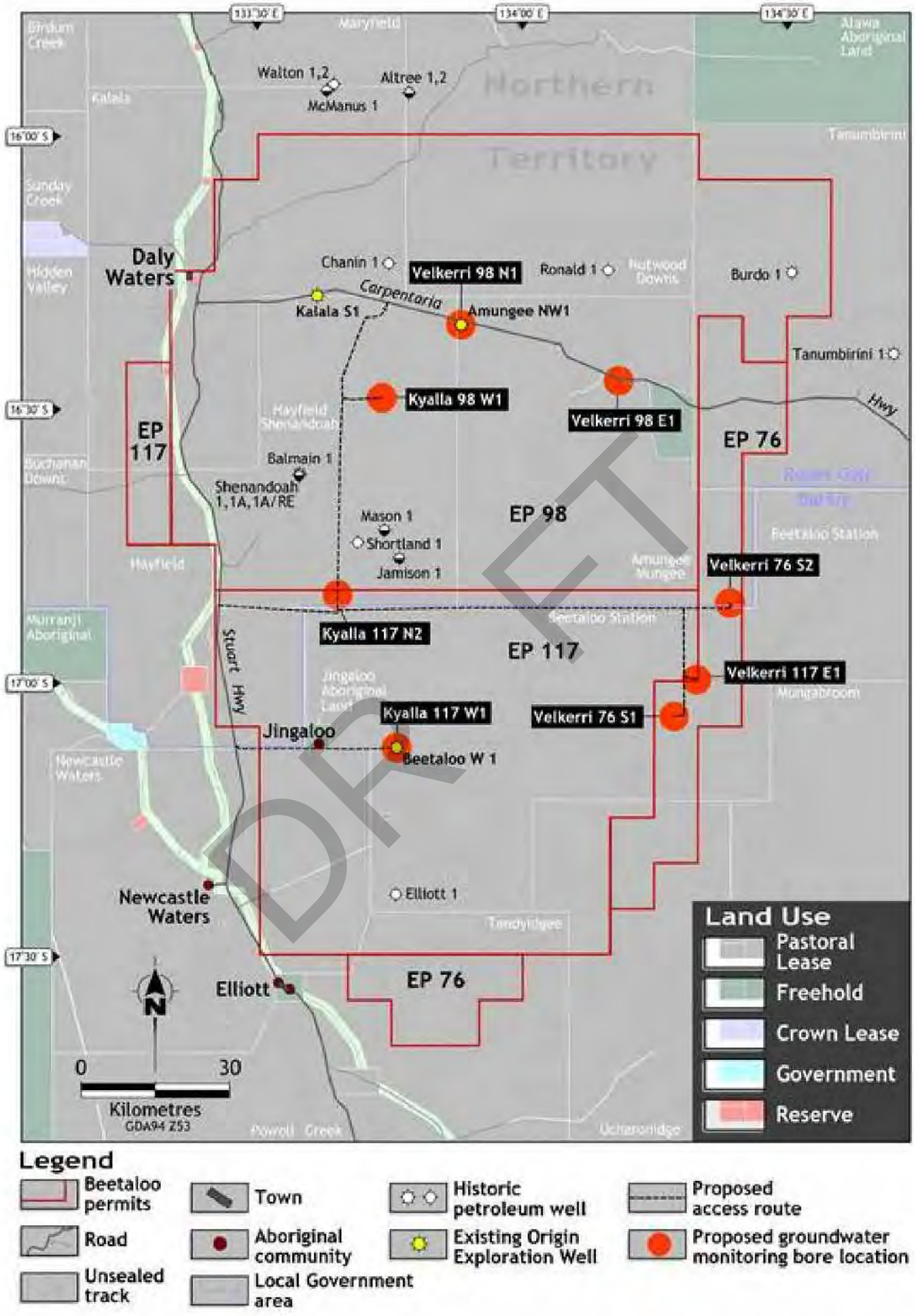
13.11 APPENDIX K Project Documentation




NEWCASTLE WATERS
STUART HIGHWAY
DALY WATERS
EXISTING ACCESS/TALOUIT DRAIN
ACCESS ROAD
DRAFT
LEGEND
EXISTING
CONTOURS
PROPOSED
ACCESS ROAD CENTERLINE
EDGE OF PAVEMENT
EDGE OF SHOULDER
EDGE OF FOOTPATH
EXTENT OF CLEARING - (EXTENT OF FREE BREAK)
NOTES:
1. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
2. LOCATION OF INTERSECTION IS TO BE CONFIRMED BY CONTRACTOR ON SITE.
3. THE CONTRACTOR IS RESPONSIBLE FOR PERMITS REQUIRED FOR CONSTRUCTION IN ROAD RESERVE AND TIE-IN TO EXISTING ROADWAY.
4. CONTRACTOR IS RESPONSIBLE TO RELOCATE EXISTING SERVICES. ANY DAMAGE TO EXISTING SERVICES TO BE RE-INSTATED AT THE CONTRACTORS EXPENSE.
5. TRAFFIC ROAD SIGNAGE TO COMPLY WITH AS1743 AND NORTHERN TERRITORY GUIDELINES.
6. SIGNAGE TO BE INSTALLED PRIOR TO ROAD USE.
7. ALL WORKS TO BE CARRIED OUT IN ACCORDANCE WITH THE APPROVED MANAGEMENT PLAN REQUIREMENTS.
8. NO CONSTRUCTION WORKS ARE TO BE CARRIED OUT OUTSIDE THE APPROVED WORK CORRIDOR BOUNDARIES.
9. CONSTRUCTION FACILITY AREA LOCATIONS TO BE APPROVED BY THE SUPERINTENDENT PRIOR TO WORKS COMMENCING.
10. NO SERVICES WERE PRESENT OR PROVIDED BY DIO AT THE TIME OF DESIGN AND ARE THEREFOR NOT SHOWN. HOWEVER THE CONTRACTOR IS RESPONSIBLE FOR CONDUCTING A SEARCH PRIOR TO WORKS BEING CARRIED OUT.
11. THE CONTRACTOR IS TO LIAISE WITH SERVICE PROVIDERS AND THE RELEVANT AUTHORITIES TO ENSURE ALL CONSTRUCTION WORKS ARE CARRIED OUT IN ACCORDANCE WITH SERVICE PROVIDERS AND RELEVANT AUTHORITIES REQUIREMENTS.
12. THIS DRAWING MAY BE USED FOR TEMPORARY ACCESS APPLICATION TO NT ROADS.
13. REFER TO DRG NT-2050-20-DA-XXXX FOR ROAD PAVEMENT DETAILS.
14. FINISH SURFACE LEVELS ARE TO FOLLOW EXISTING SURFACE LEVELS AS NEAR AS POSSIBLE AND TO THE GRADES SPECIFIED ON THE DRAWINGS.
15. TABLE DRAINS ARE TO BE CUT ALONG THE LENGTH OF THE ROAD AND ALL ROAD PAVEMENTS ARE TO HAVE A 4% CROSSFALL IN ACCORDANCE WITH THE ROAD CROSS-SECTION DETAILED ON DRG. NT-2050-20-DA-0013.
PRELIMINARY
NOT FOR CONSTRUCTION
STUART HIGHWAY INTERSECTION DETAIL
AECOM
origin
BEETALOO EXPLORATION DRILL CAMPAIGN
RYALLA 1 (T) NO-1
DRILL PAD, ACCOMMODATION CAMP AND WATER TANK
STUART HIGHWAY INTERSECTION DETAIL
NT-2050-20-DA-XXX3
A1



INSET
ACCESS ROAD
PROPERTY BOUNDARY
FOR CONTINUATION REFER TO INTERSECTION DETAIL
STUART HIGHWAY INTERSECTION DETAIL
STUART HIGHWAY
ACCESS ROAD
DALY WATERS
NEWCASTLE WATERS
ROAD RESERVE
INSTALL
STOP
ACCESS ROAD SETOUT
LEGEND
NOTES:
DRAFT
NOT FOR CONSTRUCTION
AECOM
origin
NT-2050-20-DD-0021


133°30' E
134°00' E
134°30' E
16°00' S
16°30' S
17°00' S
17°30' S
Northern Territory
Walton 1,2
Altree 1,2
McManus 1
Daly Waters
Chanin 1
Velkerri 98 N1
Ronald 1
Burdo 1
Kalala S1
Carpentaria
Amungee NW1
Tanumbirini 1
Kyalla 98 W1
Velkerri 98 E1
Hwy
EP 117
EP 76
Balmain 1
Shenandoah 1,1A,1A/RE
Mason 1
Shortland 1
Jamison 1
EP 98
Beetaloo Station
Velkerri 76 S2
Kyalla 117 N2
EP 117
Stuart Hwy
Velkerri 117 E1
Mungabroom
Kyalla 117 W1
Velkerri 76 S1
Jingaloo
Beetaloo W 1
Newcastle Waters
Elliott 1
Elliott
EP 76
N
0
30
Kilometres
GDA94 Z53
Land Use
Pastoral Lease
Freehold
Crown Lease
Government
Reserve
Legend
Beetaloo permits
Road
Unsealed track
Town
Aboriginal community
Local Government area
Historic petroleum well
Existing Origin Exploration Well
Proposed access route
Proposed groundwater monitoring bore location

13.12 APPENDIX L Safe Work Method Statement

SAFE WORK METHOD STATEMENT	SWMS-01 Traffic Control	PH: 89 42 2228
Trafficwerx NT	6 Nylander Street Parap, NT 0820	ABN: 10 142 427 889

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This Safe Work Method Statement must be reviewed in consultation with employees for relevance for the task and approved by TWNT management prior to implementation.

TWNT Principal Contractor	YES	NO	Date of Issue
Principal Contractor		X	
Principal Contractor ABN			Contact Details
			Address
Principal Approval	☐ Yes approved for use *(approval document to attached to this SWMS)* ☐ Not approved – Principal SWMS used		
Project:		**Location**	

Activity / Task	Traffic Control		
High Risk Construction Work	Risk of a Person Falling More Than 2 Metres		Work in Telecommunication Tower		Demolition of Load Bearing Structures	
	Likely to involve Disturbing Asbestos		Temporary Load –bearing support for structural alterations or repairs		Work in or near confined space	
	Work in or near a shaft or trench deeper than 1.5m or a tunnel		Use of Explosives		Work on or near pressurised gas	
	Work on or near chemical, fuel or refrigerant lines		Work on or near energised electrical installations or services		Work in an area that may have a contaminated or flammable atmosphere	
	Tilt up or precast concrete elements	√	Work on in or adjacent to road, railway, shipping land or other traffic	√	Work in an area with movement of powered mobile plant	
	Work in areas with artificial extremes of temperature		Work in or near water or other liquid that involves a risk of drowning		Diving Work	

SWMS No / Rev No	
SWMS Developed by	
Persons Responsible for reviewing	
Review Timeframes	Prestart Daily☐ Weekly ☐Monthly
Plant & Equipment required:	Traffic Signage, Stop/Slow Bats, Cones, Bollards, Traffic Vehicle, Hand Held UHF, Flashing Light
Maintenance Checks / Service Requirements	As per manufacturers requirements, Vehicle serving
Permits, Approvals, Licences Required	Relevant local authority permits/approvals (work on roads)
Competencies / Tickets Required	Construction Induction White Card, WZ1, WZ2, WZ3,

Mandatory PPE Requirements

Other PPE Requirements

Management Approval: SWMS approved for use, from date of issue:	Name:	Position:	Signature:

SAFE WORK METHOD STATEMENT	SWMS-01 Traffic Control	PH: 89 42 2228
Trafficwerx NT	6 Nylander Street Parap, NT 0820	ABN: 10 142 427 889

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LEGISLATIVE REQUIREMENTS				
Consulted: Regulations and Acts, Codes of Practice, Standards, Australian Standards, Industry best practice guides and other required items such as manuals.				
Legislation				
Work Place Health and Safety Act (National Uniform Legislation)	Work Health and Safety Regulations (National Uniform Legislation)	NT Return to Work Act	NT Return to Work Regulations	Managing Noise and Hearing Loss in the Workplace
Managing the Risk of Falls in the Workplace				
Australian Standards				
ISO 14001 Environmental Management Systems	AS/NZS 9001 Quality Management Systems	AS 1742.2 Manual of Uniform Traffic Control Devices – Traffic Control Devices for General Use	AS/NZS 4801 Occupational Health and Safety Management Systems	Prevention of Falls in General Construction
AS-3745 .5:2010 Planning for Emergencies in Facilities	AS/NZS 31000 Risk Management - Principles and Guidelines	AS 1742.3 Manual of Uniform Traffic Control Devices – Traffic Control for Work on Roads	AS/NZS 1336:2014 Eye Protection	AS/NZS 2210.1:2010 Safety Footwear
AS 1742.1 Manual of Uniform Traffic Control Devices – General Introduction and Index of Signs	AS/NZS 4602.1:2011 High Visibility Safety Garments	AS 1742.4 Manual of Uniform Traffic Control Devices – Speed Devices	AS 1742.10 Manual of Uniform Traffic Control Devices – Pedestrian Control and Protection	AS 1742.13 Manual of Uniform Traffic Control Devices – Local Area Traffic Management
Codes of Practice / Other Resources				
WHS Consultation, Co-Operation and Co-Ordination	First Aid in the Workplace	How to Manage Work Health and Safety Risks	Fatigue Management	Hazardous Manual Tasks 2016
NT Road Users Handbook	Managing the Work Environment and Facilities.			

SAFE WORK METHOD STATEMENT	SWMS-01 Traffic Control	PH: 89 42 2228
Trafficwerx NT	6 Nylander Street Parap, NT 0820	ABN: 10 142 427 889

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		Consequences				
		Insignificant	**Minor**	**Moderate**	**Major**	**Catastrophic**
	OHS	Minor incident/first aid	Medical treatment injury/ restricted work duties/general safety breach	LTI less than 5 days minor Injury	Minor Permanent disability/ LTI greater than 5 days	Fatality/Serious permanent disability
	Environmental	Negligible reversible impact, requiring minor remediation	Minor reversible impact, requiring minor remediation	Moderate impact short term effect, moderate remediation	Serious impact with medium term effect, significant remediation	Disastrous environ impact, long term effect, major remediation
	Quality	Less than $25K in damage or cost	$25K - $50K in damage or cost	$50K - $100K in damage or cost	$100K - $150Kin damage or cost	Greater than $150K in damage or cost
LIKELIHOOD	**Almost certain** *Could occur with the failure of defences*	17 High	22 Extreme	23 Extreme	24 Extreme	25 Extreme
	Likely *Could occur with the failure of defences*	15 High	16 High	19 Extreme	20 Extreme	21 Extreme
	Possible *Involve the failure of a hard defence or multi basis defences*	9 Moderate	8 Moderate	13 High	14 High	18 Extreme
	Unlikely Involve *the failure of multiple hard defences*	4 Low	5 Low	7 Moderate	11 High	12 High
	Rare *Involve the unlikely failure of multiple hard defences*	1 Low	2 Low	3 Low	6 Moderate	10 High

LOW	*Acceptable risk, activity may proceed with current controls in place.*	HIGH	*The activity **CANNOT** proceed until additional supervision is required, use of permit systems as required and controls are to be reviewed by senior management prior to proceeding*
MODERATE	*The activity is to be reviewed by senior management prior to proceeding.*	EXTREME	*The activity **MUST NOT** proceed. **Stop** Work Immediately seek senior management assistance*

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Step	Description of Tasks	Potential Hazards	R /B *Risk with No Controls*	Control Measures: Actions to be Taken. **Hierarchy of Controls:** *E= Elimination/ Design Modification, S= Substitution, I= Isolation, Eng= Engineering, A= Administration, PPE= Personal Protective Equipment*	R / A *Risk After Control Measures*	Responsible Person/s
1	**Authorisation of Work**	Unqualified Personnel	19	➢ Licensed traffic controllers (Wz 2 / Wz 3), ➢ Current drivers licence, ➢ Valid construction induction (white card), ➢ Ensure all personnel have signed/ trained in the use of SWMS, ➢ Training to be conducted under the direct supervision of a qualified controller, (approved by DIPL) ➢ Reflective high visibility clothing worn,	3	Supervisor
		Unaware of Project Hazards / Risks	19	➢ Attend all required inductions, meetings identified by the principal contractor for the project, ➢ Identification of required UHF channel to be used ➢ Notify principal contractor of any new risks / incidents, in conjunction with TWNT supervisor	3	TWNT Supervisor Traffic Controllers
		Traffic Management Plan incorrect	19	➢ Site inspection conducted by Wz1 person to ensure correct and current plan developed, ➢ Traffic management plan (TMP) / TGS authorised by WZ1, appraised by DIPL, ➢ Competent / qualified controllers	3	TWNT Supervisor Traffic Controllers
		Incorrect equipment/signage	13	➢ Signage to be placed as per identified on TGS in conjunction with TMP, ➢ Adequate number of signage / bollards, cones, stop/slow bats, other required items onsite for implementation ➢ UHF / Hand held radios in good working order	3	TWNT Supervisor Traffic Controllers
		Traffic vehicle not equipped	13	➢ Traffic vehicle to have: ➢ Fixed or hand-held UHF available, ➢ Flashing light working, ➢ First aid kit – stocked, ➢ Vehicle prestart completed	3	TWNT Supervisor Traffic Controllers
2	**Site Mobilisation**	Traffic Management Plan not endorsed / approved for use	13	➢ Traffic management plan is to be developed by a qualified Wz1 Person, ➢ Plan is to be submitted to the NTG DIPL for appraisal, ➢ NO works is allowed to commence until plan has been appraised	3	TWNT Supervisor Traffic Controllers
		Collison with Traffic Vehicle	19	➢ Traffic vehicle to park a safe distance of roadway, ➢ Ensure that no traffic is coming from both directions prior to exiting vehicle, ➢ Ensure that traffic vehicle flashing light is operational and working	3	TWNT Supervisor Traffic Controllers

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		Incorrect location for traffic area for implementation of TGS	**19**	➢ Area to be identified onsite as per TGS, ➢ Signage to be installed as per TGS identified with correct distances between signs, bollards, and or cones used ➢ Where TGS is incorrect location, devices used – contact is to be made immediately to the supervisor, ➢ TGS to be updated by qualified WZ1 Person prior to further use	**3**	TWNT Supervisor Traffic Controllers
		Slips, Trips and Falls	**13**	➢ Visual inspection of area prior to any walking – works, ➢ Keep work areas clean, ➢ Attend daily onsite prestart inspection	**3**	TWNT Supervisor Traffic Controllers
		Other personnel	**19**	➢ Attend principal contractor prestart meeting – give notification to supervisor where a new risk or change has occurred to TGS / TMP, ➢ All TWNT personnel are required to sign onto the daily prestart, inspection, diary form, ➢ Ensure other personnel on site are made aware of the TMP at daily pre-start meeting ➢ TMP drawing to be displayed on site ➢ Any changes to TMP to be disseminated to others at pre-start meetings and displayed on site	**3**	TWNT Supervisor Traffic Controllers
3	**Emergency**	Inadequate Emergency Preparedness	**19**	➢ Notification of onsite muster point identified at induction, ➢ Emergency equipment locations identified at inductions, ➢ Emergency response to be accordance with the principal contractor plan and TMP	**3**	TWNT Supervisor Traffic Controllers
4	**Set Up Traffic Control**	Traffic Controller struck by traffic whilst marking out – setting up TGS	**19**	➢ DO not run across road, ➢ Ensure visual inspection is conducted on both lanes of traffic prior to any works, ➢ Work in the direction of traffic, ➢ TGS not set up during the rain & minimum 300 m sight distance required during the fog prior to set up TGS. ➢ Traffic controller to call on UHF Channel (Identified at Induction) when passing other vehicles throughout the worksite. ➢ Get acknowledgement from operator that it is safe to pass on site. ➢ Place signs with protection from a shadow vehicle equipped with arrow board and/or rotating amber lights visible. **Sequence of erection & removal of signs as per the AS 1742.3 2009:** ➢ Advance warning & regulatory signs ➢ All intermediate advance warning & regulatory signs & device	**3**	TWNT Supervisor Traffic Controllers

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				➢ Start of the work area ➢ Delineation of the work area or side track ➢ All other warning & regulatory signs, including termination and end of temporary speed zone signs		
		Slips, Trips, Falls – possible into traffic	13	➢ Traffic controllers are required to ensure safety shoes are worn with good grip on the soles. ➢ Keep their eye on the path and check surrounding area, e.g. working at uneven surface of ground, shoulders and/or verge ➢ Check of uneven and slippery ground conditions prior to approach	3	TWNT Supervisor Traffic Controllers
		Incorrect placement / spacing of signage	13	➢ A site inspection must be undertaken before preparing a TGS so localised specific hazards e.g. corners, hills, angle of sun, merging lanes etc are taken into consideration when designing the TGS, ➢ Traffic supervisor is to conduct a daily site inspection immediately after traffic control has been installed and rectify problems found, ➢ The position and provision for parking on the side of roads also needs to be considered when placing signs to ensure parked cars do not obscure signs to oncoming traffic.	3	TWNT Supervisor Traffic Controllers
		Pedestrians	13	➢ Traffic control to be set up as per TGS, ➢ Ensure that only authorised personnel are allowed to enter worksite, ➢ Ensure signs/traffic control devices remain appropriate to traffic conditions e.g. signs visible to all person/s, ➢ TGS to ensure that there is identified separation between works, vehicles and pedestrians	3	TWNT Supervisor Traffic Controllers
		Manual Handling	13	➢ Traffic control devices, signs are to be delivered to the work areas via the approved Traffic Control vehicle, ➢ Traffic controllers are to seek assistance from other workers to lift / carry any difficult signs e.g. oversized, ➢ Ensure that a clear path is taken towards the areas where traffic devices are to be displayed	3	TWNT Supervisor Traffic Controllers
		Traffic devices fall into path of traffic / machines	19	➢ Traffic controllers are to ensure that sign placement – distances is on accordance with the TGS ➢ All temporary signage used is to be secured via weighted sand bags, at least 1 per sign, ➢ Permanent signs should be fixed; if above is not sufficient, ➢ Ensure that signs are set up in a clear of roadway, and are secured to remain in position during wind, rain, or passing traffic,	3	TWNT Supervisor Traffic Controllers

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				➢ Daily checklists are to be completed 3 times a day – daily prior to any works, middle of day and end of day to ensure that all traffic devices are visible and in correct location		
		Signage not visible	19	➢ Signage to be used as per the Australian standards, ➢ Signage to be visible from required traffic direction, clean, and erected as per TGS	3	TWNT Supervisor Traffic Controllers
		Manual Handling Injury	13	➢ Correct body posture, ensure correct lifting technique is used (Straight back and bend knee's) ➢ Two persons lift where required ➢ Avoid twisting	3	TWNT Supervisor Traffic Controllers
		Un-serviceable Equipment	13	➢ Prestart check of all equipment for damage – report damaged equipment to supervisor ➢ Note on daily pre-start for replacement ➢ Check flashing light and reverse alarms are operational on vehicles	3	TWNT Supervisor Traffic Controllers
		Communications	13	➢ Ensure correct UHF channel to be used on this site ➢ Ensure all personal, machinery and vehicles are clear prior to start up ➢ Hand Held UHF's checked – ensure fully charged battery	3	TWNT Supervisor Traffic Controllers
		Working Near Mobile Plant	19	➢ Visual inspection of area, ➢ Inducted to project, ➢ Ensure UHF is working, ➢ Traffic controllers to wear high-vis clothing, ➢ DO NOT exit vehicle in path of any machine, ensure visual checks is conducted both ways prior to exit	3	TWNT Supervisor Traffic Controllers
		Working near crocodile habitat		➢ Visual inspection of area ➢ DO NOT enter waterway without appropriate risk controls ➢ Stay well clear of the waterway where possible or use a spotter where required ➢ Establish a plan and an escape route in the event of a crocodile sighting	3	TWNT Supervisor Traffic Controllers
6	**Night Works**	Inadequate Lighting	19	➢ Lighting is to be provided where traffic control is to be implemented to ensure clear vision to enable reading of signage requirements, ➢ All signs are to be clean and visible	3	TWNT Supervisor Traffic Controllers
		Personnel not visible	19	➢ Traffic controllers are to wear high vis clothing, ➢ Remain of roadway where possible, ➢ Be clearly seen from traffic	3	TWNT Supervisor Traffic Controllers
7		Traffic Controller struck by	19	➢ Ensure adequate protection for workers setting up traffic management	3	TWNT Supervisor

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	Installing Lane Closures	traffic / plant		➢ Positive communications – UHF ➢ Flashing amber beacon ➢ High visibility reflective clothing		Traffic Controllers
		Slips, Trips and Falls	**19**	➢ Competent personnel ➢ Ensure signage is set up as per the TMP ➢ Ensure signs are set up where they do not pose a danger to pedestrians or traffic ➢ Ensure signs are visible to on-coming traffic ➢ Ensure signs are stable – use of sand bags where required	**3**	TWNT Supervisor Traffic Controllers
8	**Controlling Traffic**	Personnel injury	**19**	➢ Ensure Stop/Slow personnel are in correct position ➢ Clear visibility to on-coming traffic ➢ Positive communications - UHF ➢ Competent personnel	**3**	Traffic Controllers
		Collison	**13**	➢ Undertake regular checks to ensure signage/barricading is not damaged or moved ➢ Ensure signs are unobstructed by vegetation etc ➢ Ensure any temporary traffic light systems are operational ➢ Document checks	**3**	Traffic Controllers
		Fatigue	**13**	➢ Ensure adequate breaks are taken ➢ Adequate personnel to cover all breaks in order to maintain TMP requirements	**3**	Traffic Controllers
		Heat/UV Exposure	**13**	➢ Adequate potable water supply ➢ Take regular breaks ➢ Where possible – a shade structure could be installed ➢ Wide/sun brims to hard hats ➢ Sun protection ➢ Sunglasses ➢ Long sleeves/pants	**3**	Traffic Controllers
		Construction traffic	**19**	➢ All construction traffic not in use to be parked out of work zone ➢ Where possible – construction traffic to be moved off the roadways as soon as possible.	**3**	Traffic Controllers

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		Detours	**13**	➢ Ensure signage complies with TMP ➢ Monitor ground conditions of detour regularly and after any rain event ➢ Where required, traffic control vehicle to lead traffic through detours to maintain reduced speed limit	**2**	Traffic Controllers
		Traffic congestion	**13**	➢ Consider stopping construction work to reduce congestion and start traffic flowing ➢ Where possible – schedule works outside heavy traffic times	**2**	Traffic Controllers
9	**TMP / TGS Changes**	Incorrect TGS used	**19**	➢ TMP /TGS changes to be conducted by a qualified Wz1 person, ➢ New changes to be submitted to NTG DIPL for approval ➢ ALL old TMP/ TGS are to be removed from use, ➢ ONLY new TMP / TGS is to be available for use, ➢ Site traffic controller to ensure the traffic devices are implemented correctly	**3**	Site Supervisor Traffic Controllers
10	**Removal of traffic control equipment**	Struck by Traffic / Mobile Plant	**19**	➢ Remove or cover unrequired overnight signage – where works are continuing the next day ➢ Where job is finished – remove signage/cones/barricading from the middle out	**3**	Site Supervisor Traffic Controllers
		Manual Handling	**13**	➢ Use correct manual handling procedures – bend knees, straight back, avoid twisting	**3**	Traffic Controllers
		Traffic Devices falling into traffic path	**19**	➢ All signage is to be secured by sand bags at least one per sign, ➢ Signage to be positioned a safe distance from live traffic, ➢ Daily inspection conducted on signage – 3 times per day, ➢ Any sign fallen down to be re-erected as per the TGS	**3**	Traffic Controllers
		Documentation	**13**	➢ Ensure all documentation pertaining to checks has been completed by relevant person ➢ Ensure the next shift is made aware of any changes to the TMP and that these changes will be implemented and disseminated to workers	**3**	Traffic Controllers
		Working near crocodile habitat		➢ Establish a communication plan and an escape route in the event of a crocodile sighting ➢ Conduct visual inspection of area ➢ DO NOT enter waterway without appropriate risk controls ➢ Stay well clear of the waterway where possible or use a spotter where required	**3**	TWNT Supervisor Traffic Controllers

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Induction / Sign On					
Prior to signing the below, I have had opportunity for input into the development or review of the SWMS. I acknowledge by signing below I am FIT for duty, I have read and understand he steps involved with this SWMS and my obligations that relate to the individual activities that create the SWMS I will comply with this SWMS, Company Policies and Procedures, and ensure those around me comply or I will stop the works immediately.					
Date	**Name**	**I was consulted / had input into the SWMS content**		**Company**	**Signature**
		Yes / No	**Comments**		

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ADDITIONAL HAZARDS / STEPS TO PROCESS IDENTIFIED

Additional Steps / Hazards are to be recorded below in table. Once completed given to TWNT supervisor to update SWMS content.
Where an update has occurred, all personnel **MUST** resign on to acknowledge any changes.

STEP	DESCRIPTION	HAZARDS	CURRENT RISK LEVEL	CONTROL MEASURES	RESIDUAL RISK LEVEL

Information has been redacted due to confidentiality requirements

13.14 APPENDIX N TMP Completion Checklist

This checklist MUST be completed to ensure all required documentation has been included in this TMP before providing for use at the work site.

Document	Yes	N/A
Risk Analysis - **Completed**	✓	
Traffic Guidance Scheme(s) - **Completed**	✓	
Sign and Equipment Manifest - **Completed**	✓	
Certificate of Currency of Public Liability Insurance - **Current**	✓	
Road Authority Application for Permit to Work within the NTG Road Reserve – **Completed**		
Conditions of Approval - **Completed**		
Road Authority Permit/Tracking No. Notification - **Assigned**		
Portable Traffic Signal Authorisation - **Approval**		✓
Temporary Speed Limit Authorisation - **Approval**		
Agency Notification - **Transmitted**		
Public Notification - **Actioned**		✓

Checklist completed by:

Print name	
Signature	
Date	

Appendix I Erosion & Sediment Control Plan

BEETALOO BASIN GROUNDWATER MONITORING BORE INSTALLATION PROJECT

Erosion and Sediment Control Plan

EP76, EP98 and EP117

This document outlines the basic principles for Contractors to develop site specific erosion and sediment control plans for Beetaloo Basin Groundwater Monitoring Bore Installation Project. This ESCP should be read in conjunction with Beetaloo Basin Groundwater Monitoring Bore Installation Project Environmental Management Plan.

Review record

Rev	Date	Reason for issue	Reviewer/s	Consolidator	Approver
A	05/11/2018	Draft ESCP released for comment	A.Court	M.Kernke	M.Hanson
0	22/11/2018	ESCP final	A.Court	M.Kernke/ M.Pollock	M.Hanson

Review due: 05/11/2019

Erosion and Sediment Control Plan

NT-2050-15-MP-0019

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1. Introduction

As part of the development of Origin's Groundwater Monitoring Bore Installation Environmental Management Plan (EMP) the pre-mitigated risk for potential impacts associated with soil and erosion was considered a medium risk.

To mitigate the risk of soil and erosion, this Erosion and Sediment Control Plan (ESCP) has been developed to provide directions for the Contractor in erosion and sediment control during construction of access tracks and groundwater monitoring bore pad. As well as ongoing maintenance and monitoring once sites are established.

The design of the pad will comply with Northern Territory and local government statutory laws and regulations and are to be designed to all relevant and applicable codes and standards. This ESCP has been developed in accordance with the following guidelines:

- *Best Practice Erosion and Sediment Control* (IECA, 2008)
- *Land Clearing Guidelines Technical Report No. 20/2009D* (NRETAS, 2010)
- *Erosion and Sediment Control Guidelines for Rural Development Environment* Fact Sheet (DLRM, 2018).

Origin and its Contractors shall implement this ESCP to minimise the impact of the proposed Groundwater Monitoring Bore Installation program on the external environment.

1.1 Objectives

The objectives of this ESCP are to manage Origin's activities within the Permit Area in a manner that minimises the impacts upon soil, vegetation and surface water which may come about as a result of soil disturbance activities including land clearing and monitoring bore pad establishment. This plan is designed to provide guidance for the onsite construction of infrastructure, relying on onsite personnel to deploy the relevant ESC where appropriate.

The ESCP will aim to:

- Address key soil and water management issues, including legislative and client requirements.
- Determine the "Type" of ESC controls to be implemented during and post construction.
- Wherever practical identify, eliminate and reduce hazards and associated risks inherent in specific work activities, which if untreated would lead to a diminished product or create the potential for an accident, dangerous occurrence or environmental incident.

To avoid significant and/or sustained deterioration in downstream water quality this ESCP may be amended as required, in response to the Monitoring and Maintenance Program described herein. Standard drawings are provided as guide, with the Construction Supervisor making final determination on site.

Strategies shall be developed, implemented and reviewed on a regular basis, to ensure all risks are identified, measured and recorded throughout the course of the project. All ESC devices will be design and installed in accordance with the NT *Land Clearance Guidelines Land Technical Report No. 20/2009D* (NRETAS, 2010).

2. Erosion Susceptibility

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

Erosion will occur in the permit area if the land is used beyond its capacity, as is seen if land is overstocked or vehicle movements not controlled, for example. The location of proposed lease areas have been examined on the ground, to determine the risk of erosion occurring.

Factors considered include the following.

- Soil type – soils with higher clay content are prone to generation of bulldust and are easily eroded by wind and water. Gravelly soils tend to be more robust to disturbance on the scale expected during the water bore

drilling program. The majority of the proposed groundwater monitoring bore sites were non-dispersive soils and had high gravel content.

- Slope – the slope of the site will determine the risk of erosion during rainfall events, with steeply inclined areas a higher risk than small undulations in the landform. All the proposed groundwater bore drilling locations were flat with a slope of <1%. During the program, the crossings of the access track on the small ephemeral streams and Newcastle Creek will require additional controls.
- Aspect – the position of the access track and pads in relation to the direction of the contour should be considered and creation of tracks across (as opposed to parallel with) the contour should be avoided.
- Rainfall – Table 1 and Table 2 present the erosion risk rating based on average monthly rainfall using the rating system provided in the IECA (2008) Table 4.4.2 for Daly Waters (northern sites) and Newcastle Waters (Kyalla 117 W1-2). The construction activities for the groundwater bore drilling is proposed to be completed prior to the onset of the 2018 wet season. As the program pushes out into November and December, the risk of erosion from rainfall considered moderate to high in the northern sites, and low to moderate in the southern sites.

Table 1 Erosion Risk Rating based on average monthly rainfall at Daly Waters

-Item	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall (mm)	165.4	165.4	120.1	23.6	5.0	5.6	1.5	1.7	4.9	22.5	59.4	110
Erosion Risk*	H	H	H	VL	VL	VL	VL	VL	VL	VL	M	H

** E = Extreme (>225 mm); H = High (100+ to 225 mm); M = Moderate (45+ to 100 mm); L = Low (30+ to 45 mm); VL = Very Low (0 to 30 mm)*

Table 2 Erosion Risk Rating based on average monthly rainfall at Newcastle Waters

Item	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall (mm)	125.5	130.9	93.7	24.6	9.3	5.3	3.4	1.0	5.4	20.9	35.7	77.3
Erosion Risk*	H	H	M	VL	VL	VL	VL	VL	VL	VL	L	M

** E = Extreme (>225 mm); H = High (100+ to 225 mm); M = Moderate (45+ to 100 mm); L = Low (30+ to 45 mm); VL = Very Low (0 to 30 mm)*

Based on the sites descriptions and the results from the soil samples, the erosion risk for the proposed lease areas is considered None/Slight erosion risk. This was confirmed during the field survey in August 2018 which reported no evidence of erosion within the proposed lease areas with the exception of a record of very minor evidence of scalds caused by sheet erosion at Velkerri 117 E1-1 which is consistent with natural processes.

It is noted that the proposed groundwater bore drilling programming is of short duration, with the aim to be completed prior to onset of the monsoon season. The construction crew will be responsible for monitoring of the weather, using up to date weather data from the Bureau of Meteorology. This will be critical to ensure activities can be completed and sites stabilised prior to the onset of the monsoon season.

2.1.1 Soil Loss Estimate

IECA 2008 includes a soil loss estimation methodology to determine the type of controls a project should adopt to limit soil loss during construction when soils are exposed to rainfall. Long term average soil loss resulting from sheet and rill flow can be predicted using the Revised Universal Soil Loss Equation (RUSLE).

Soil loss calculated using RUSLE for the project area was calculated as follows:

A = R . K . LS . C . P

Where A = annual soil loss due to erosion [tonnes/hectare/year (t/ha/yr)]

R = rainfall erosivity factor based on 2-year ARI, 6-hour rainfall event of 10.1mm/hr = **2249**)

K = soil erodibility factor of **0.04** for silty, clay loam)

LS = topographic factor derived from slope length and slope gradient (**0.44**)

C = cover and management factor (**1**)

P = erosion control practice factor (**1.3**)

The 2 year 6 hour ARI rainfall intensities were sourced for each set of coordinates in Table 2 and the maximum rainfall intensity of 10.1mm/hr was chosen. The 2-year rainfall intensities varied between 9.41mm/hr to 10.1mm/hr, causing the R-factor to vary between 1990 and 2249.

Based on the RUSLE soil loss methodology, the Project was estimated to have a soil loss of 51 t/ha/yr.

2.1.2 Erosion Risk and Determination of ESC Controls

Erosion risk ratings for the Project area has been determined based on the average monthly erosivity (R-factor of 2627), average monthly rainfall depth (mm) (refer Table 1 and Table 2) and soil loss (estimated at 51t/ha/yr). As indicated in Table 3, the Project has an erosion risk rating of "very low" to "high".

Table 3 Erosion Risk Rating (adapted from IECA, 2008, Tables 4.4.1, 4.4.2 and 4.4.3)

Erosion Risk Rating	R-Factor	Average Monthly Rainfall Depth (mm)	Soil Loss (t/ha/yr)
Very Low	0 to 60	0 to 30	0 to 150
Low	60+ to 100	30+ to 45	150+ to 225
Moderate	100+ to 285	45+ to 100	225+ to 500
High	285+ to 1500	100+ to 225	500+ to 1500
Extreme	>1500	>225	>1500

Table 4, provides an indication of the "Type" of erosion and sediment controls that should be deployed during construction depending on annual soil loss. The Project triggers the use of Type 3 erosion and sediment controls.

Table 4 Sediment Control Standard (adapted from IECA, 2008, Table 4.5.1)

Catchment Area (m^2)	Soil Loss Rate Limit (t/ha/yr)		
	Type 1	Type 2	Type 3
250	N/A	N/A	All Cases
1000	N/A	N/A	All Cases
2500	N/A	>75	75
>2500	>150	150	75

Table 5 provides a range of erosion and sediment controls that can be deployed on the Project for each 'Erosion and Sediment Control Type'.

Table 5 Classifications of Sediment Controls

Type 1	Type 2	Type 3
Sheet Flow		
Buffer Zone Capable of infiltrating 100% of stormwater runoff	Buffer Zone Capable of infiltrating 100% of stormwater runoff Topsoil Berm Filter sock Filter sock drop inlet	Buffer Zone Capable of infiltrating 100% of stormwater runoff Modular sediment trap Topsoil barrier Filter fence Sediment fence
Concentrated Flow		
Sediment basin sized in accordance with design standard	Filter tube dam Rock filter dam Sediment basin smaller than design standard Sediment trench Sediment weir	Coarse sediment trap Modular sediment trap U-shaped sediment trap
Dewatering Sediment Control		
Type F/D Basin	Filter bag or filter tube Filter tube dam Portable sediment tank Settling pond Sump pit	Filter Fence Grass Filter Bed Portable sediment tank Sediment Fence
In-stream sediment control		
Pump sediment laden water to an off-stream Type F/D Basin	Filter bag or filter tube Filter tube dam Portable sediment tank Settling pond Sump pit	Filter Fence Portable sediment tank Sediment filter cage

Standard drawings for erosion and sediment controls are available at:

http://www.austieca.com.au/publications/book-6-standard-drawings.

The proposed ESCP for the groundwater bore well sites are provided in Appendix A. Standard drawings that may be applicable for the Project, including controls for access tracks and stream crossings are provided in Appendix B and Appendix C. The final design of the ESC controls will be dependent on decisions made in the field by the Construction Supervisor.

3. Erosion and Sediment Controls

Error! Reference source not found. summarises the ESCP measures to be considered during the completion of works associated with the construction of access tracks and lease pads.

Activity	Management Controls
Land Clearing	- Selective clearing, using lighter machinery such as graders or smaller bulldozers, taking care not to overwork the site. Overworking the site can lead to the loss of topsoil, compaction, formation and wheel rutting. - Retention of vegetation buffers surrounding streams and creeks, as outlined in the *NTG Land Clearing Guidelines 2010*. - Undertake clearing for each stage in small units over time, keeping the disturbed area small and time of exposure short, in conjunction with progressive re-vegetation. - All reasonable and practicable measures must be taken to minimise the removal of, or disturbance to, trees, shrubs and ground covers (organic or inorganic) that are intended to be retained. - Bulk tree clearing must occur in a manner that minimises disturbance to existing ground cover (organic or inorganic). - Bulk tree clearing and grubbing of the site must be immediately followed by specified temporary stabilisation measures (e.g. gravel, soil berm) prior to commencement of each stage of construction works. - No land clearing shall be undertaken unless preceded by the installation of adequate drainage and sediment control measures, unless such clearing is required for the purpose of installing such measures, in which case, only the minimum clearing required to install such measures shall occur. - Prior to land clearing, areas of protected vegetation, and significant areas of retained vegetation must be clearly identified (e.g. with high-visibility tape, or light fencing) for the purposes of minimising the risk of unnecessary land clearing. - All land clearing must be in accordance with the Federal, Territory and local government vegetation clearing requirements.
Access Track Construction	- Where possible, the use of existing roads and tracks will be utilised to access the groundwater bore lease area, and where new tracks are required, they are to be locate along the most direct and practicable route to groundwater bore lease area. - Minimise track width and surface disturbance (e.g. topsoil, seed and root stock) as far as practicable to allow safe passage of required equipment. - Track formation can reduce or eliminate the need for patch gravelling. Where gravelling is still considered to be warranted, the formation process can remove undesirable material and/or box the imported material where it is required. Track formation will be required for the following reasons: • Drainage control, especially in areas where erosion or sediment influences are evident, any vegetation, topography, wheel rutting or compaction is likely to intercept, concentrate and channel water.

Activity	Management Controls
	• Where the topography of the track location or the drainage characteristics of the soil are likely to hinder access for a protracted time period following rain (e.g. 1 to 2 weeks). • Where natural side-slope pose a safety hazard to potential users of the track (e.g. Contractors, Land Owners) - Place scrub and vegetation cleared from the route adjacent to the route where practical to facilitate its return to the disturbed area. Where this occurs, spread the material out rather than form windrows. - Construct access tracks in a manner best designed to include erosion controls such as table trains and turn-out drains. This may require cross drains discharging into table drains. Cross drains may require rip-rap and/or silt traps. - Due to the flat terrain across the permit area road crowning should be avoided to allow water to naturally cross the road. - Form tracks to allow off-road drainage. Where track intercepts the direction of overland flow and re-directs this flow to a non-natural drainage line, install erosion control works to minimise potential erosion. - The design and position of erosion control measures to be determined in the field by experienced operator and site engineer, based on the site characteristics of the access track location. - Where deemed table drains and cut-out drains to be constructed, they should have a broad flat base at least 1m wide and should not be graded to produce a V. To minimise erosion the slope should be no greater than 0.5% on erodible soils or 1% on stable soils. Refer to Typical Offlet Drain and Table Drain Block for further detail (Appendix B). - Where cut-out drains are required, they should be spaced based on the slope of the area (i.e. 0.5% slope, allow for cut-out draining every 170-180 m or 1 % slope, allow for cut-out drainage every 120-130 m etc) (refer to NT Road Drainage Fact Sheet). It is noted that the recommended distance between turn-out drains is a guide and may not apply to all locations along the access track. - Monitor road conditions to ensure deterioration with possible adverse environmental impacts, does not occur. Assist in the maintenance and repair work on roads and tracks used. - Following completion of activities and within 2 years after the surrender of a lease, the land surrounding or affected by the installation of access tracks shall be restored in accordance with the site-specific rehabilitation plan and final determination of asset (i.e. if transferring asset ownership to landholder).
Pad construction	- Pad construction to be in accordance with the typical erosion and sediment control plan. The Topsoil Berm dimension to be in accordance with the IECA Standard Drawing MB-01 presented in Appendix A. - Surface flows entering the lease from undisturbed areas upslope ('clean' water), and stormwater runoff arising from disturbed areas ('dirty' water) are to be managed by diverting the upslope runoff around the site and unstable slopes to avoid or minimise soil erosion and prevent 'clean water' adding to the volume of 'dirty water' to be managed. It is proposed topsoil berms to be utilised to achieve this.

Activity	Management Controls
	- Prior to the commencement of construction, a site inspection is to be undertaken with Construction Supervisor to determine if topsoil stripping is required. The determination will be based on the assessment of the suitability of the existing grass cover, slope and proposed disturbance. If topsoil stripping is not required than an assessment by the Construction Supervisor can be made to remove the clean water and dirty water topsoil berms. It is not expected core logs would be required for the sites. - Where topsoil stripping is required, the stripping depth would be in accordance with Technical Instruction (NT-2050-15-TI-0001) and amelioration rates agreed with the Construction Supervisor. The expected nominal depth of topsoil is 50 to 150 mm. Final strip depth to be confirmed in the field. - For sites that are heavily treed, the felled trees would be stockpiled nearby for future use in rehabilitation. - Maintenance of erosion and sediment control devices will be required. The following would be undertaken: • Inspection of erosion and sediment control devices to be completed in accordance with Section 5 Maintenance schedule. • The Contractor shall inspect all environmental devices on a regular basis. Any rectification of damage to the environmental control devices or cleaning out of devices is to be carried out by Contractor/Origin as required. • Regular maintenance to be undertaken until sufficient ground cover is established to provide stabilisation to disturbed areas. - Following completion of activities and within 2 years after the surrender of a lease, the land surrounding or affected by the groundwater monitoring bores shall be restored in accordance with the site-specific rehabilitation plan and final determination of asset (i.e. if transferring asset ownership to landholder).
Stream and Creek Crossings	Where a crossing is required to be upgraded, a bed level crossing as detailed in Appendix B, will be installed in accordance with the following: - Crossings will be aligned perpendicular to the water flow. - Crossing is to be constructed from clean rocks (minimal fine material) that are an equivalent or larger size than the natural bed material at the crossing. - The surface is to be left rough and not to be over compacted (e.g. track-rolled finish or rougher). - The lowest point of the bed level crossing must be installed at the level of the lowest point of the natural stream bed (preconstruction), within the footprint of the proposed crossing. - There must be a height difference of at least 100 mm from the lowest point of the crossing to the edges of the low flow section of the crossing. Where scour protection is required: - Scour protection must abut the surface edge of the crossing at the same level (this is to ensure that there is no drop in elevation at the join). - If the crossing is set below bed level then the surface of the scour protection must also be below bed level. - The stream bed must abut the scour protection at the same level (this is to ensure that there is no drop in elevation at the join). - The scour protection is installed at a gradient no steeper than 1 in 20 or the natural channel gradient, whichever is steeper. - Scour protection must incorporate a low flow channel. Use clean rocks (minimal fine material), at least 100 mm diameter.

Activity	Management Controls
	- Ensure the rock armouring is not over compacted but left proud and uneven (track-rolled finish or rougher). - Use clean rocks (minimal fine material), at least 100 mm diameter. - The retention of vegetation buffers, as outlined in the NTG Land Clearing Guidelines – Northern Territory Planning Scheme 2010, as they relate to stream order has been considered for the siting of proposed access tracks and pads.
Soil and Stockpile Management	- All reasonable and practicable measures must be taken to obtain the maximum benefit from existing topsoil and can be reused back on the site for erosion and sediment control and future rehabilitation at completion of project. - Stockpiles of erodible material that has the potential to cause environmental harm if displaced, must be: (i) Appropriately protected from wind, rain, concentrated surface flow and excessive up-slope stormwater surface flows. (ii) Located at least 2m from any hazardous area, retained vegetation, or concentrated drainage line. (iii) Located up-slope of an appropriate sediment control system. (iv) Provided with an appropriate protective cover (synthetic vegetative) if the materials are likely to be stockpiled for more than 28 days. (v) Provided with an appropriate protective cover (synthetic or vegetative) if the materials are likely to be stockpiled for more than 10 days during those months that have a high erosion risk. - A suitable flow diversion system must be established immediately up-slope of a stockpile of erodible material that has the potential to cause environmental harm if displaced, if the up-slope catchment area draining to the stockpile exceeds 1500m^2 - Avoid creating windrows – do not create windrows across creeks, use rollers when putting in tracks in preference to dozers, or walk the dozer with the blade raised off the ground.
Site Management	- Ongoing maintenance and repair work as required on tracks utilised for the program. - No off lease or off-road driving. - The construction schedule must aim to minimise the duration that any and all areas of soil are exposed to the erosive effects of wind, rain and surface water flow. - Land-disturbing activities must be undertaken in such a manner that allows all reasonable and practicable measures to be undertaken to: (i) allow stormwater to pass through the site in a controlled manner and at non-erosive flow velocities. (ii) minimise soil erosion resulting from rain, water flow and/or wind. (iii) minimise adverse effects of sediment runoff, including safety issues. (iv) prevent, or at least minimise, environmental harm resulting from work-related soil erosion and sediment runoff. (v) ensure that the value and use of land/properties adjacent to the site (including access roads) are not diminished as a result of the adopted ESC measures.

Activity	Management Controls
	- Additional and/or alternative ESC measures must be implemented in the event that site inspections, the site's Monitoring and Maintenance Program, or the regulatory authority, identifies that unacceptable offsite sedimentation is occurring as a result of the work activities. - Tracks to be regularly inspected for early signs of compaction, erosion, soil degradation (generation of bulldust) and maintenance implemented. - Sediment (including clay, silt, sand, gravel, soil, mud and cement waste) deposited off the site as a direct result of an on-site activity, must be collected and the area appropriately cleaned/rehabilitated as soon as reasonable and practicable, and in a manner that gives appropriate consideration to the safety and environmental risks associated with the sediment deposition.
Drainage Control	- Wherever reasonable and practicable, stormwater runoff entering the site from external areas, and non-sediment laden (clean) stormwater runoff entering a work area or area of soil disturbance, must be diverted around or through that area in a manner that minimises soil erosion and the contamination of that water for all discharges. - During the construction period, all reasonable and practicable measures must be implemented to control flow velocities in such a manner than prevents soil erosion along drainage paths and at the entrance and exit of all drains and drainage pipes during all storms up to the relevant design storm discharge. - To the maximum degree reasonable and practicable, all waters discharged during the construction must discharge onto stable land, in a non-erosive manner.
Erosion Control	- Synthetic reinforced erosion control mats and blankets (if required) must not be placed within, or adjacent to, riparian zones and watercourses if such materials are likely to cause environmental harm to wildlife or wildlife habitats. - A minimum 60% ground cover must be achieved on all non-completed earthworks exposed to accelerated soil erosion if further construction activities or soil disturbances are likely to be suspended for more than 30 days during those months when the expected rainfall erosivity is less than 60; minimum 70% cover within 30 days if between 60 and 100; minimum 70% cover within 20 days if between 100 and 285; minimum 75% cover within 10 days if between 285 and 1500; and minimum 80% cover within 5 days if greater than 1500.
Sediment Control	- Optimum benefit must be made of every opportunity to trap sediment within the work site, and as close as practicable to its source. - Sediment traps must be installed and operated to both collect and retain sediment. - The potential safety risk of a proposed sediment trap to site workers and the public must be given appropriate consideration, especially those devices located within publicly accessible areas (i.e. in close proximity to Stuart and Carpentaria Highway). - All reasonable and practicable measures must be taken to prevent, or at least minimise, the release of sediment from the site. - Sediment control devices must be de-silted and made fully operational as soon as reasonable and practicable after a sediment-producing event, whether natural or artificial, if the device's sediment retention capacity falls below 75% of its design retention capacity. - Materials, whether liquid or solid, removed from sediment control devices during maintenance or decommissioning, must be disposed of in a manner that does not cause ongoing soil erosion or environmental harm.

Activity	Management Controls
Site Rehabilitation	- Following completion of works, disturbed areas to be restored and/or rehabilitated. - Gravel pits to have topsoil returned and re-profiled. - All compacted areas will be ripped and scarified to promote regeneration of vegetation. - All disturbed areas should be allowed to naturally regenerate or be revegetated on completion of use. - Compacted areas should be contour ripped to 0.5m depth where practicable. - At completion of activities, establish vegetation similar to adjacent vegetation, unless agreement with landowner for alternative use. - All disturbed areas identified as very low, low, medium or high erosion risk must be suitably stabilised prior to anticipated rainfall, from the day that soil disturbances on the area have been finalised. - Stabilise disturbed areas quickly to reduce the potential for erosion. Methods of stabilisation will be site specific. - Previously removed vegetation and topsoil will be uniformly re-spread over disturbed area to assist with rehabilitation process through agencies of increased infiltration and return of seed bearing topsoil. - Windrows of debris that cannot be removed should be aligned down the contour or in a manner appropriate to avoid channelling and concentrating runoff. All other windrows are to be removed as soon as practicable. - The type of ground cover applied to completed earthworks is compatible with the anticipated long-term land use, environmental risk, and site rehabilitation measures.

4. Monitoring

Monitoring for soil erosion and related issues is best undertaken at critical stages, such as:

- During siting of access track and water bore areas – this is when there is greatest opportunity to avoid erosion problems.
- After completion of a specific phase of activity all areas disturbed should be inspected for early signs of compaction, erosion and soil degradation (generation of bulldust).
- When accessing the site after the wet season look for signs of erosion. If significant impacts are identified remediation works may need to be conducted prior to continued vehicular access.

Where rehabilitation of a site is undertaken, rehabilitation monitoring will be undertaken annually to assess the rehabilitation success and determine where additional remedial works are required. Success criteria is defined as:

- Safe for humans and wildlife
- Non-polluting
- Stable, with appropriate vegetation cover and erosion and sediment controls in place and functioning
- Land condition suitable for existing pastoral land use.

Photographic records will be maintained over the duration of the activities for documenting soil disturbance.

All environmentally relevant incidents are to be recorded in a field log that must remain accessible to all relevant regulatory authorities.

5. Maintenance

All temporary erosion and sediment control measures, including drainage control measures, must be fully operational and maintained in proper working order at all times during the duration of the project.

When undertaking construction work, erosion and sediment control measures must be inspected:

- at least daily (when work is occurring on-site)
- within 24 hours of expected rainfall (when working onsite)
- within 18 hours (or as soon as practicable) of a rainfall event of sufficient intensity and duration to cause runoff on-site or greater than 20mm in 24 hours.

Sediment removed from sediment traps and places of sediment deposition must be disposed of in a lawful manner that does not cause ongoing soil erosion or environmental harm.

Prior to the completion of activities on the ground, the construction areas will be stabilised to the satisfaction of the Construction Supervisor. Regular inspections would occur throughout the year until the land is handed back.

6. References

Catchment and Creeks Pty Ltd. 2012. *Erosion & Sediment Control – A Field Guide for Construction Site Managers V5.* Catchment and Creeks. Brisbane. QLD.

Department of Natural Resources, Environment, The Arts and Sport (NRETAS) 2010. *Land Clearing Guidelines*. Northern Territory Government.

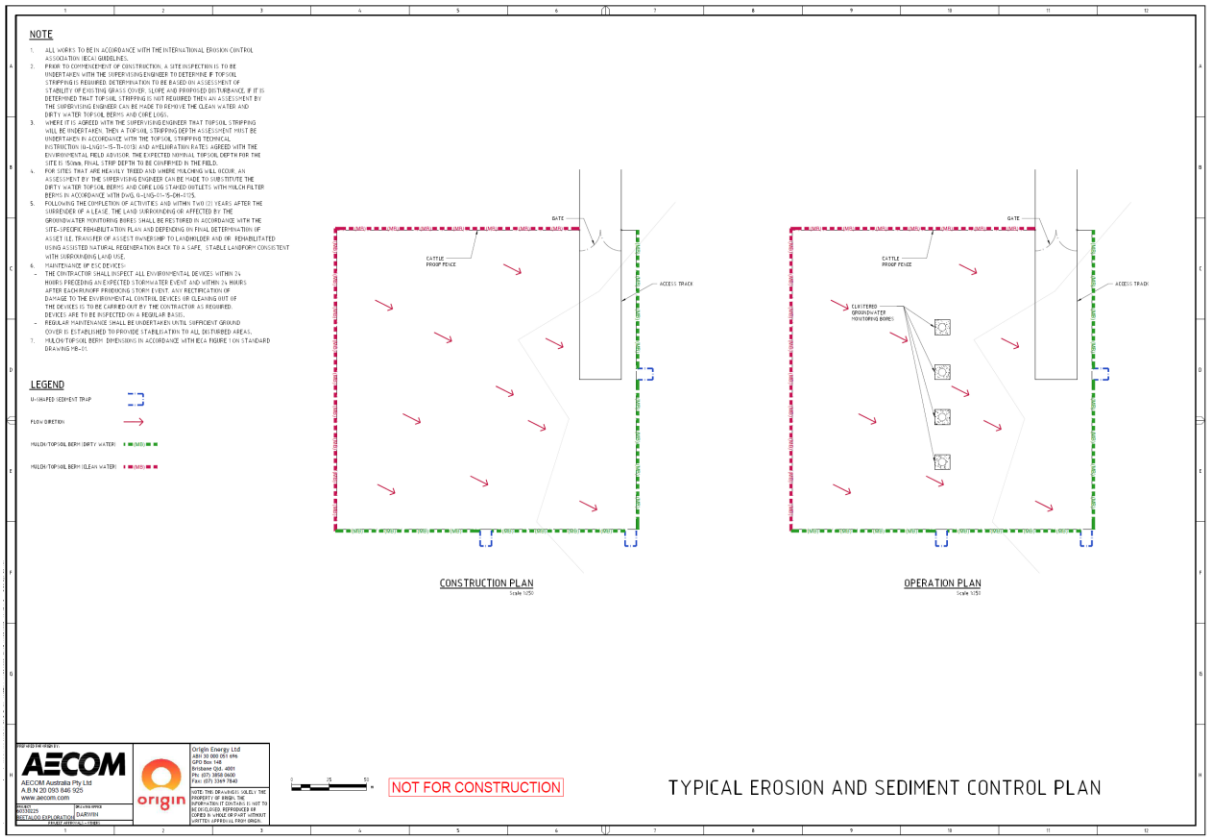
Department of Agriculture, Fisheries and Forestry. 2013. *Code for Self-Assessable Development Minor Waterway Barrier Works Part 4: Bed Level Crossings Code Number WWBW01 April 2013*. State of Queensland, Qld.

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

Origin Energy Resources Limited. 2018. *Draft Beetaloo Basin Groundwater Monitoring Bore Installation Program Environmental Management Plan*.

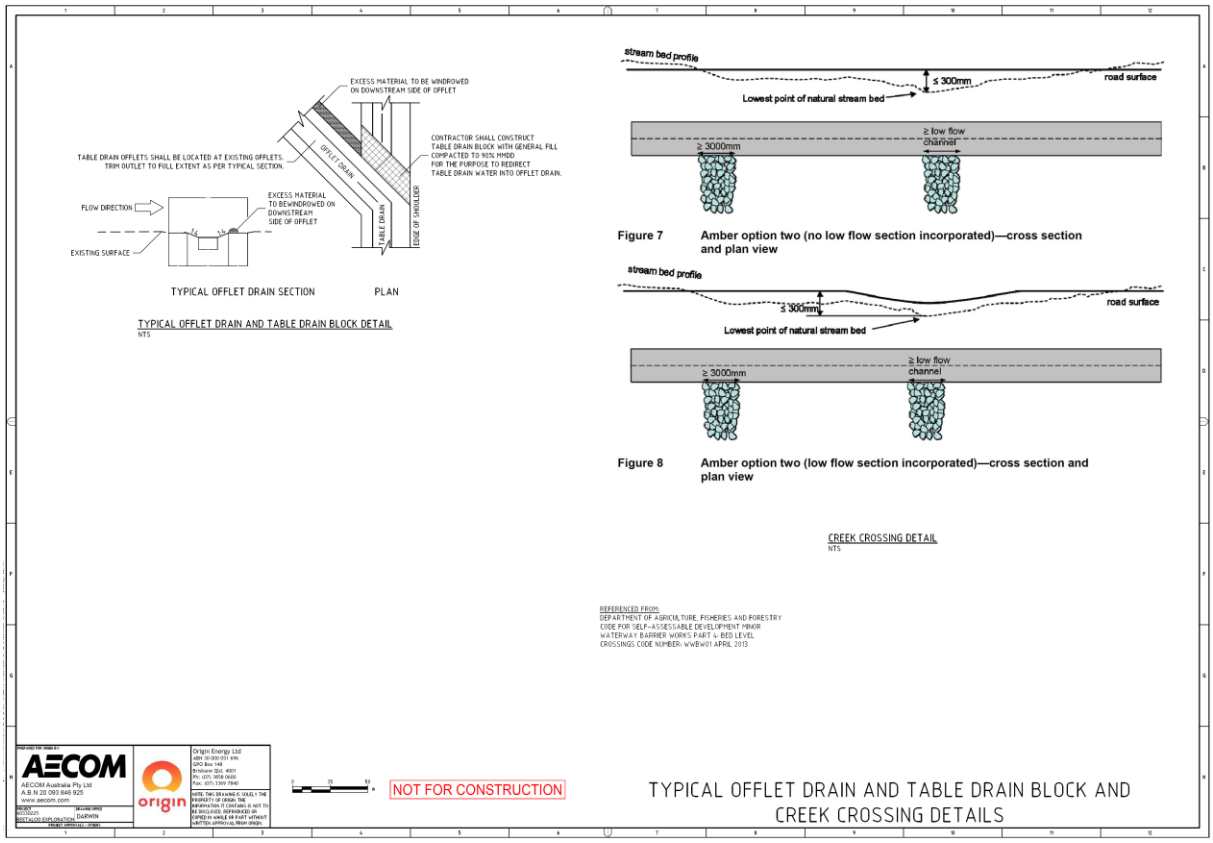
Scientific Inquiry into Hydraulic Fracturing in the Northern Territory. 2018. *Scientific Inquiry into Hydraulic Fracturing in the Northern Territory – Final Report.*

Appendix A Erosion and Sediment Control Plan for Groundwater Bore Site



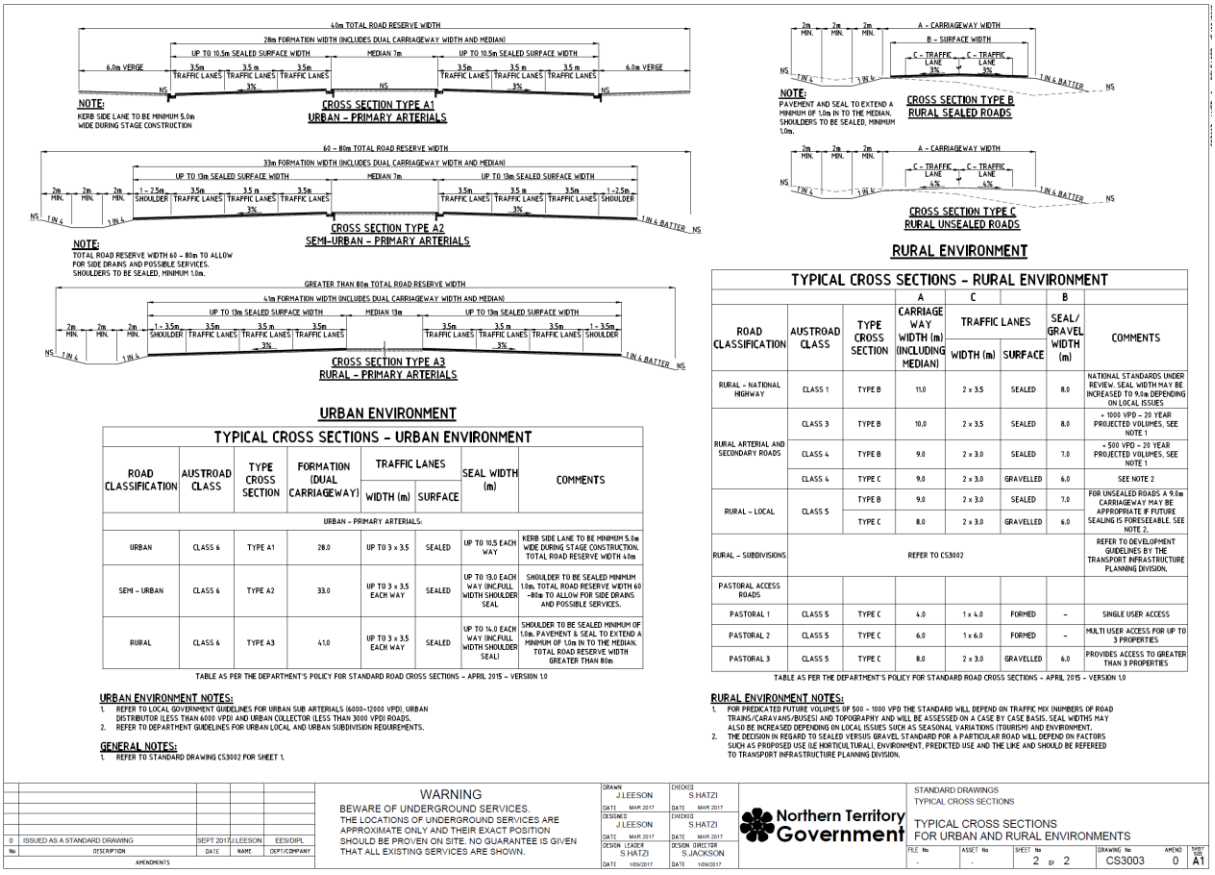
Review due: 05/11/2019

Appendix B Standard Cross Section for Access Tracks



Appendix C Other Standard Specifications that may be applicable to Project

Typical Cross Section for Road Classification – Pastoral 3



URBAN ENVIRONMENT

TYPICAL CROSS SECTIONS – URBAN ENVIRONMENT

ROAD CLASSIFICATION	AUSTROAD CLASS	TYPE CROSS SECTION	FORMATION (DUAL CARRIAGEWAY)	TRAFFIC LANES		SEAL WIDTH (m)	COMMENTS
				WIDTH (m)	SURFACE		
URBAN – PRIMARY ARTERIALS:							
URBAN	CLASS 6	TYPE A1	28.0	UP TO 3 x 3.5	SEALED	UP TO 10.5 EACH WAY	KERB SIDE LANE TO BE MINIMUM 5.0m WIDE DURING STAGE CONSTRUCTION. TOTAL ROAD RESERVE WIDTH 4.0m
SEMI – URBAN	CLASS 6	TYPE A2	33.0	UP TO 3 x 3.5 EACH WAY	SEALED	UP TO 13.0 EACH WAY (INCFULL WIDTH SHOULDER SEAL	SHOULDER TO BE SEALED MINIMUM 1.0m. TOTAL ROAD RESERVE WIDTH 60 –80m TO ALLOW FOR SIDE DRAINS AND POSSIBLE SERVICES.
RURAL	CLASS 6	TYPE A3	41.0	UP TO 3 x 3.5 EACH WAY	SEALED	UP TO 14.0 EACH WAY (INCFULL WIDTH SHOULDER SEAL)	SHOULDER TO BE SEALED MINIMUM OF 1.0m. PAVEMENT & SEAL TO EXTEND A MINIMUM OF 1.0m IN TO THE MEDIAN. TOTAL ROAD RESERVE WIDTH GREATER THAN 80m

TABLE AS PER THE DEPARTMENT'S POLICY FOR STANDARD ROAD CROSS SECTIONS – APRIL 2015 – VERSION 1.0

URBAN ENVIRONMENT NOTES:
1. REFER TO LOCAL GOVERNMENT GUIDELINES FOR URBAN SUB ARTERIALS (6000–12000 VPD), URBAN DISTRIBUTOR (LESS THAN 6000 VPD) AND URBAN COLLECTOR (LESS THAN 3000 VPD) ROADS.
2. REFER TO DEPARTMENT GUIDELINES FOR URBAN LOCAL AND URBAN SUBDIVISION REQUIREMENTS.

GENERAL NOTES:
1. REFER TO STANDARD DRAWING CS3002 FOR SHEET 1.

RURAL ENVIRONMENT

TYPICAL CROSS SECTIONS – RURAL ENVIRONMENT

ROAD CLASSIFICATION	AUSTROAD CLASS	TYPE CROSS SECTION	A CARRIAGE WAY WIDTH (m) (INCLUDING MEDIAN)	C TRAFFIC LANES		B SEAL/ GRAVEL WIDTH (m)	COMMENTS
				WIDTH (m)	SURFACE		
RURAL – NATIONAL HIGHWAY	CLASS 1	TYPE B	11.0	2 x 3.5	SEALED	8.0	NATIONAL STANDARDS UNDER REVIEW. SEAL WIDTH MAY BE INCREASED TO 9.0m DEPENDING ON LOCAL ISSUES
RURAL ARTERIAL AND SECONDARY ROADS	CLASS 3	TYPE B	10.0	2 x 3.5	SEALED	8.0	> 1000 VPD – 20 YEAR PROJECTED VOLUMES, SEE NOTE 1
	CLASS 4	TYPE B	9.0	2 x 3.0	SEALED	7.0	> 500 VPD – 20 YEAR PROJECTED VOLUMES, SEE NOTE 1
	CLASS 4	TYPE C	9.0	2 x 3.0	GRAVELLED	6.0	SEE NOTE 2
RURAL – LOCAL	CLASS 5	TYPE B	9.0	2 x 3.0	SEALED	7.0	FOR UNSEALED ROADS A 9.0m CARRIAGEWAY MAY BE APPROPRIATE IF FUTURE SEALING IS FORESEEABLE. SEE NOTE 2.
		TYPE C	8.0	2 x 3.0	GRAVELLED	6.0	
RURAL – SUBDIVISIONS	REFER TO CS3002						REFER TO DEVELOPMENT GUIDELINES BY THE TRANSPORT INFRASTRUCTURE PLANNING DIVISION.
PASTORAL ACCESS ROADS							
PASTORAL 1	CLASS 5	TYPE C	4.0	1 x 4.0	FORMED	–	SINGLE USER ACCESS
PASTORAL 2	CLASS 5	TYPE C	6.0	1 x 6.0	FORMED	–	MULTI USER ACCESS FOR UP TO 3 PROPERTIES
PASTORAL 3	CLASS 5	TYPE C	8.0	2 x 3.0	GRAVELLED	6.0	PROVIDES ACCESS TO GREATER THAN 3 PROPERTIES

TABLE AS PER THE DEPARTMENT'S POLICY FOR STANDARD ROAD CROSS SECTIONS – APRIL 2015 – VERSION 1.0

RURAL ENVIRONMENT NOTES:
1. FOR PREDICATED FUTURE VOLUMES OF 500 – 1000 VPD THE STANDARD WILL DEPEND ON TRAFFIC MIX (NUMBERS OF ROAD TRAINS/CARAVANS/BUSES) AND TOPOGRAPHY AND WILL BE ASSESSED ON A CASE BY CASE BASIS. SEAL WIDTHS MAY ALSO BE INCREASED DEPENDING ON LOCAL ISSUES SUCH AS SEASONAL VARIATIONS (TOURISM) AND ENVIRONMENT.
2. THE DECISION IN REGARD TO SEALED VERSUS GRAVEL STANDARD FOR A PARTICULAR ROAD WILL DEPEND ON FACTORS SUCH AS PROPOSED USE (IE HORTICULTURAL), ENVIRONMENT, PREDICTED USE AND THE LIKE AND SHOULD BE REFEREED TO TRANSPORT INFRASTRUCTURE PLANNING DIVISION.

No	DESCRIPTION	DATE	NAME	DEPT./COMPANY
0	ISSUED AS A STANDARD DRAWING	SEPT 2017	J.LEESON	EES/DIPL

AMENDMENTS

WARNING
BEWARE OF UNDERGROUND SERVICES.
THE LOCATIONS OF UNDERGROUND SERVICES ARE APPROXIMATE ONLY AND THEIR EXACT POSITION SHOULD BE PROVEN ON SITE. NO GUARANTEE IS GIVEN THAT ALL EXISTING SERVICES ARE SHOWN.

DRAWN	CHECKED
J.LEESON	S.HATZI
DATE MAR 2017	DATE MAR 2017
DESIGNED	CHECKED
J.LEESON	S.HATZI
DATE MAR 2017	DATE MAR 2017
DESIGN LEADER	DESIGN DIRECTOR
S.HATZI	S.JACKSON
DATE 10/9/2017	DATE 10/9/2017

Northern Territory Government

STANDARD DRAWINGS
TYPICAL CROSS SECTIONS
TYPICAL CROSS SECTIONS FOR URBAN AND RURAL ENVIRONMENTS

FILE No	ASSET No	SHEET No	DRAWING No	AMEND	SHEET SIZE
-	-	2 OF 2	CS3003	0	A1

Review due: 05/11/2019

MATERIALS

(i) MULCH MUST COMPLY WITH THE REQUIREMENTS OF AS4454.

(ii) MAXIMUM SOLUBLE SALT CONCENTRATION OF 5dS/m.

(iii) MOISTURE CONTENT OF 30 TO 50% PRIOR TO APPLICATION.

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION AND EXTENT. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, MATERIAL TYPE, OR METHOD OF INSTALLATION CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. WHEN SELECTING THE LOCATION OF A MULCH FILTER BERM, TO THE MAXIMUM DEGREE PRACTICAL, ENSURE THE BERM IS LOCATED:

(i) TOTALLY WITHIN THE PROPERTY BOUNDARIES;

(ii) ALONG A LINE OF CONSTANT ELEVATION (PREFERRED, BUT NOT ALWAYS PRACTICAL);

(iii) AT LEAST 1m, IDEALLY 3m, FROM THE TOE OF A FILL EMBANKMENT;

(iv) AWAY FROM AREAS OF CONCENTRATED FLOW.

3. ENSURE THE BERM IS INSTALLED IN A MANNER THAT AVOIDS THE CONCENTRATION OF FLOW ALONG THE BERM, OR THE UNDESIRABLE DISCHARGE OF WATER AROUND THE END OF THE BERM.

4. ENSURE THE BERM HAS BEEN PLACED SUCH THAT PONDING UP-SLOPE OF THE BERM IS MAXIMISED.

5. ENSURE BOTH ENDS OF THE BERM ARE ADEQUATELY TURNED UP THE SLOPE TO PREVENT FLOW BYPASSING PRIOR TO WATER PASSING OVER THE BERM.

6. ENSURE 100% CONTACT WITH THE SOIL SURFACE.

7. WHERE SPECIFIED, TAKE APPROPRIATE STEPS TO VEGETATE THE BERM.

MAINTENANCE

1. DURING THE CONSTRUCTION PERIOD, INSPECT ALL BERMS AT LEAST WEEKLY AND AFTER ANY SIGNIFICANT RAIN. MAKE NECESSARY REPAIRS IMMEDIATELY.

2. REPAIR OR REPLACE ANY DAMAGED SECTIONS.

3. WHEN MAKING REPAIRS, ALWAYS RESTORE THE SYSTEM TO ITS ORIGINAL CONFIGURATION UNLESS AN AMENDED LAYOUT IS REQUIRED OR SPECIFIED.

4. REMOVE ACCUMULATED SEDIMENT IF THE SEDIMENT DEPOSIT EXCEEDS A DEPTH OF 100mm OR 1/3 THE HEIGHT OF THE BERM.

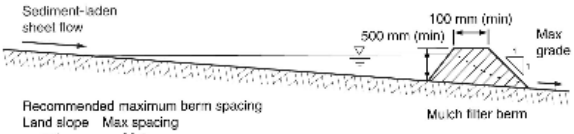
5. DISPOSE OF SEDIMENT IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

REMOVAL (IF REQUIRED)

1. WHEN DISTURBED AREAS UP-SLOPE OF THE BERM ARE SUFFICIENTLY STABILISED TO RESTRAIN EROSION, THE BERM MAYBE REMOVED.

2. REMOVE ANY COLLECTED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

3. REHABILITATE/REVEGETATE THE DISTURBED GROUND AS NECESSARY TO MINIMISE THE EROSION HAZARD.



Recommended maximum berm spacing

Land slope	Max spacing
< 2%	30 m
5%	25 m
10%	15 m
20%	8 m

Figure 1 - Typical placement of mulch filter berm

Drawn	Date		
GMW	Apr-10	Mulch Filter Berms	MB-01

MATERIALS

ROCK: HARD, ANGULAR, DURABLE, WEATHER RESISTANT AND EVENLY GRADED WITH 50% BY WEIGHT LARGER THAN THE SPECIFIED NOMINAL ROCK SIZE AND SUFFICIENT SMALL ROCK TO FILL THE VOIDS BETWEEN THE LARGER ROCK. THE DIAMETER OF THE LARGEST ROCK SIZE SHOULD BE NO LARGER THAN 1.5 TIMES THE NOMINAL ROCK SIZE. SPECIFIC GRAVITY TO BE AT LEAST 2.5.

GEOTEXTILE FABRIC: HEAVY-DUTY, NEEDLE-PUNCHED, NON-WOVEN FILTER CLOTH, MINIMUM BIDIM A24 OR EQUIVALENT.

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION, EXTENT AND INSTALLATION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, OR METHOD OF INSTALLATION CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. CLEAR THE PROPOSED CHANNEL AREA OF TREES, STUMPS, ROOTS, LOOSE ROCK, AND OTHER OBJECTIONABLE MATERIALS.

3. EXCAVATE THE CHANNEL TO THE LINES AND GRADES AS SHOWN ON THE PLANS. OVER-CUT THE CHANNEL TO A DEPTH EQUAL TO THE SPECIFIED DEPTH OF ROCK PLACEMENT SUCH THAT THE FINISHED ROCK SURFACE WILL BE AT THE ELEVATION OF THE SURROUNDING LAND.

4. ROCK MUST BE PLACED WITHIN THE CHANNEL AS SPECIFIED WITHIN THE APPROVED PLANS, INCLUDING THE PLACEMENT OF ANY SPECIFIED FILTER LAYER.

5. IF DETAILS ARE NOT PROVIDED ON THE ROCK PLACEMENT, THEN THE PRIMARY ARMOUR ROCK MUST BE EITHER PLACED ON:

(i) A FILTER BED FORMED FROM A LAYER OF SPECIFIED SMALLER ROCK (ROCK FILTER LAYER).

(ii) AN EARTH BED LINED WITH FILTER CLOTH;

(iii) AN EARTH BED NOT LINED IN FILTER CLOTH, BUT ONLY IF ALL VOIDS BETWEEN THE ARMOUR ROCK ARE TO BE FILLED WITH SOIL AND POCKET PLANTED IMMEDIATELY AFTER PLACEMENT OF THE ROCK.

6. IF A ROCK/AGGREGATE FILTER LAYER IS SPECIFIED, THEN PLACE THE FILTER LAYER IMMEDIATELY AFTER THE FOUNDATIONS ARE PREPARED. SPREAD THE FILTER ROCK IN A UNIFORM LAYER TO THE SPECIFIED DEPTH BUT A MINIMUM OF 150mm. WHERE MORE THAN ONE LAYER OF FILTER MATERIAL HAS BEEN SPECIFIED, SPREAD EACH LAYER SUCH THAT MINIMAL MIXING OCCURS BETWEEN EACH LAYER OF ROCK.

7. IF A GEOTEXTILE (FILTER CLOTH) UNDERLAY IS SPECIFIED, PLACE THE FABRIC DIRECTLY ON THE PREPARED FOUNDATION. IF MORE THAN ONE SHEET OF FABRIC IS REQUIRED TO OVER THE AREA, OVERLAP THE EDGE OF EACH SHEET AT LEAST 300mm AND PLACE ANCHOR PINS AT MINIMUM 1m SPACING ALONG THE OVERLAP.

8. ENSURE THE GEOTEXTILE FABRIC IS PROTECTED FROM PUNCHING OR TEARING DURING INSTALLATION OF THE FABRIC AND THE ROCK. REPAIR ANY DAMAGE BY REMOVING THE ROCK AND PLACING WITH ANOTHER PIECE OF FILTER CLOTH OVER THE DAMAGED AREA OVERLAPPING THE EXISTING FABRIC A MINIMUM OF 300mm.

9. WHERE NECESSARY, A MINIMUM 100mm LAYER OF FINE GRAVEL, AGGREGATE OR SAND SHOULD BE PLACED OVER THE FABRIC TO PROTECT IT FROM DAMAGE.

10. PLACEMENT OF ROCK SHOULD FOLLOW IMMEDIATELY AFTER PLACEMENT OF THE FILTER LAYER. PLACE ROCK SO THAT IT FORMS A DENSE, WELL GRADED MASS OF ROCK WITH A MINIMUM OF VOIDS.

11. PLACE ROCK TO ITS FULL THICKNESS IN ONE OPERATION. DO NOT PLACE ROCK BY DUMPING THROUGH CHUTES OR OTHER METHODS THAT CAUSE SEGREGATION OF ROCK SIZES.

12. THE FINISHED SURFACE SHOULD BE FREE OF POCKETS OF SMALL ROCK OR CLUSTERS OF LARGE ROCKS. HAND PLACING MAY BE NECESSARY TO ACHIEVE THE PROPER DISTRIBUTION OF ROCK SIZES TO PRODUCE A RELATIVELY SMOOTH, UNIFORM SURFACE. THE FINISHED GRADE OF THE ROCK SHOULD BLEND WITH THE SURROUNDING AREA. NO OVERFALL OR PROTRUSION OF ROCK SHOULD BE APPARENT.

13. IMMEDIATELY UPON COMPLETION OF THE CHANNEL, VEGETATE ALL DISTURBED AREAS OR OTHERWISE PROTECT THEM AGAINST SOIL EROSION.

14. WHERE SPECIFIED, FILL ALL VOIDS WITH SOIL AND VEGETATE THE ROCK SURFACE IN ACCORDANCE WITH THE APPROVED PLAN.

MAINTENANCE

1. ROCK-LINED CHANNELS SHOULD BE INSPECTED PERIODICALLY AND AFTER SIGNIFICANT STORM EVENTS. CHECK FOR SCOUR OR DISLODGED ROCK. REPAIR DAMAGED AREAS IMMEDIATELY.

2. CLOSELY INSPECT THE OUTER EDGES OF THE ROCK PROTECTION. ENSURE WATER ENTRY INTO THE CHANNEL OR CHUTE IS NOT CAUSING EROSION ALONG THE EDGE OF THE ROCK PROTECTION.

3. CAREFULLY CHECK THE STABILITY OF THE ROCK LOOKING FOR INDICATIONS OF PIPING, SCOUR HOLES, OR BANK FAILURES.

4. REPLACE ANY DISPLACED ROCK WITH ROCK OF A SIGNIFICANTLY (MINIMUM 110%) LARGER SIZE THAN THE DISPLACED ROCK.

Drawn	Date		
GMW	May-10	Rock Linings	RR-02

APPLICATION

1. REFER TO APPROVED PLANS FOR LOCATION, EXTENT, AND APPLICATION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, OR METHOD OF APPLICATION CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. FILL OR SUITABLY CONTOUR ANY EXISTING RUTTING, RILLING OR GULLIES.

3. SUITABLY DIVERT UP-SLOPE STORMWATER RUNOFF AROUND TREATED AREA AS DIRECTED WITHIN THE APPROVED PLANS, OR OTHERWISE AS DIRECTED BY THE SITE ENGINEER.

4. APPLY TREATMENT TO THE AREA TO THE DEPTH AND FREQUENCY (SPACING) SPECIFIED ON THE APPROVED PLANS, OR OTHERWISE AS DIRECTED BY THE SITE ENGINEER.

5. IMMEDIATELY SEED AND MULCH ROUGHENED AREAS TO OPTIMISE SEED GERMINATION AND GROWING CONDITIONS.

MAINTENANCE

1. DURING THE CONSTRUCTION PERIOD, INSPECT THE TREATED AREA PRIOR TO FORECAST RAINFALL, DAILY DURING EXTENDED PERIODS OF RAINFALL, AFTER SIGNIFICANT RUNOFF PRODUCING RAINFALL, OR OTHERWISE ON A WEEKLY BASIS.

2. FILL EROSION RILLS SLIGHTLY ABOVE THE ORIGINAL GRADE, OR REGRADE THE SLOPE AS DIRECTED TO REMOVE THE RILLS.

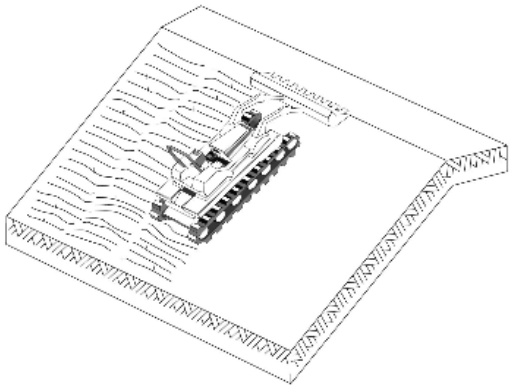


Figure 1 - Application of surface roughening on slope

Drawn	Date		
GMW	Dec-09	Surface Roughening	SR-01

Review due: 05/11/2019

Appendix J Origin Beetaloo Basin Project Poster series

2019 Work Program

This year's work program consists of two exploration wells to evaluate liquids rich gas potential.

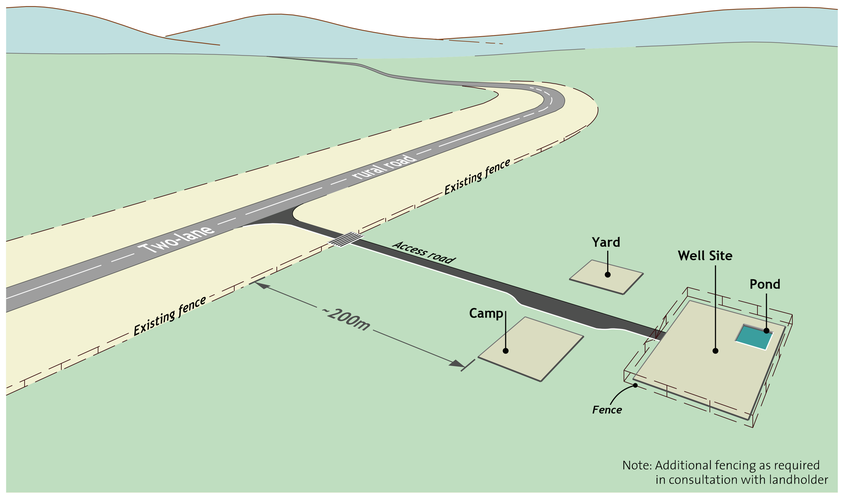
EP 76 Drill and fracture stimulate the Velkerri 76 well

EP 117 Drill and fracture stimulate the Kyalla 117 well

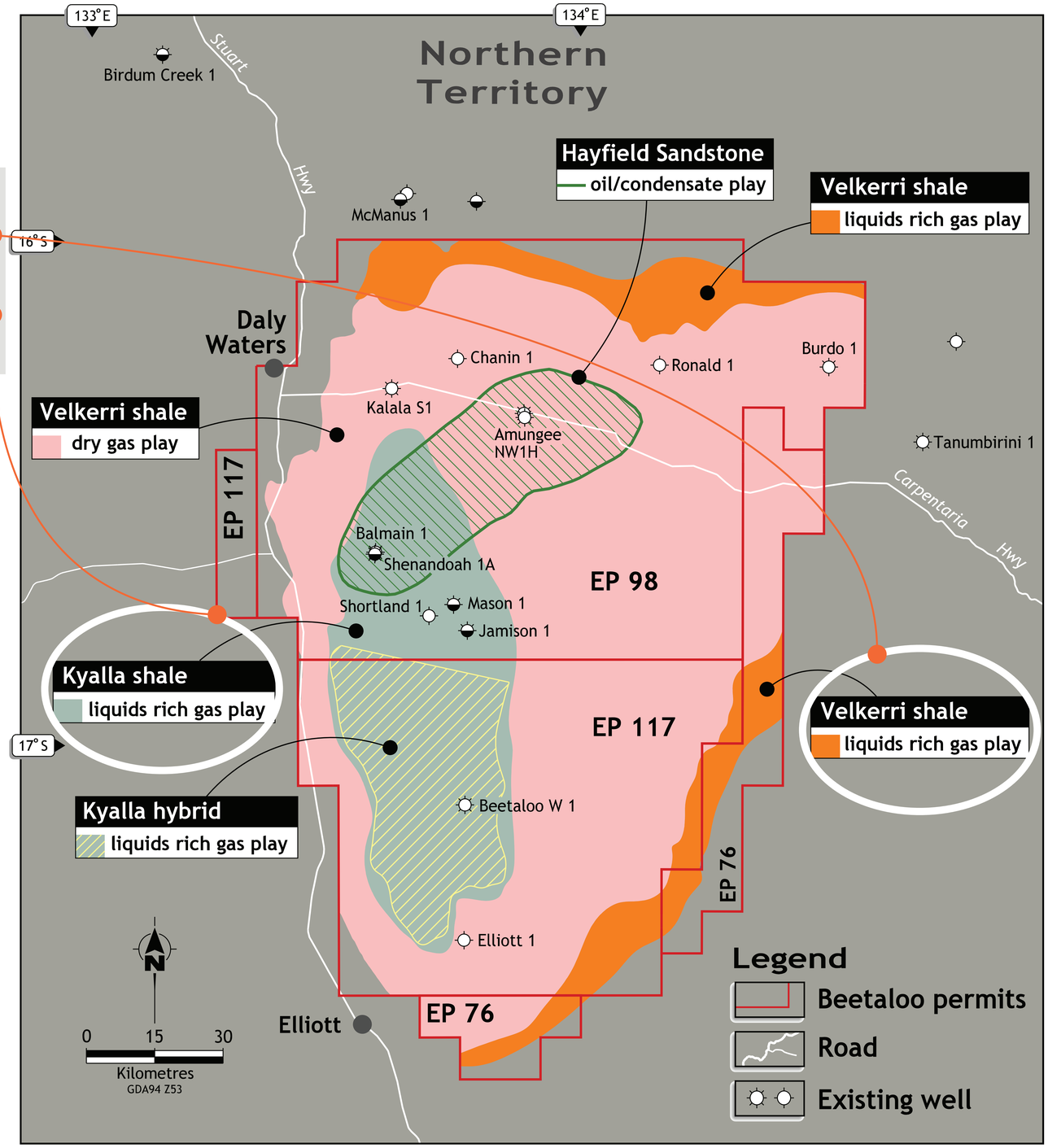
Native Title Holders and custodians together with the Northern Land Council (NLC) completed sacred site clearance and avoidance surveys for this work in September 2018.

Geological studies will continue in other exploration permit areas.

Drilling surface location layout



Note: Additional fencing as required in consultation with landholder



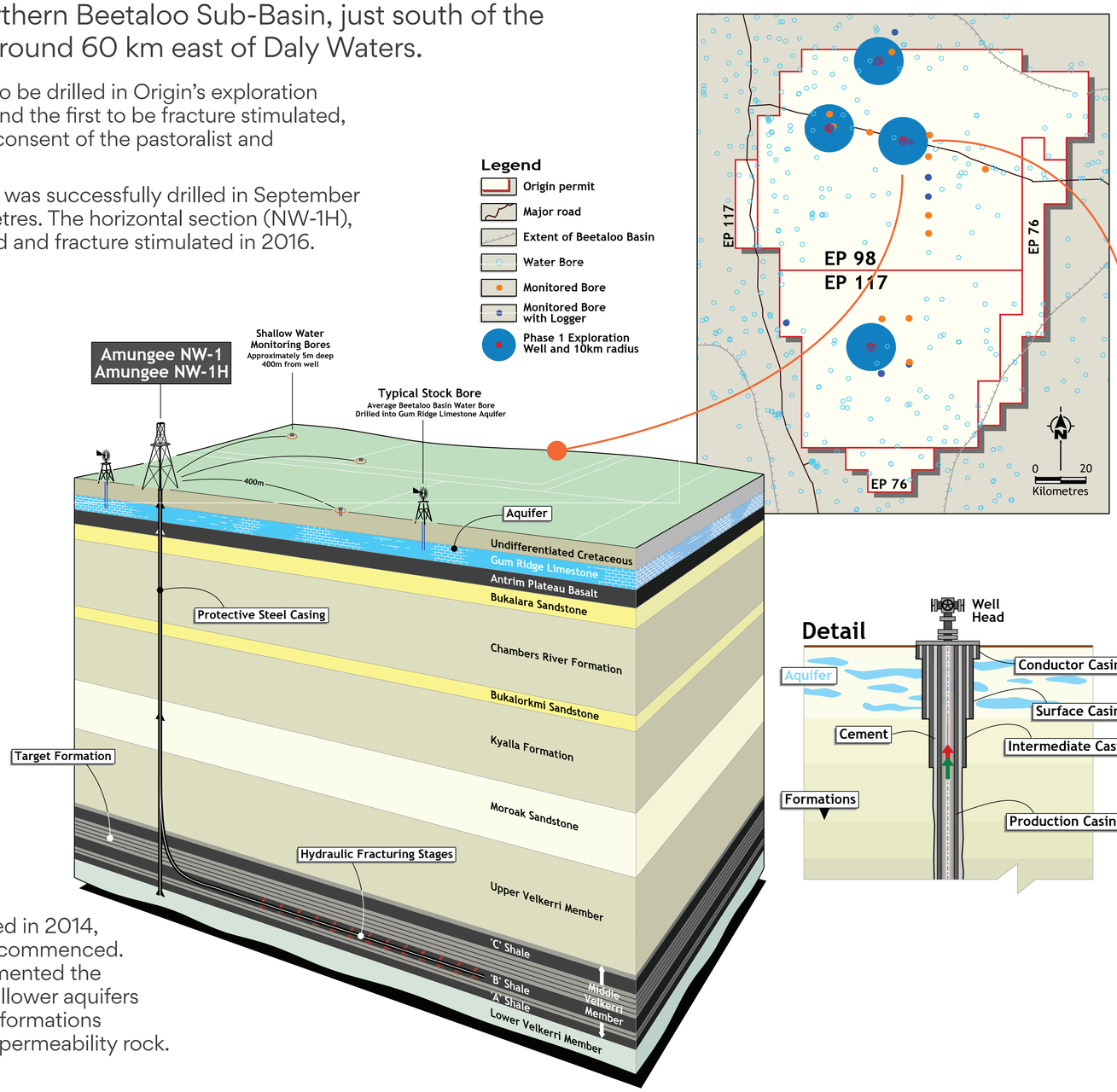
Amungee NW-1 & NW-1H
(Drilling & Environmental Controls)

The Amungee NW-1 / NW-1H well is in the in centre of Exploration Permit 98 (EP98) in the northern Beetaloo Sub-Basin, just south of the Carpentaria Highway and around 60 km east of Daly Waters.

Amungee is the first horizontal well to be drilled in Origin's exploration program in the Beetaloo sub-basin and the first to be fracture stimulated, within existing regulations and with consent of the pastoralist and Traditional Owners.

The vertical stage of the well (NW-1) was successfully drilled in September 2015 to a depth of around 2,600 metres. The horizontal section (NW-1H), around 1,100 metres long, was drilled and fracture stimulated in 2016.

Subsequent production testing over a 57-day period confirmed the wells ability to flow gas, returning an average of 1.1 million cubic feet of gas per day.



Groundwater monitoring

Groundwater monitoring is a regulatory requirement that allows us to detect any potential groundwater impacts that may occur from exploration activities. It also improves our understanding of the natural variability of water volumes and quality, and broader hydrogeological system in the Beetaloo sub-Basin.

Groundwater monitoring commenced in 2014, before current exploration activities commenced. A formal monitoring plan was implemented the following year - focussing on the shallower aquifers which are separated from the target formations containing gas by over 1.5km of low permeability rock.

This monitoring has found there no evidence of any impact from current exploration activities.

- Groundwater levels have remained stable in the shallower Cretaceous and Cambrian Limestone aquifers;
- The Cenozoic perched aquifer closest to surface responds strongly to rainfall, but water levels recede quickly suggesting a limited storage volume;
- Little or no hydrocarbons have been detected in bore sampling. Only one location found dissolved methane in trace concentrations
- All water sampled is suitable for stock use

Beetaloo Basin Gas

Our exploration program is evaluating both dry gas and liquids rich wet gas in the Velkerri and shallower Kyalla shale formations. Each play has different characteristics.

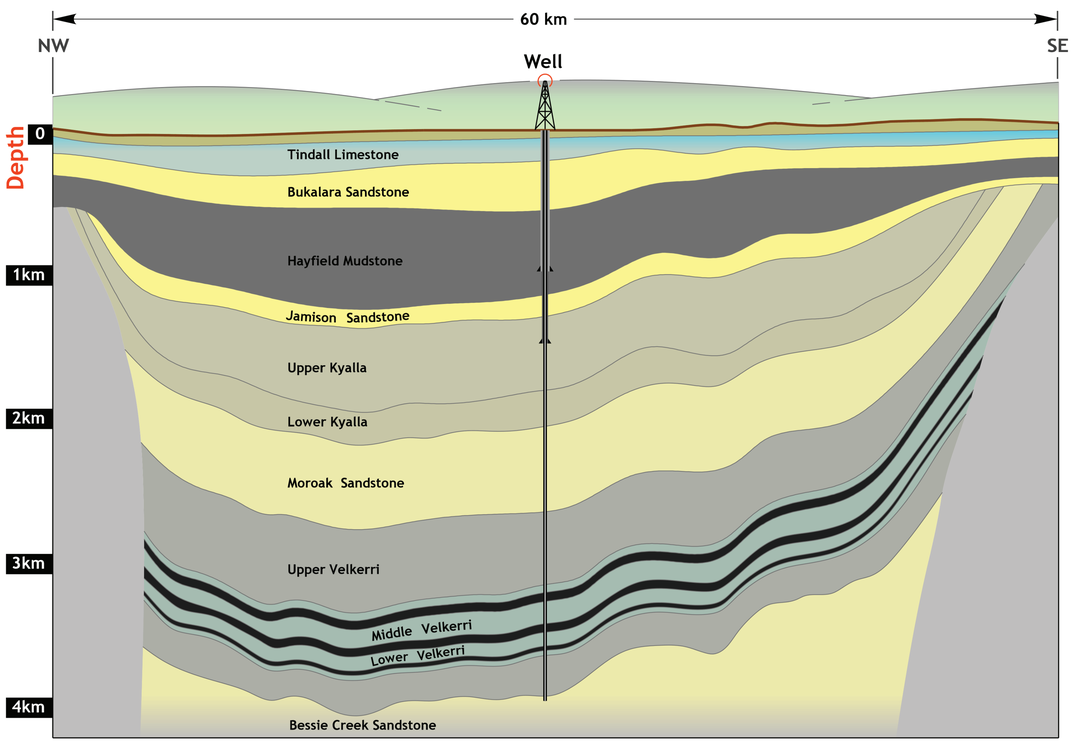
A Billion Years In The Making

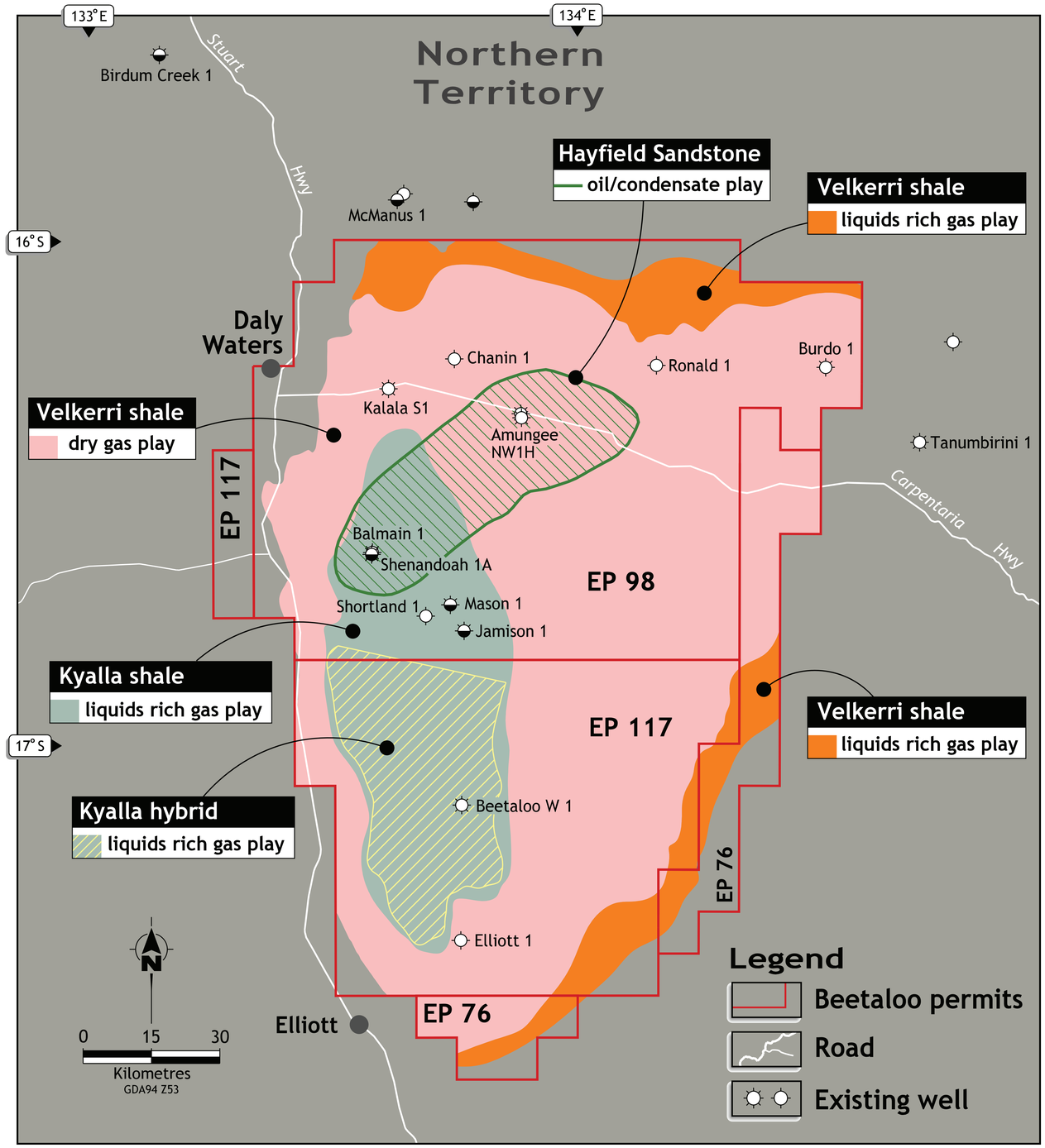
The Beetaloo Basin is 1.4 billion years old - much older than the dinosaurs that roamed the earth between 150 to 200 million years ago.

It's the Proterozoic age, continents are yet to form and the Top End is part of a vast tropical sea.

The Earth's atmosphere is around 3% oxygen and complex life like plants and animals are yet to evolve. Micro-organisms like algae are the main life form. As they die they settle on the ocean floor.

The right combination of depth and temperature then combines to creates the shale rocks we now know as the Velkerri formation, trapping vast reserves of natural gas around two and a half kilometers below surface.





Beetaloo Exploration Project

Origin, together with joint venture partner Falcon Oil and Gas, is exploring for gas in the Northern Territory's Beetaloo Basin.

The Resource Potential

Our exploration project in the Beetaloo Basin is a multi-year, nine well shale gas project that started in mid-2014.

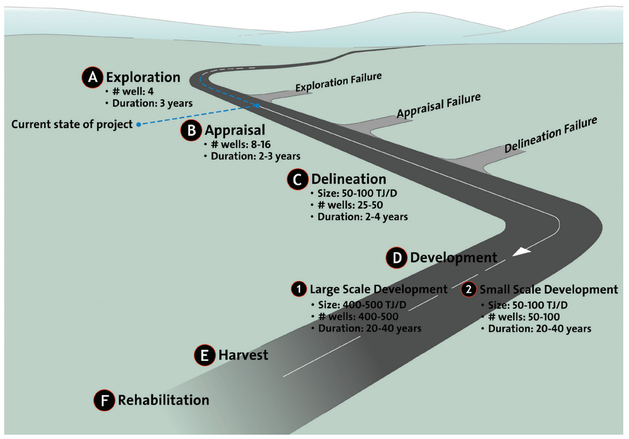
So far, we've drilled four wells. All within regulations and with the consent of the pastoralists and Native Title holders. We plan to drill two more this year (2019).

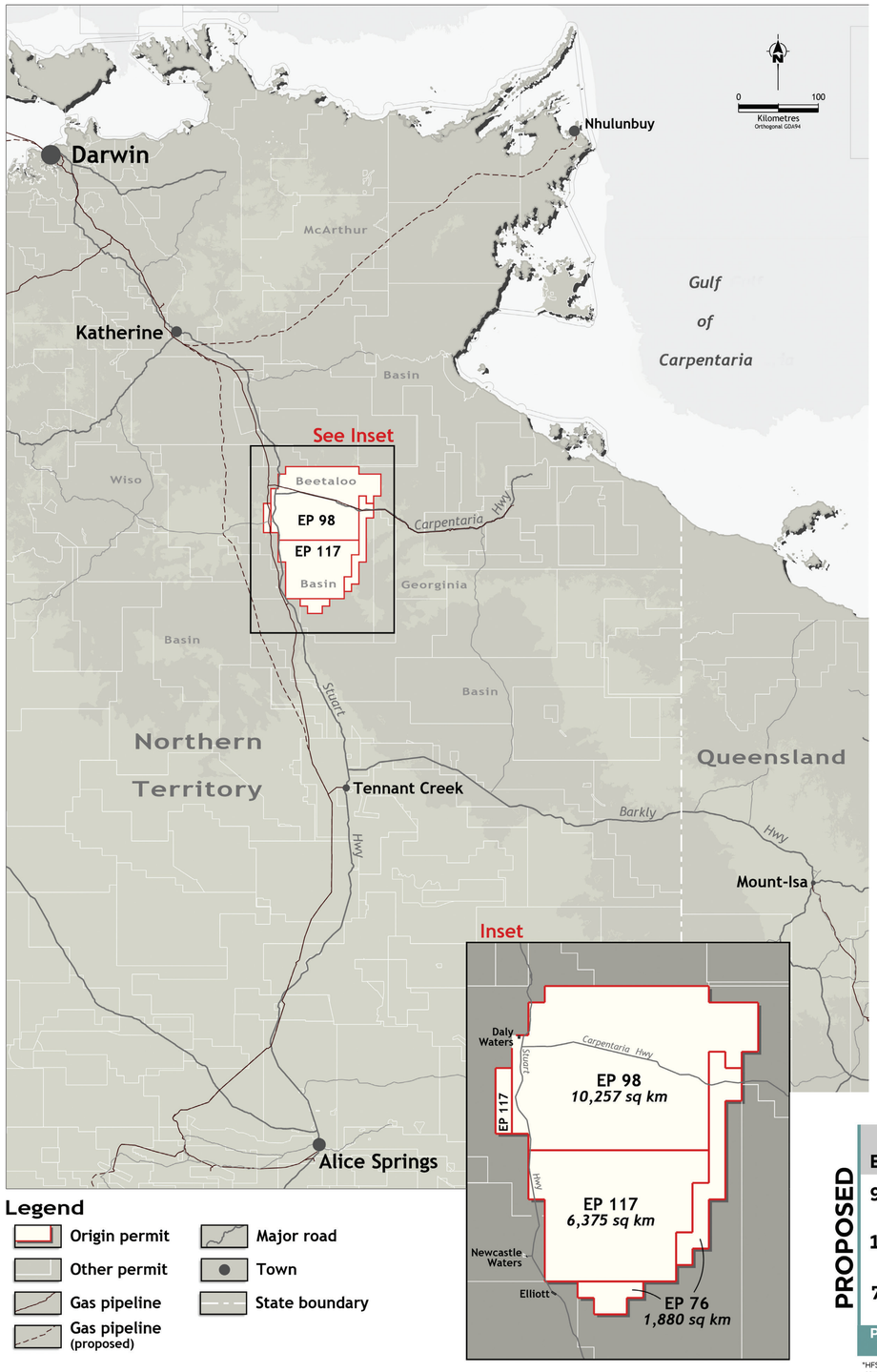
We think there's a very large gas resource underneath the ground with outstanding potential.

We estimate our project could have as much as 61 trillion cubic feet of gas, with 6.6 trillion cubic feet of that already recognised as a contingent resource.

Just how big is this? The Inpex project is 12 trillion cubic feet and the Mereenie gas fields have produced around 240 billion cubic feet since the mid 1980's.

The Road Ahead





The Benefits

If successful, and development goes ahead, the project means:

- more work for and jobs with local companies, including Aboriginal companies
- the opportunity to supply goods and services to the project
- financial payment for host pastoralists and Native Title holders
- taxes and royalties – providing government with more money that can go to improving community services, infrastructure and telecommunications
- energy security (delivering gas to the Eastern Australia)

Our Permit Commitments

PROPOSED

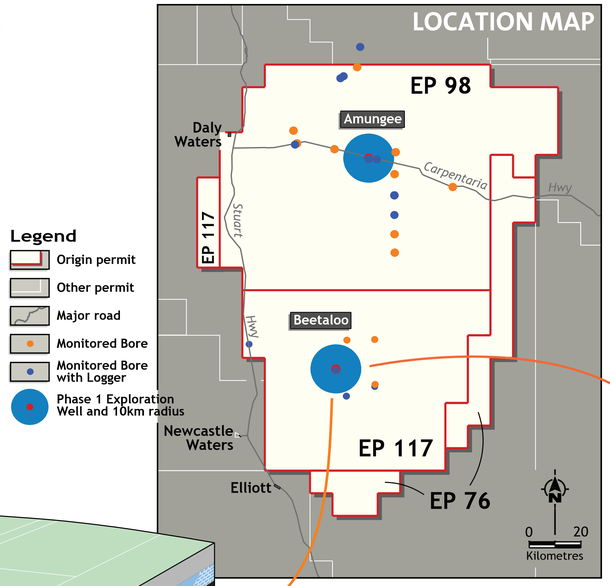
EP	2014	2015	2016	Moratorium 2017-2018	2019-2020	2021-2022
98	Geological and geophysical studies	2 vertical wells, 1 horizontal well	1 HFS horizontal well		Geological and geophysical studies	Geological and geophysical studies
117	Geological and geophysical studies	Geological and geophysical studies	1 vertical well		1 vertical pilot / evaluation well 1 HFS horizontal well	1 HFS horizontal well
76	Geological and geophysical studies	Geological and geophysical studies	Geological and geophysical studies		1 vertical pilot / evaluation well 1 HFS horizontal well	1 HFS horizontal well
Permit Year	1	2	3		4	5

*HFS
Hydraulic Fracture Stimulation 4 March 2019

Beetaloo W1
(Drilling & Environmental Controls)

The Beetaloo W-1 well is in the centre of Exploration Permit 117 (EP117) in the southern Beetaloo Sub-Basin, east of the Stuart Highway and around 54 km northeast of Elliott.

The vertical well was successfully drilled in July 2016 to a depth of around 3,100 metres within the lower Velkerri formation. The well was cased and suspended in September that year.



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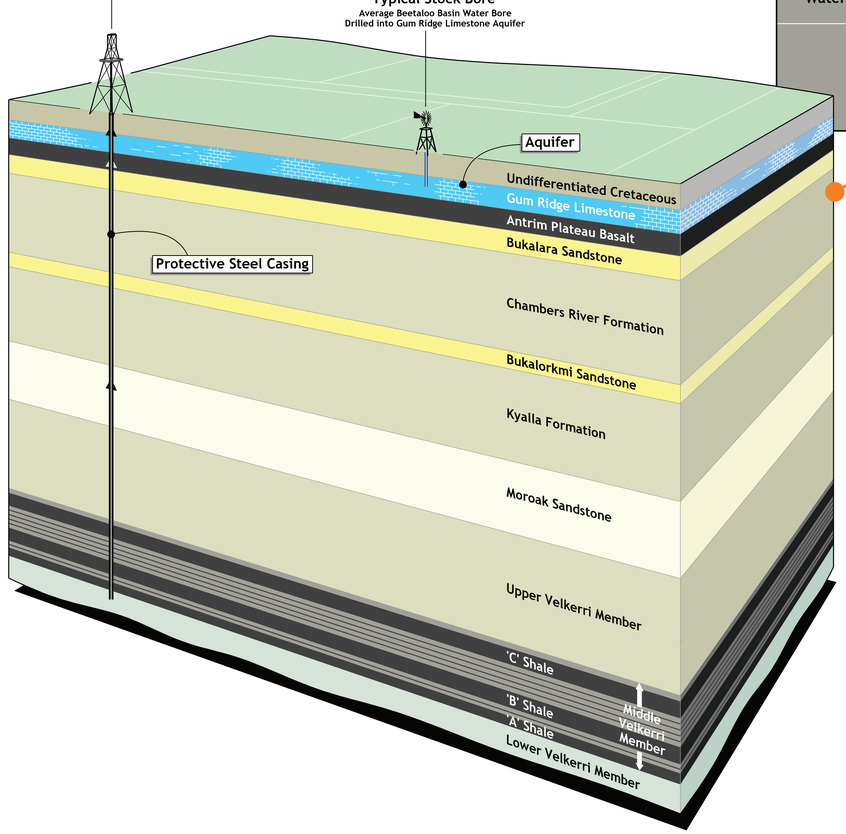
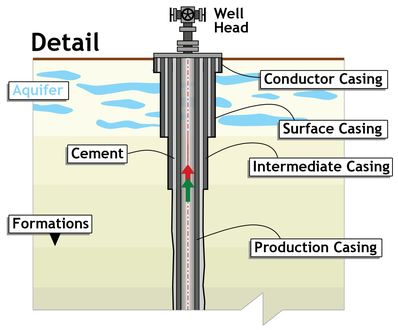




Conventional and Unconventional

Conventional and Unconventional are industry terms used to define where gas is found underground and how it's extracted.

It's the same gas (natural gas reserves are mostly methane with some propane, butane and light condensates) - the main difference is how it occurs in nature today.

Conventional gas has typically migrated from where it formed millions of years ago to a sandstone reservoir where it's trapped between porous grains under a denser layer of rock that acts as a cap or seal.

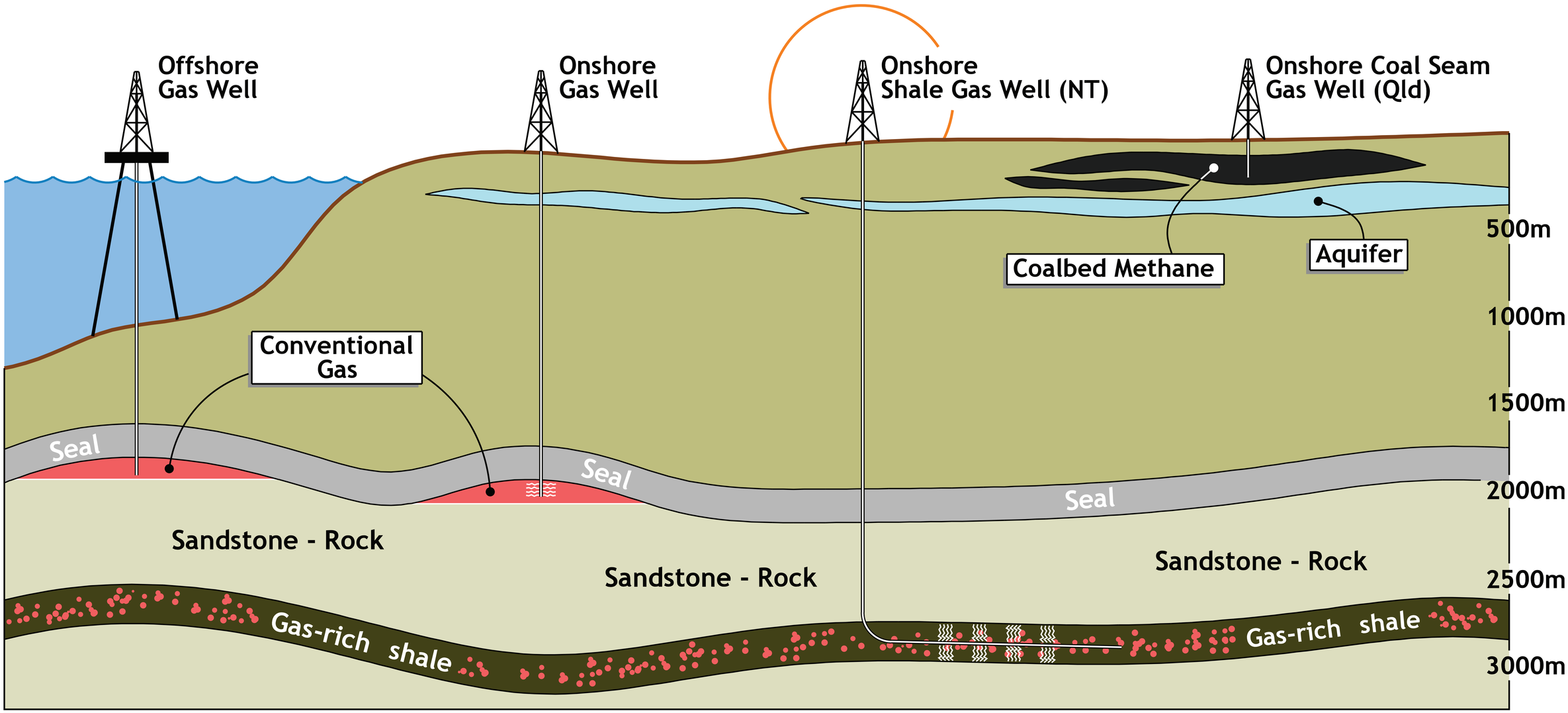
Unconventional gas is typically extracted from where it formed, in coal seams or shale formations that can be less porous and are sometimes described as tighter.

Extracting gas from either source can require a range of different techniques and processes.

It's a common misunderstanding that conventional reserves do not require fracture stimulation and unconventional reserves do.

For example, around a third of conventional wells in the Mereenie field near Alice Springs have been fracked.

Less than a quarter of Origin's unconventional coal seam gas wells in Queensland are fracked.



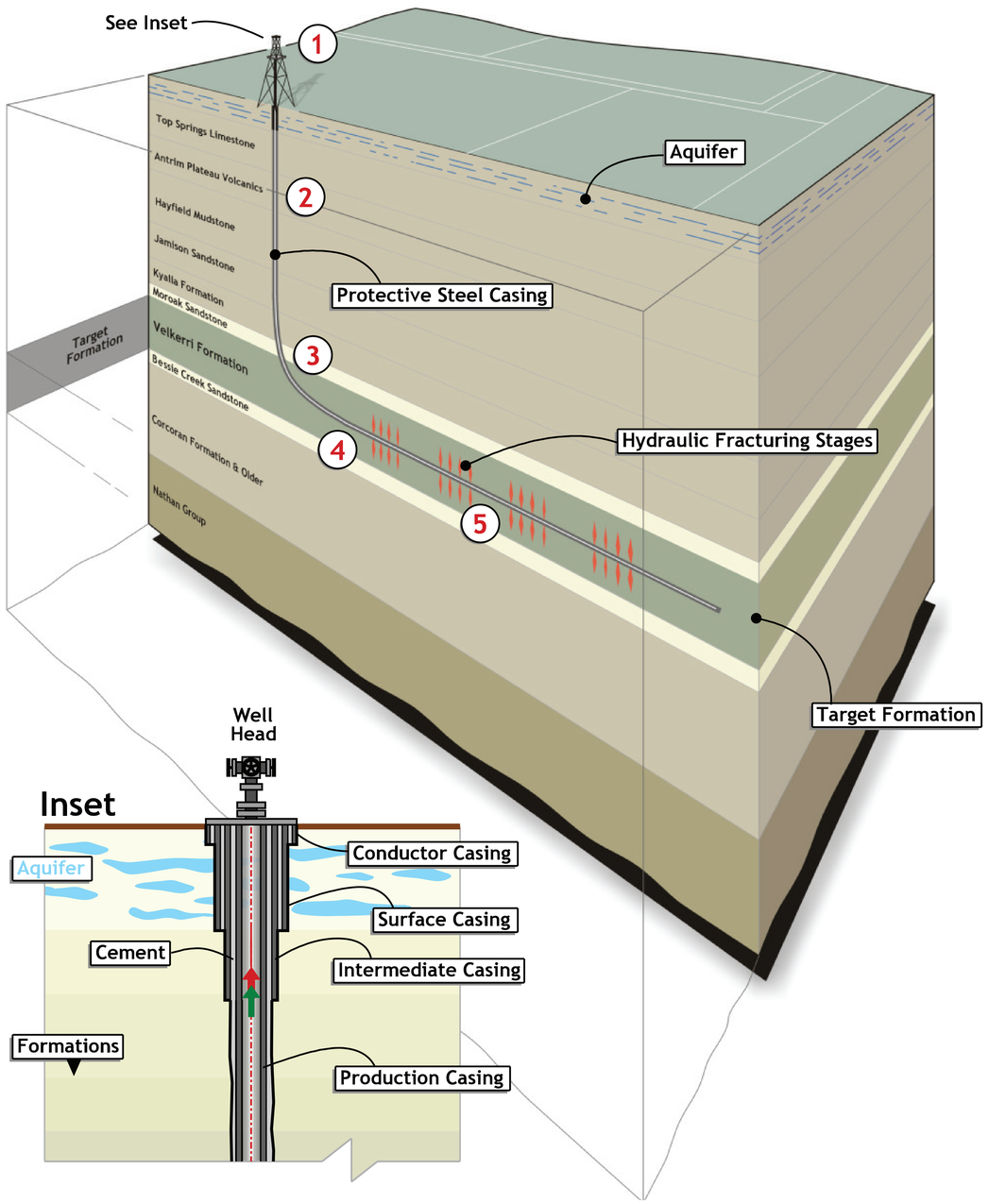
Drilling For Shale Gas

Our exploration program includes drilling both vertical and horizontal wells that target the underground shale rock formations in the Beetaloo Basin.

Long Reach Horizontal Drilling

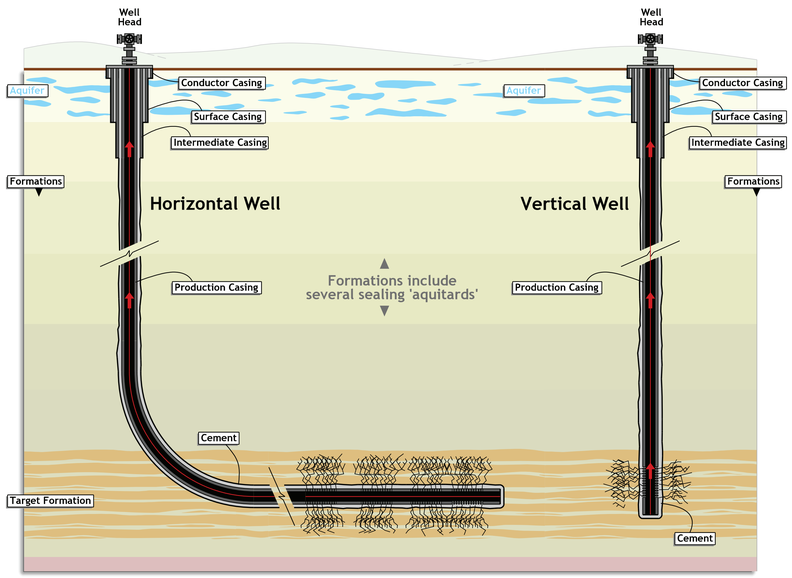
Steps in Horizontal Drilling:

1. Negotiate and agree access, obtain approval and bring in drilling rig and equipment
2. Drill vertical section of well using conventional methods
3. Drill kick-off (curved) section, with the use of a downhole motor mounted directly above the bit, in order to make the turn from vertical to horizontal. Downhole instruments called MWD (measuring while drilling) packages transmit sensor readings upward, allowing operators at the surface to build the angle
4. Drill horizontal wellbore, still using MWD to hold the angle and direction
5. Case off the well with steel casing and cement to allow for completion and fracture stimulation, preparing the well for production



Vertical Wells and Long Reach Horizontal Wells

- Origin will drill both vertical and horizontal wells during the Exploration Phase/s
- Vertical wells allow a more cost effective assessment of the potential for gas and liquids in the target zones and provide some information on production capability
- Horizontal wells will be required to assess the potential for economic gas and liquid recovery rates
- Horizontal wells are most likely to be required for field development



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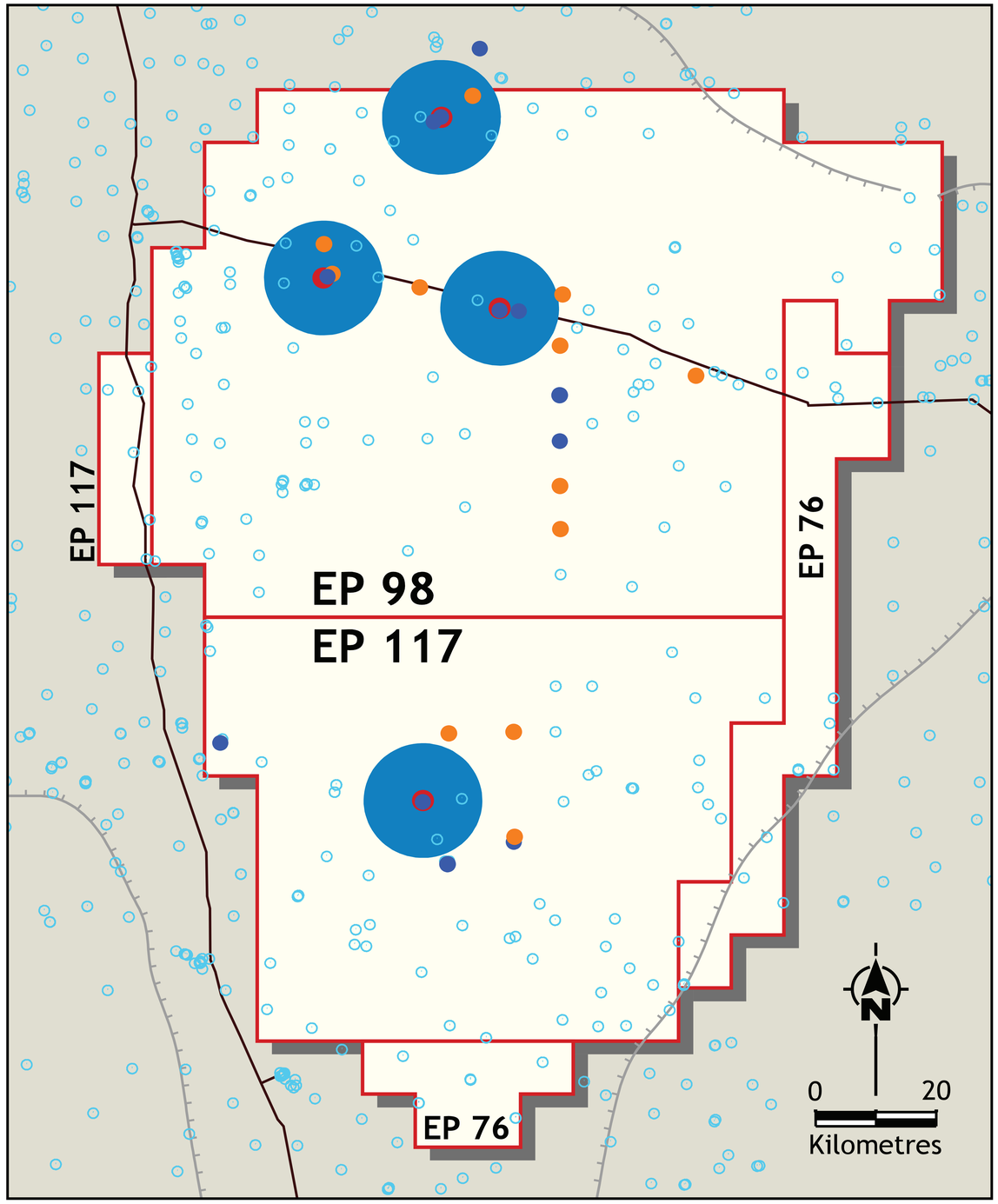


Legend

- Origin permit
- Major road
- Extent of Beetaloo Basin
- Water Bore
- Monitored Bore
- Monitored Bore with Logger
- Phase 1 Exploration Well and 10km radius

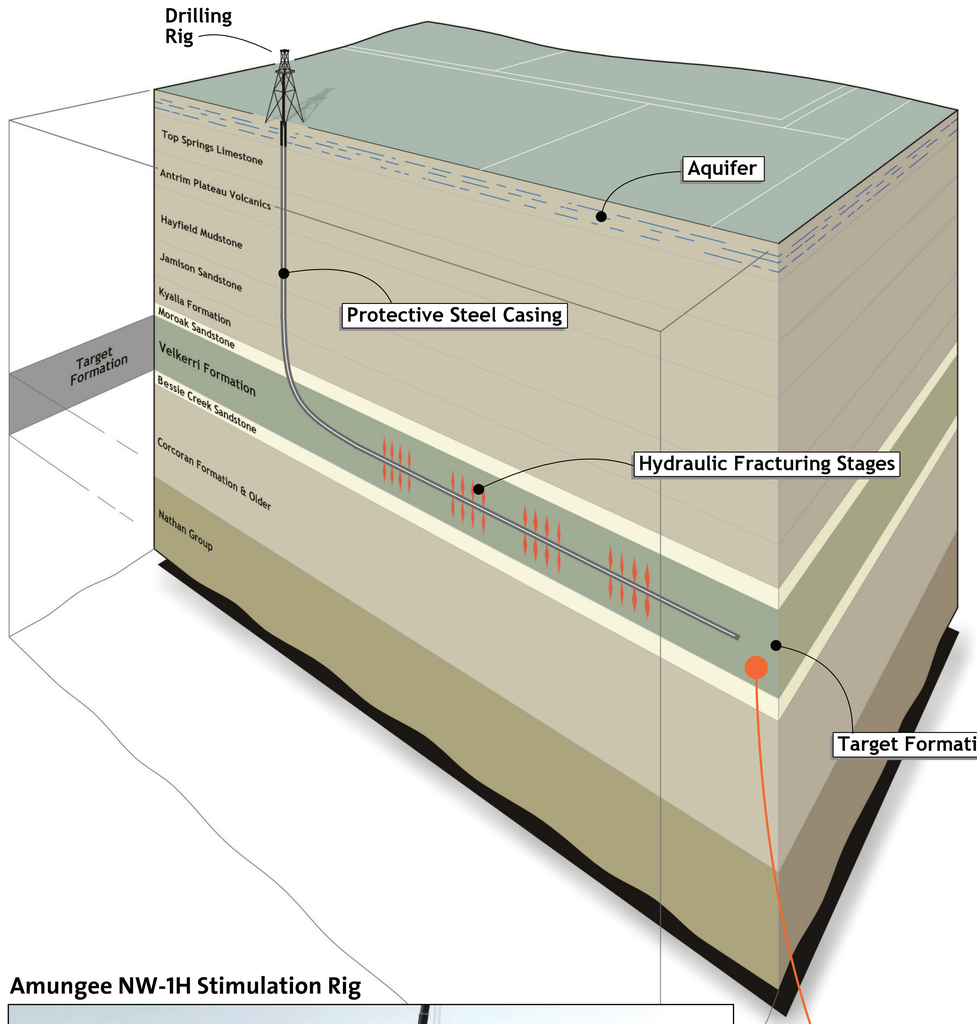
Hydraulic Fracture Stimulation (Fracking)

Fracking is the technical process designed to release the gas trapped in the dense shale rocks deep underground.

It involves pumping water mixed with sand and some chemical additives in low concentrations under pressure to fracture the shale, creating tiny pathways in the rock that allow the gas to flow into the well and be brought to the surface.

Key facts about fracking in the Beetaloo

- Distance offers important protection – there's over 2 kilometres between the shallower aquifers and the deeper rocks where gas is found.
- Both zones are effectively sealed off by several thick geological layers in between called aquatards.
- It's not physically possible for a fracture to extend upwards into the aquifer. Because of the distance, and because the amount of energy and pressure used in fracking isn't enough to connect and create pathways outside of the rock formation where gas is found.
- Any natural vertical fractures or old abandoned bores are extremely unlikely to provide a pathway for fracking fluids to reach a fresh water zone due to the greater weight (what's called hydrostatic head pressure) pushing down from above.
- Seismic work allows us to map the geology and avoid any large structures or faults.



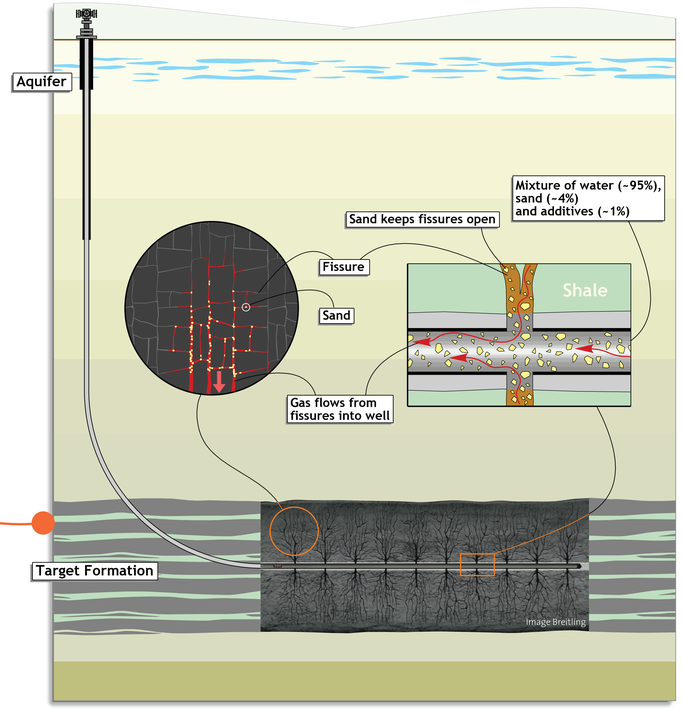
Amungee NW-1H Stimulation Rig

Protecting groundwater

We understand how important groundwater resources are to Traditional Owners, pastoralists and the community.

Both engineered and natural geological barriers isolate and protect underground water sources.

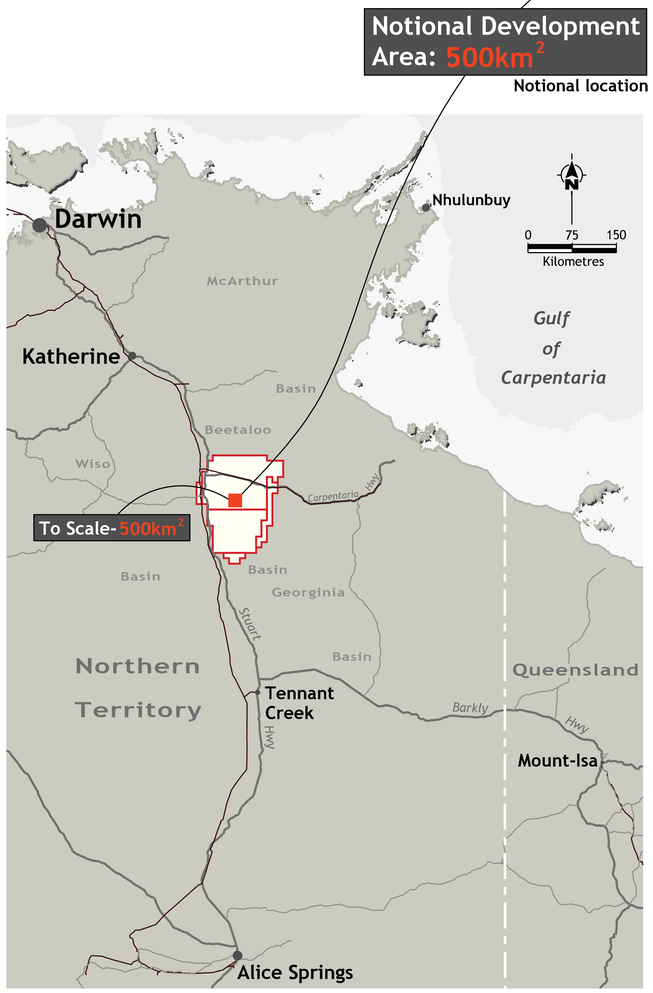
Multiple controls are put in place to protect the environment and groundwater. If these controls aren't successfully met when we drill - we don't frack.

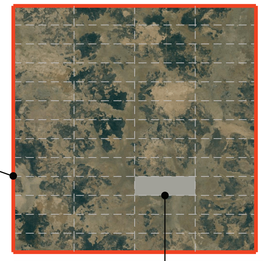


Minimising Above Ground Impacts

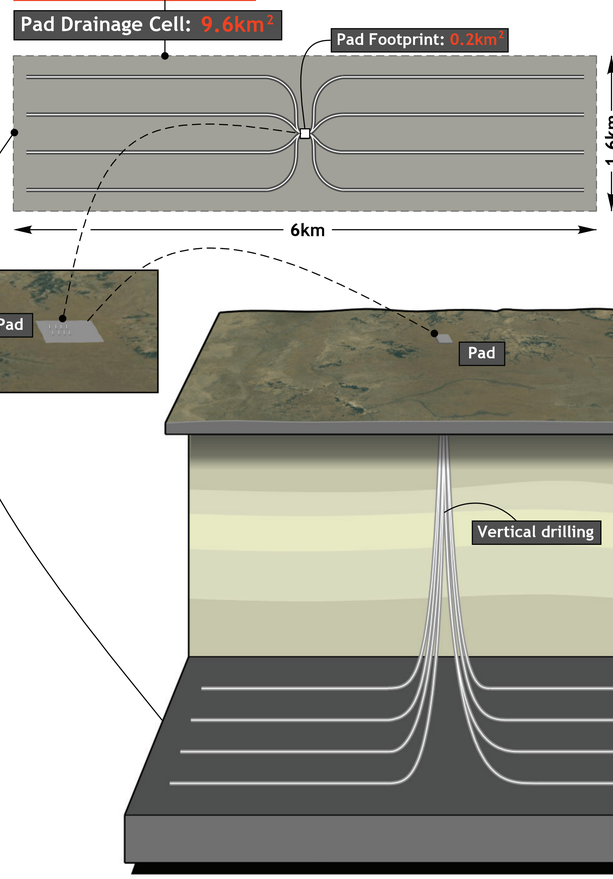
Multi -pad drilling and horizontal wells have a small surface footprint – minimising disruption to pastoral operations.

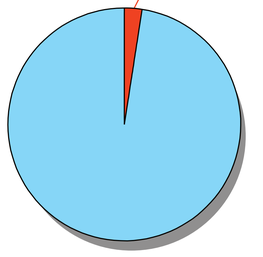
- In our submission to the NT Scientific Inquiry we described the surface footprint for large scale development scenario being no more than 10 square kilometres.
- This is based on multi-pad well design, and related surface infrastructure taking up no more than 2 per cent of a 500 square km land area.
- As further context, this total development area would occur on a handful of pastoral leases.





Preliminary estimates	Dimensions per pad	Area per pad
Pad footprint	140m x 140m	.02km²
Pipeline right of away footprint per pad	3km x 30m	.09km²
Road footprint per pad	3km x 10m	.03km²
Total surface area footprint per pad	-	.10km²
Total subsurface drainage area per pad	6km x 1.6km	9.6km²





Well Integrity

Engineering standards, steel and cement ensure the drilling and fracking of gas wells do not create a pathway between the underground layers of rock or deteriorate over time.

Built Strong - To Last The Test Of Time

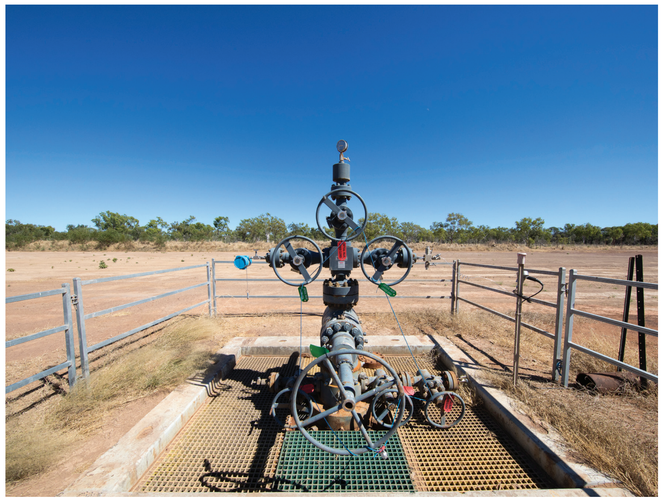
A gas well has three main parts – the steel casing, the above ground well head, and cement which is engineered to be as strong as the rock that it will live in.

Casing and cement hold the hole open and protect or prevent any cross flow between the surrounding underground formations. The cement is pumped down the inside and back up the outside of the casing.

An x-ray device sent down the well (a technique called logging) combined with pressure testing confirm the quality of the job.

The casing is designed to ensure its strong enough to withstand the most extreme loads it could be subjected to.

Added to this is a program of regulatory control and oversight, and the requirement to appropriately decommission every well at the end of its operational life.



Engineering Standards And Performance Data

Category		Description	Risk
1		Shallow surface casing + top of production casing cement below over pressured hydrocarbon reservoir	High
2		Shallow surface casing + top of production casing cement below under pressured hydrocarbon reservoir	
3		Shallow surface casing + top of production casing cement above top of gas	
4		Shallow surface casing + top of production casing cement above surface casing shoe	
5		Deep surface casing + top of production casing cement below under pressured hydrocarbon reservoir	
6		Deep surface casing + top of production casing cement above top of gas	
7		Deep surface casing + top of production casing cement above surface casing shoe	
8		Deep surface casing + 1 intermediate casing + top of production casing cement below top of gas	
9		Shallow surface casing + 1 intermediate casing + top of production casing cement above casing shoe	
10		Deep surface casing + 1 intermediate casing + top of production casing cement above top of gas	
11		Deep surface casing + 1 intermediate casing + top of production casing cement above casing shoe	
12		Deep surface casing + 2 intermediate casing strings + top of production casing cement above casing shoe	Low

Origin's minimum design requirement for a producing well

Origin's minimum design requirement for a P&A well

Origin's Beetaloo wells

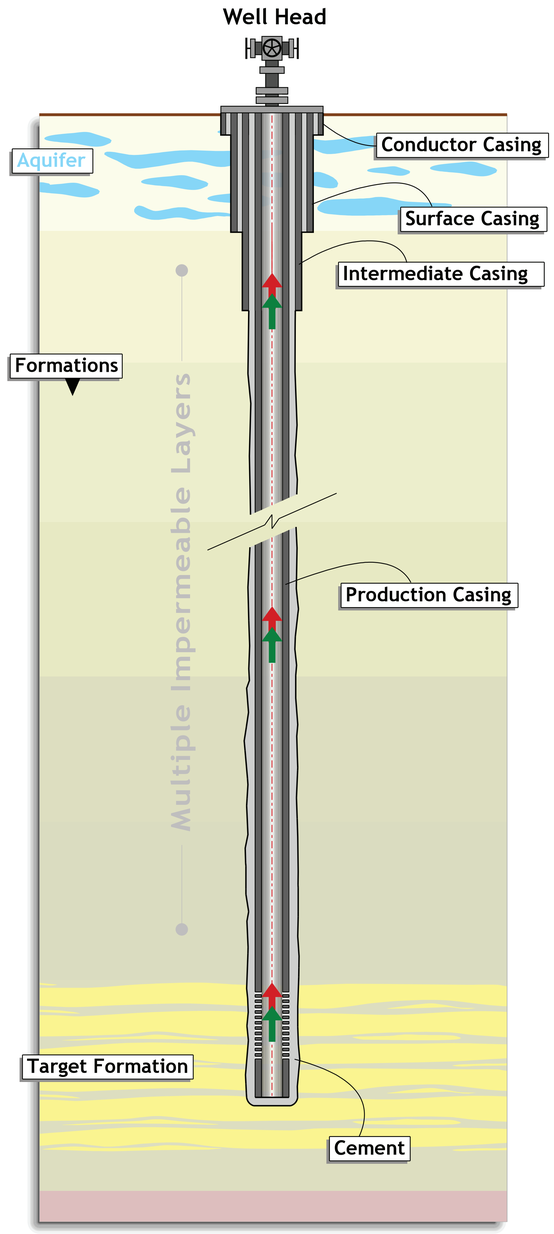
(a) **Vertical and deviated wells**

CATEGORY	ORIGINAL WELL COUNT	POTENTIAL BARRIER FAILURES	POTENTIAL BARRIER FAILURES %	CATASTROPHIC BARRIER FAILURES	CATASTROPHIC BARRIER FAILURES %	AVG COMPLETION DATE	P&A WELL COUNT	CURRENT WELL COUNT	ORIGINAL AVG SURFACE CASING DEPTH (FT)	ORIGINAL AVG TOP OF PRODUCTION CEMENT (FT)
Category 1	166	100	60.24%	3	1.81%	1979	57	15	253	7,334
Category 2	621	219	35.27%	5	0.81%	1983	138	301	306	6,566
Category 3	46	16	34.78%	1	2.17%	1987	14	31	321	4,008
Category 4	7	0	0.00%	0	0.00%	1982	1	15	222	125
Category 5	8,789	77	0.88%	1	0.01%	1995	782	6,140	559	6,111
Category 6	5,433	6	0.11%	0	0.00%	2007	105	7,181	712	2,816
Category 7	1,766	0	0.00%	0	0.00%	2009	8	2,040	719	534
TOTAL	16,828	418	2.48%	10	0.06%		1,105	15,723		
D&A	147									

(b) **Horizontal wells**

CATEGORY	ORIGINAL WELL COUNT	POTENTIAL BARRIER FAILURES	POTENTIAL BARRIER FAILURES %	CATASTROPHIC BARRIER FAILURES	CATASTROPHIC BARRIER FAILURES %	AVG COMPLETION DATE	P&A WELL COUNT	CURRENT WELL COUNT	ORIGINAL AVG SURFACE CASING DEPTH (FT)	ORIGINAL AVG TOP OF PRODUCTION CEMENT (FT)
Category 1	0	0	0.00%	0	0.00%	NA	0	0	NA	NA
Category 2	0	0	0.00%	0	0.00%	NA	0	0	NA	NA
Category 3	0	0	0.00%	0	0.00%	NA	0	0	NA	NA
Category 4	0	0	0.00%	0	0.00%	NA	0	0	NA	NA
Category 5	0	0	0.00%	0	0.00%	NA	0	0	NA	NA
Category 6	269	0	0.00%	0	0.00%	2012	1	268	789	2,153
Category 7	704	0	0.00%	0	0.00%	2012	2	702	929	442
TOTAL	973	0	0.00%	0	0.00%		3	970		
D&A	0									

Well Construction - Protecting Aquifers



Working With Host Traditional Owners

Origin strives to be open and transparent with host Traditional Owners in each area by working closely with the people in community and the Northern Land Council (NLC) to address any concerns and educate people on our industry, its practices and policies.

Sacred Site Surveys
Scared site Identification

- Sacred site inspections
- Well site clearances
- Access track clearances
- Special work conditions
- AAPA certificates
- Ongoing management to those conditions

Employment & Training

- DCGI Training (Drilling & Completions General Induction)
- Run in conjunction with local business interest
- Local people employed through primary contractor with onsite training of machinery operation during road construction works
- Ongoing well site maintenance programs to be determined

Environmental Scouting

- Civil activities
- Road construction
- Borrow pit locations
- Water bores

Hydraulic Fracture Visit

- Amungee NW-1H
- Visit held in collaboration with Traditional Owners and local pastoralists
- Open access to onsite Supervisors and HFS Engineer to facilitate a conversation about the onsite processes and address any questions with direct answers
- Site tour showed full layout of the equipment and its associated uses

Welcome to Country
Beetaloo W-1

At the invitation of the host Traditional Owners, Origin revived a Welcome to Country as a mark of respect and recognition of the importance of the land that we are working on the safety of all people working and visiting the site

About Origin

Many Australians know Origin as one of the country's largest electricity retailers. We also have significant interests in power generation and natural gas production. This includes exploring for natural gas reserves to develop as future energy sources. Where we find that it makes good sense to produce the gas, we develop and deliver it to our customers in Australia and overseas.

How We Operate

We know we have to get energy right. For our customers. For our communities. For the planet.

Relationships are built on trust and doing what we say what will do. We realise every community is different and that locals know the areas where we work far better than we do.

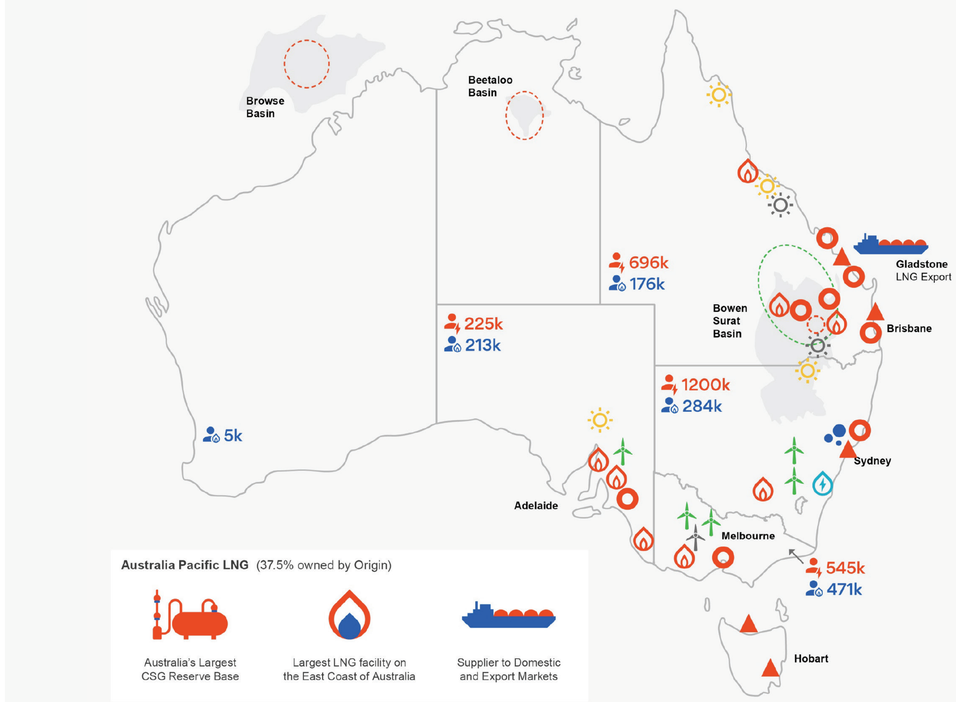
We promise to talk with you about our plans and listen, to help better guide our decision making.

Co-existence is a proven reality in other parts of the country today.

We will always look for ways we can work together to create shared benefit for all Territorians.

Gas wells on Qld grazing lands

Where We Operate



One Of Australia's Leading Energy Companies

Australia's Leading Energy Retailer
4.1 million gas, electricity and LPG customer accounts

Ensuring Domestic Gas Supply
Delivering around 30% of all gas on the east coast with APLNG

Growing Renewable Supply
Targeted to make up more than 25% of our generation mix by 2020

Powering Australia
7,000 MW of gas, coal and renewable generation and storage across the east coast

Appendix K Table of compliance with Section 7(2)(a)

Section 7(2)(a)	Document and Content	Date Provided

(i) "the regulated activity the interest holder proposes to carry out"	**Letter from Origin to [redacted] (on behalf of Amungee)** (**Appendix L**)
	• Includes a table outlining the regulated activities Origin proposes to perform for Velkerri Well 76, including:
	  ○ Drilling of 1-3 new wells;
	  ○ Construction of a new well pad;
	  ○ Drilling of 3-4 new water bores (1-2 extraction and 2 monitoring);
	  ○ Construction of a drilling camp; and
	  ○ Construction of a new access road.
	• Includes a timetable outlining the work program Origin proposes to undertake.
		22 August 2018

	Letter from Origin to [redacted] (Draft Land Access and Compensation Agreement) (**Appendix L**)
	• Lists the activities Origin proposes to carry out on Amungee Mungee Station from the date of the Agreement until December 2020, including:
	  ○ Monitoring, maintenance and rehabilitation of existing wells, access roads and monitoring bores;
	  ○ Walking the area of the exploration permits;
	  ○ Driving along existing roads and tracks in the area;
	  ○ Identifying and installing water monitoring or extraction bores including, where required, the construction of access roads to drill these bores;
	  ○ Taking soil or water samples;
	  ○ Geophysical surveying not involving site preparation;
	  ○ Aerial, electrical or environmental surveying;
	  ○ Emissions monitoring, including installation or monitoring stations;
	  ○ Survey pegging;
	  ○ Scouting (including preliminary consideration of appropriate sites for wells and other infrastructure);
		22 August 2018

Section 7(2)(a)	Document and Content	Date Provided
	○ Investigations and surveys and any other minimal impact activities including, without limitation, environmental, flora and fauna, geotechnical, cultural heritage and native title field work; and ○ All other activities incidental to the activities above which will have no impact or only a minor impact.	
	Draft Pastoral Land Access and Compensation Agreement (**Appendix L**) • Item 1 of Schedule 2 (P30 – 33) lists the Agreed Petroleum Activities which include all activities and works reasonably associated with the construction and operation of one exploration well and includes the following activities: ○ Gates, grids, fences and access points; ○ Existing access roads; ○ New access track(s); ○ Petroleum exploration well; ○ Rig laydown area; ○ Laydown area; ○ Water bore; ○ Campsite; and ○ Scouting, surveys and soil and water sampling activities. • Item 3 of Schedule 2 (P34) list the indicative duration of the Agreed Petroleum Activities.	20 November 2018
	Beetaloo Basin Exploration Project – Weed Management Plan (**Appendix B**) • Lists the primary activities subject to the Weed Management Plan as being (P5): ○ Access track construction, use and maintenance; ○ Exploration lease pad construction, use and maintenance; ○ Gravel pit construction and maintenance; ○ Drilling, stimulating, completing and maintaining petroleum exploration wells; and • Routine access, maintenance and monitoring of all exploration areas subject to this plan.	17 May 2019
	Trafficwerx NT Traffic Management Plan (**Appendix H**)	17 May 2019

Section 7(2)(a)	Document and Content	Date Provided
	• Provides that a temporary site access road will be constructed as a regulated activity (P2-3), including project dates, hours of work, duration and traffic management plans.	

	Draft Beetaloo Basin Groundwater Monitoring Bore Installation Program – Velkerri 76 Environment Management Plan (**Appendix L**)
	• Identifies the regulated activities to be undertaken by Origin, including (on P8):
	  ○ Construction of two 50m^2 groundwater monitoring bore lease sites;
	  ○ Establishment of six 100m^2 gravel pits;
	  ○ Installation of approximately 2km of access tracks;
	  ○ Grading and forming of 80km of existing access tracks (including vegetation clearing)
	  ○ Installation of fencelines, gates, grids and firebreaks.
	• Provides for specific groundwater monitoring and sampling bore drilling activities to be undertaken (P10-12).
	• Provides for the construction of civil contractor working camps (P12).
		22 May 2019

	Draft Beetaloo Basin Velkerri 76 S2 Civil Construction Environment Management Plan (**Appendix L**)
	• Provides detailed information on the civil construction program for regulated activities, including details of (P12–15):
	  ○ Exploration well-lease pad infrastructure, camp pad and helipads program;
	  ○ Drilling sumps;
	  ○ Stockpile area;
	  ○ Gravel pits;
	  ○ Access tracks; and
	  ○ Fly camps.
	• Provides detail on the water supply and use ancillary to the regulated activities (P15-16).
	• Provides a timetable of each civil construction activity to be undertaken (P22).
		22 May 2019

Section 7(2)(a)	Document and Content	Date Provided
	Origin Drilling For Shale Gas Poster (**Appendix J**) • Explains that the exploration program for future activities will include drilling of both vertical and horizontal wells. Provides a description of the steps involved in drilling horizontal wells.	24 May 2019
(ii) "the location (or locations) where it is proposed to carry out the activity"	**Email from Origin to** [redacted] (**Appendix L**) • An Origin representative offered to arrange a sit down meeting with [redacted] of Bullwaddy Pastoral Co Pty Limited, part owner of Amungee Mungee Station, to go through the well location selection process and ranking.	2 July 2018
	Letter from Origin to [redacted] **(as representative for joint owners of Amungee Mungee Station)** (**Appendix L**) • Includes a map of potential well location clearance areas, coordinates of new wells and proximity requirements of supporting facilities. • The work programme timeline attached to the letter allowed the landholder to gain an understanding of the impacts on its operations of Origin's early phase works and the later fracking and stimulation phase.	22 August 2018
	Draft Pastoral Land Access and Compensation Agreement (**Appendix L**) • Identifies the affected Pastoral Property (NT Portion 1079, Vol 786 Folio 762) activities to be undertaken on (P1). • Item 2 of Schedule 2 states the access tracks and well site are shown in the plans attached to Annexure D of the agreement. No plans are attached to Annexure D (P34).	20 November 2018
	Beetaloo Basin Exploration Project – Weed Management Plan (**Appendix B**) • Includes maps of the proposed exploration activities and locations of current weed growth and of high weed risk in relation to proposed well locations (high-aerial view) (P4, 10 – 12).	17 May 2019
	Trafficwerx NT Traffic Management Plan (**Appendix H**) • Includes multiple detailed diagrams outlining the construction areas of the proposed access roads in relation to the Stuart Highway (Appendix C – P46 to 52, Appendix K P68). • Provides for the specific location of the proposed access road along the Stuart Highway (P1).	17 May 2019

Section 7(2)(a)	Document and Content	Date Provided
	Draft Beetaloo Basin Groundwater Monitoring Bore Installation Program – Velkerri 76 Environment Management Plan (**Appendix L**) • Includes map of EP98, EP117 and EP76 locations and location of proposed Velkerri 76 well in EP area (P2). • Includes proposed lease area location detail for Velkerri well control and impact monitoring bores (P3 – Table 1). • Includes proposed gravel pit location detail (P4 – Table 2). • Includes proposed water bore lease area layouts (P10 - 11 – Figures 4 and 5).	22 May 2019

	Draft Beetaloo Basin Velkerri 76 S2 Civil Construction Environment Management Plan (**Appendix L**)
	• Includes map of EP98, EP117 and EP76 locations and proposed infrastructure location and disturbance area (P2 – 3).
	• Includes detailed location information for regulated activities proposed to occur (P3 – Table 1), including:
	  ○ Velkerri 76 S2 well pad;
	  ○ Camp lease pad;
	  ○ Stockpile laydown;
	  ○ Helipad;
	  ○ Gravel Pits 4 and 5 (with associated access tracks);
	  ○ Gravity Pits 6 and 7.
	• Includes map of specific location of Velkerri S2 site (P12 of PDF – Figure 3).
	• Includes map of specific location of Velkerri S2 site in relation to Vegetation communities (P43 of PDF – Figure 7).
	• Appendix B includes infrastructure design drawings which includes locality plan (P86 of PDF).
		22 May 2019

	Origin Groundwater Monitoring Poster (**Appendix J**) • Includes a map of proposed Phase 1 exploration wells and proximity to Origin's monitored water bores.	24 May 2019
	Origin Beetaloo Exploration Project Poster (**Appendix J**) • Includes a map of Origin EP98, EP117 and EP76 locations.	24 May 2019

Section 7(2)(a)	Document and Content	Date Provided
	Origin 2019 Work Program Poster (**Appendix J**) • Includes a map of EP98, EP117 and EP76 and the location of each Phase 1 exploration well in broader EP98, EP117 and EP76 area. • Includes a map of the drilling surface location in proximity to the Stuart Highway.	24 May 2019
(iii) "the anticipated environmental impacts and environmental risks of the activity"	**Beetaloo Basin Exploration Project – Weed Management Plan** (**Appendix B**) • The purpose of the Plan is to ensure the risk of weed introduction and spread, resulting from the regulated activities performed by Origin, are mitigated to protect (among other things) the environmental interests of the Territory (P4). • Considers the risk of weed spreading and introduction with evidence from previous weed management surveys conducted on the land (P9 - 17 – incl. Table 4).	17 May 2019
AND	**Trafficwerx NT Traffic Management Plan** (**Appendix H**) • Includes references to the anticipated environmental impacts or environmental risks of access track construction and other traffic-environment aspects in describing environmental management processes and outcomes.	17 May 2019

(iv) "the proposed environmental outcomes in relation to the activity"	**Draft Beetaloo Basin Groundwater Monitoring Bore Installation Program – Velkerri 76 Environment Management Plan** (**Appendix L**)
	• Provides detailed description for and associated risks of the physical environment of the EP98, EP117 and EP76 area, including (P23-28):
	  ○ Climate;
	  ○ Geology;
	  ○ Soils;
	  ○ Hydrology; and
	  ○ Hydrogeology.
	• Provides detailed description for and associated risks of the biological environment of the EP98, EP117 and EP76 area, including (P28-32):
	  ○ Bioregions;
	  ○ Vegetation communities;
		22 May 2019

Section 7(2)(a)	Document and Content	Date Provided
	○ Flora; ○ Weeds; ○ Fauna; ○ Significant / endangered fauna; and ○ Feral and pest fauna. • Provides a description of environmental and cultural sensitives, including (P33-34): ○ Native title; ○ Archaeology Assessment; ○ Areas of cultural significance; ○ Natural resources; ○ Non-indigenous heritage; ○ Historic heritage assessment; and ○ Protected or conservation areas. • Includes an outline of Origin's risk management approach and management tools (P39-42). • Includes detailed tables of environmental impacts, risks and outcomes for specific environmental aspects, including: ○ Soil and erosion (P43 - Table 19); ○ Surface Water and Groundwater (P44 – Table 20); ○ Vegetation, Flora, Fauna and Habitat (P45 – Table 21); ○ Weeds (P46 – Table 22); ○ Waste Management (P47 – Table 23); ○ Air Quality – Dust and Emissions (P48 – Table 24); ○ Lighting, noise, vibration and visual amenity (P48 – Table 25); ○ Bushfire (P49 – Table 26); ○ Cultural heritage and sacred sites (P49 – Table 27); and ○ Community (P50 – Table 28).	

Section 7(2)(a)	Document and Content	Date Provided
	• Provides an emergency response plan to account for situations of high risk of environmental harm occurring, including bushfire and contaminant spills (P56). • Includes table outlining water bore drilling program risk assessment (P267 of PDF).	

	Draft Beetaloo Basin Velkerri 76 S2 Civil Construction Environment Management Plan (**Appendix L**)
	• Includes an assessment of environmental factors against environmental objectives at risk (P8–10 – Table 5).
	• Provides a detailed description for and associated risks of the physical environment of the EP98, EP117 and EP76 area (P23-27), including:
	  ○ Climate;
	  ○ Geology;
	  ○ Soils;
	  ○ Hydrology; and
	  ○ Hydrogeology.
	• Provides a detailed description for and associated risks of the biological environment of the EP98, EP117 and EP76 area (P27-34), including:
	  ○ Bioregions;
	  ○ Vegetation communities;
	  ○ Flora;
	  ○ Weeds;
	  ○ Fauna;
	  ○ Significant / endangered fauna;
	  ○ Feral and pest fauna.
	• Provides description of environmental and cultural sensitives (P34- 37), including:
	  ○ Native title;
	  ○ Archaeology Assessment;
	  ○ Areas of cultural significance;
	  ○ Natural resources;
		22 May 2019

Section 7(2)(a)	Document and Content	Date Provided
	○ Non-indigenous heritage; ○ Historic heritage assessment; and ○ Protected or conservation areas. • Includes an outline of Origin's risk management approach and management tools (P39-42). • Includes detailed tables of environmental impacts, risks and outcomes for specific environmental aspects, including: ○ Soil and erosion (P46 – Table 24); ○ Surface Water and Groundwater (P47–48 – Tables 25 - 26); ○ Vegetation, Flora, Fauna and Habitat (P49 – Table 27); ○ Weeds (P50 – Table 28); ○ Waste Management (P51 – Table 29); ○ Air Quality – Dust and Emissions (P52 – Table 30); ○ Lighting, noise, vibration and visual amenity (P53 – Table 31); ○ Bushfire (P54 – Table 32); ○ Cultural heritage and sacred sites (P55 – Table 33); ○ Community (P56 – Table 34); and ○ Traffic (P56 – Table 35). • Provides an emergency response plan to account for situations of high risk of environmental harm occurring, including bushfire and contaminant spills (P64). • Appendix D - Erosion and Sediment Control Plan includes an assessment of the permit area erosion susceptibility (P130–134 of PDF), including: ○ Erosion hazard assessment for Velkerri; ○ Soil loss estimate; and ○ Erosion risk and determination of erosion and sediment control. • Appendix H – Environmental Risk Assessment includes detailed table assessing environmental factors against activity risk sources (P248 of PDF).	
	Letter from Origin to [redacted] (on behalf of Amungee) (**Appendix L**)	22 August 2018

Section 7(2)(a)	Document and Content	Date Provided
(v) "the possible consequences of carrying out the activity to the stakeholder's rights or activities"	• Includes a map and coordinates table detailing the locations and clearance buffers of proposed work at three well locations, including the Velkerri V76 well. • The map included in the letter shows the planned route of access tracks across the land and the proposed clearance areas. • Attachment 2 is a draft work program of activities Origin intends to undertake on the land.	

	Draft Pastoral Land Access and Compensation Agreement (**Appendix L**)
	• Clause 3 (P5) provides that Origin must conduct the regulated activities in such a way:
	  ○ as to not interfere with the lawful rights or activities of the stakeholder;
	  ○ that is in accordance with good exploration and petroleum industry practice;
	  ○ that is within an agreed access area and not on any part of the pastoral property.
	• Clause 5 (P7) provides that Origin must give written notice of at least 10 business days before commencing the regulated activities.
	• Clause 7 (P8) provides the stakeholder with an opportunity to inspect the regulated activities.
	• Clause 8 (P8) provides the stakeholder an avenue to make suggestions to Origin about the regulated activities where they affect the stakeholder's activities or rights.
	• Clause 10 (P8-9) provides that Origin must not carry out any regulated activities within 5 kilometres of a residence and within 1 kilometre of a garden or artificial water accumulation. Origin must also erect and maintain appropriate temporary fencing.
	• Clause 11 (P9) requires Origin to use best endeavours to ensure that the regulated activities do not cause an impaired capacity to any water aquifers beneath the property and having the property certified as 'organic'.
		20 November 2018

	Beetaloo Basin Exploration Project – Weed Management Plan (**Appendix B**) • The plan details the risk mitigation measures to be implemented to control / prevent weed spread. The plan demonstrates how risk of week spread will be managed to ensure there is no consequence in this regard to the stakeholders' rights and activities.	17 May 2019

Section 7(2)(a)	Document and Content	Date Provided
	Trafficwerx NT Traffic Management Plan (**Appendix H**) • The plan includes information about project dates and what times of day traffic management will be in place (P3). • Discussion about how traffic impacts will be managed are discussed in relation to fumes, volatile substances, noise, air quality (P13). • There are maps referencing the access road works proposed to be undertaken which outline impacts to traffic on the Stuart Highway (P46-52).	17 May 2019
	Draft Beetaloo Basin Groundwater Monitoring Bore Installation Program – Velkerri 76 Environment Management Plan (**Appendix L**) • Provides for the environmental impacts and risks to land (P6 and P43-50). • Lists the civil activities subject to the EMP (P8-9). • Provides images of the proposed water bore lease area layout (P10 – Figure 4). • Lists equipment and machinery required for civil construction, water bore drilling and groundwater monitoring and corresponding timeframes (P14-15). • References the pastoral leasing purpose of the underlying land, including the Amungee Mungee Station specifically (P36). • Provides erosion and sediment control measures for proposed regulated activities (P292-297 of PDF).	22 May 2019
	Draft Beetaloo Basin Velkerri 76 S2 Civil Construction Environment Management Plan (**Appendix L**) • Provides for the environmental impacts and risks to land (P8-10 and P46-57). • References the civil construction program (P12-15) which describes the location, size and proposed use of key areas for proposed regulated activities. • Outlines the peak maximum anticipated traffic flow increase associated within Origin activities for civil activities to be 44 vehicles per day during rig mobilisation and demobilisation and 12 vehicles for several days during related infrastructure equipment mobilisation and demobilisation (P18-20).	22 May 2019

Section 7(2)(a)	Document and Content	Date Provided
	• Lists equipment and machinery required for civil construction works and provides detailed civil construction scope timing indicating impacts to land (P22). • References the pastoral leasing purpose of the underlying land, including the Amungee Mungee Station specifically. • Indicates that impacts on the stakeholder are not anticipated due to the separation distances between properties and homesteads and the regulated activities (P37). • Appendix B includes infrastructure design drawings (P85 of PDF). • Provides erosion and sediment control measures for proposed regulated activities (P135-140 of PDF).	

Appendix L set Amungee Mungee Stakeholder Consultation Documentation

Additional information regarding stakeholder engagement has been redacted due to commercial in confidence material and the pending legal proceedings.